

<p>ORAU Team Dose Reconstruction Project for NIOSH</p> <p>Technical Information Bulletin: Monte Carlo Methods for Dose Uncertainty Calculations</p>	<p>Document Number: ORAUT-OTIB-0012 Effective Date: 02/14/2005 Revision No.: 00 Controlled Copy No.: _____ Page 1 of 65</p>
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RECORD OF ISSUE/REVISIONS

ISSUE AUTHORIZATION DATE	EFFECTIVE DATE	REV. NO.	DESCRIPTION
Draft	08/26/2004	00-A	New document to establish Technical Information Bulletin for Monte Carlo Methods for Dose Uncertainty Calculations. Initiated by Matthew H. Smith.
Draft	11/12/2004	00-B	Incorporates NIOSH review comments. Initiated by Matthew H. Smith.
02/14/2005	02/14/2005	00	First approved issue. Initiated by Matthew H. Smith.

ACRONYMS AND ABBREVIATIONS

cSv centisievert

DCF dose conversion factor

GM geometric mean

GSD geometric standard deviation

H_p(10) dose equivalent at a depth of 10 millimeters

IREP Interactive RadioEpidemiological Program

mrem millirem

1.0 SCOPE

The purpose of this document is to outline an efficiency method applied to Monte Carlo methods which yield best-estimate organ dose doses for dose reconstruction. Instead of running simulations using a Monte Carlo application (such as Crystal Ball®) for each individual case, an approach using unit dose quantities combined with the appropriate dose conversion factors can be used to assign organ dose (Decisioneering, Inc., 2001). In addition, organ doses can be calculated in instances where the use of neutron to photon ratios are required using this unit dose approach. Implementation of this method allows the generation of site-specific reference tables for use in best-estimate dose reconstructions without requiring individual Monte Carlo simulations.

2.0 UNCERTAINTY OF MEASURED DOSE QUANTITIES

The foundation for this efficiency process is the estimation of dosimeter error. The calculation of this error is shown in the following equation from the *External Dose Reconstruction Implementation Guidelines* (OCAS 2002, Section 2.1.1.3.3):

$$\sigma(E) = \sqrt{\left(\frac{L_c}{1.96}\right)^2 + \left(\frac{\sigma^*}{100}(E)\right)^2}$$

where:

- L_c = critical limit (minimum detectable level)
- σ^* = estimated percent standard error
- E = exposure or dose

The uncertainty of a single dosimeter reading is calculated from the exposure or dose value (E), critical limit (L_c), and standard error (σ^*). The overall uncertainty for dosimetry readings during a year is the square root of the sum of the squares (NIOSH 2002, Section 2.1.1.3.4):

$$\sigma_D^2 = \sigma_1^2 + \sigma_2^2 + \sigma_3^2 + \dots + \sigma_i^2$$

where:

- σ_D = uncertainty of annual dose
- σ_i = uncertainty of a single dosimeter

An example of this approach is shown in Table 1, given $L_c = 40$ and $\sigma^* = 25$.

3.0 CALCULATION OF BEST-ESTIMATE ORGAN DOSE

3.1 MEASURED DOSE METHODOLOGY

To calculate a best-estimate organ dose, the annual dosimeter dose (expressed as a distribution) is combined with the organ dose conversion factors (DCFs) (also expressed as a distribution), which is then combined with energy fraction and site-specific dosimeter correction factors (typically constants). A series of Monte Carlo simulations is performed that multiplies unit dose quantities (defined as normal distributions) by the organ DCF values (defined as the triangular distributions). The input for these simulations consists of unit dose normal distributions defined with standard deviations ranging

from 5% to 105% (in 1% increments). The DCF distributions are based on the anterior–posterior geometry values in Appendix B of NIOSH (2002).

Table 1. Uncertainty values for a set of dosimeter readings.

Total dose (mrem)	Overall uncertainty
1125	109 (10%)
Individual dosimeter readings (mrem)	Individual uncertainty (1 sigma) values
0	0
62	26
67	26
78	28
0	0
67	26
0	0
62	26
62	26
62	26
62	26
62	26
62	26
62	26
67	26
62	26
67	26
67	26
67	26
67	26
62	26
0	0
0	0
0	0
0	0
0	0
0	0
90	30

Figures 1 and 2 illustrate examples of the distributions used in these simulations. The normal distribution (Figure 1 describing dosimetry error) is defined with a standard deviation of 32% (matching the data shown in Table 1). The triangular distribution (Figure 2 describing DCF error) is defined for the 30 to 250 keV photon *Hp(10)* DCF for the colon. Figure 3 shows the product of these two distributions. The outcome is a normal distribution with a mean of 0.59 and a standard deviation of 0.14 (the distribution type and associated parameters were determined using the Batch Fit feature of Crystal Ball®).

In practice, the use of these Monte Carlo simulations follows the flow in Figure 4.

Example 1 – Measured Photon/Neutron Dose

Interactive RadioEpidemiological Program (IREP) distribution choice: Normal.
 IREP Parameter 1: $1.125 \text{ (total dose in cSv)} \times 0.59 \text{ (unit dose uncertainty mean)} = 0.664 \text{ cSv}$.
 IREP Parameter 2: $1.125 \text{ (total dose in cSv)} \times 0.14 \text{ (unit dose uncertainty standard deviation)} = 0.158 \text{ cSv}$.

Using the data in Table 1, the unit dose distribution shown in Figure 3 would be chosen.

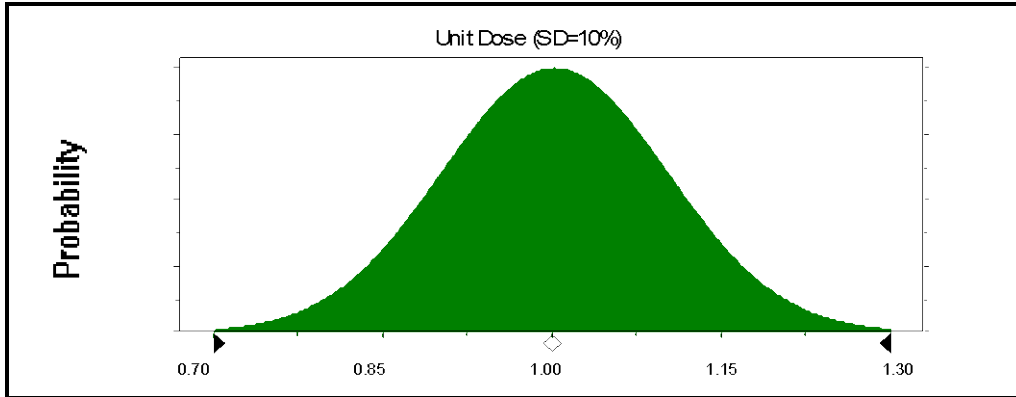


Figure 1. Dosimetry error.

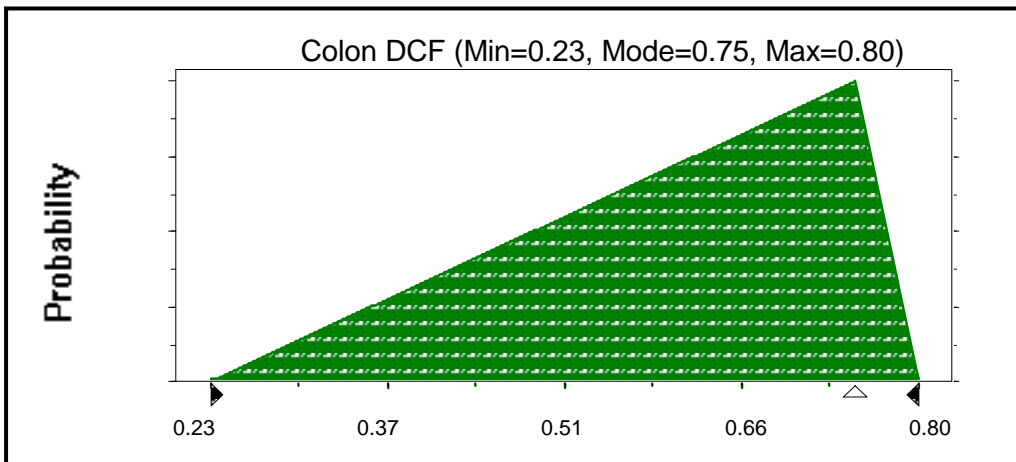


Figure 2. Dose conversion factor error.

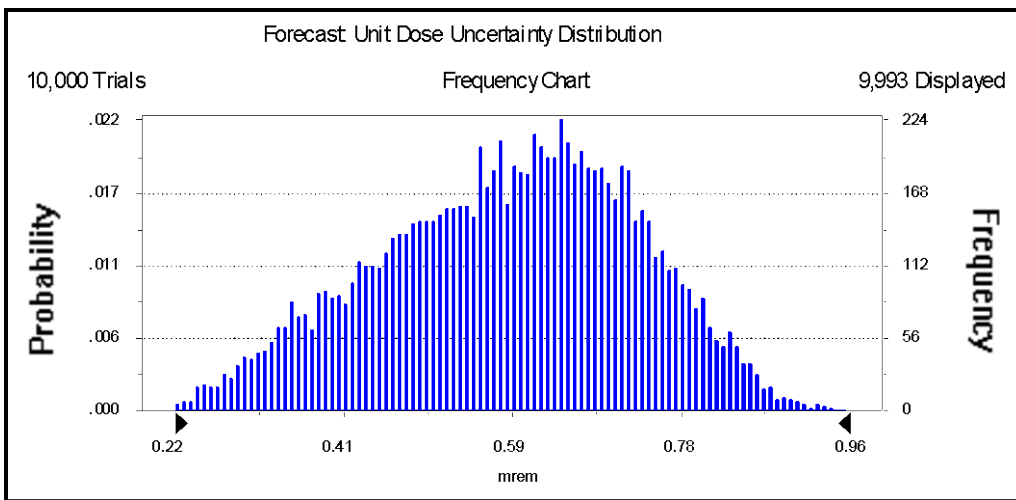


Figure 3. Unit dose uncertainty distribution.

Tables 2 through 4 show a comparison of results for the efficiency method (precalculated) and custom Monte Carlo simulations for colon, bladder, and lung calculations respectively. Because these are Monte Carlo calculations, small differences between methods are expected. The relative error figure in these tables describes the difference between the efficient method and a custom Monte Carlo calculation.

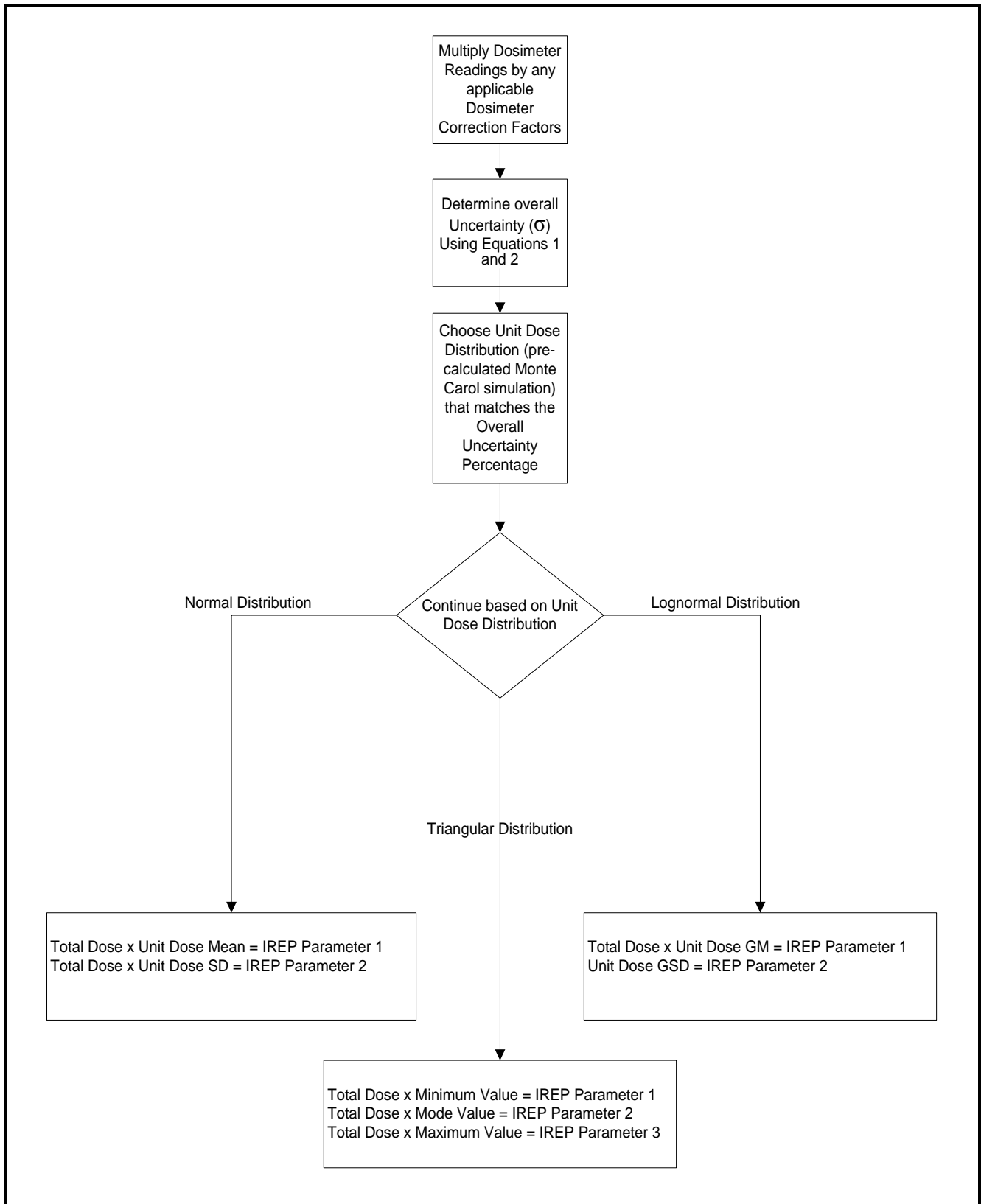


Figure 4. Monte Carlo method for best-estimate organ dose.

Table 2. Comparison of Monte Carlo methods for measured dose uncertainty—colon.

Quantity	Efficiency method	Custom Monte Carlo	Relative error
Mean	0.664 cSv	0.668 cSv	0.6 %
Standard Deviation	0.158	0.159	0.6 %

Table 3. Comparison of Monte Carlo methods for measured dose uncertainty—bladder.

Quantity	Efficiency method	Custom Monte Carlo	Relative error
Mean	0.831 cSv	0.829 cSv	0.2 %
Standard Deviation	0.149	0.148	0.7 %

Table 4. Comparison of Monte Carlo methods for measured dose uncertainty—lung.

Quantity	Efficiency method	Custom Monte Carlo	Relative error
Mean	0.641 cSv	0.640 cSv	0.2 %
Standard Deviation	0.136	0.138	1.4 %

3.2 UNCERTAINTY FOR MISSED DOSE CALCULATIONS

The missed annual dosimeter dose (expressed as a distribution) is combined with the organ DCF (also expressed as a distribution), which is then combined with energy fraction correction factors (typically constants). A series of Monte Carlo simulations is performed that multiplies unit dose quantities (defined as lognormal distributions) by the organ DCF values (defined as the triangular distributions).

Missed dose is calculated using the following relationship:

$$nLOD/2 \times \text{unit missed dose uncertainty distribution}$$

where:

- n = number of zero dosimeter readings
- LOD = dosimeter limit of detection.

Example 2 – Missed Photon/Neutron Dose

IREP distribution choice: Lognormal

IREP Parameter 1: $nLOD/2 \times GM$ of unit missed dose uncertainty distribution (lognormal)

IREP Parameter 2: GSD = 1.62

4.0 UNCERTAINTY FOR NEUTRON TO PHOTON RATIO CALCULATIONS

Using an approach similar to the one described above, neutron to photon ratio distributions can be combined with DCF distributions in a series of Monte Carlo simulations. Neutron to photon ratios are typically defined as lognormal distributions. Figure 4 illustrates the neutron to photon ratio defined for reactor workers at the Hanford Site [lognormal distribution, geometric mean (GM) = 0.41; geometric standard deviation (GSD) = 2.79] (ORAU 2004). In order to better control data quality, measured and missed photon dose quantities are treated with different methods. Neutron dose based on measured photon dose is calculated using the following relationship:

measured photon dose

- × [unit dose uncertainty distribution (Figure 1)
- × neutron to photon ratio distribution (Figure 5)
- × ICRP 60 Factor
- × organ DCF (Figure 2)]

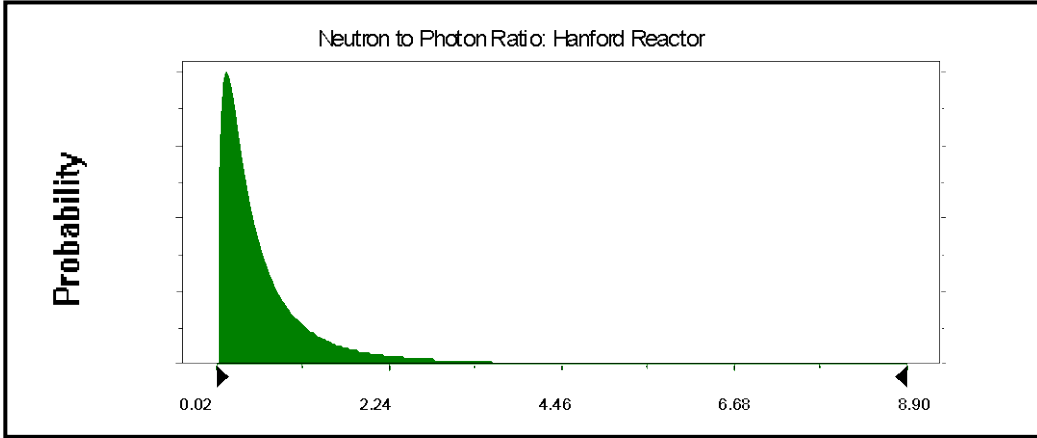


Figure 5. Neutron to photon ratio for Hanford Site reactors.

Neutron dose based on the missed photon dose is calculated as follows:

$nLOD/2$

- × unit missed dose distribution (lognormal, GM= 1; GSD = 1.52)
- × neutron to photon ratio distribution (Figure 4)
- × ICRP 60 Factor
- × organ DCF (Figure 2)]

The variables described in brackets in the equations above are quantities precalculated using Monte Carlo simulations. Figure 6 illustrates the outcome for the measured photon dose method (lognormal, GM = 0.206; GSD = 2.85), while the results of the missed photon dose method are shown in Figure 7 (lognormal, GM = 0.208; GSD = 3.07). Figure 8 summarizes these determinations.

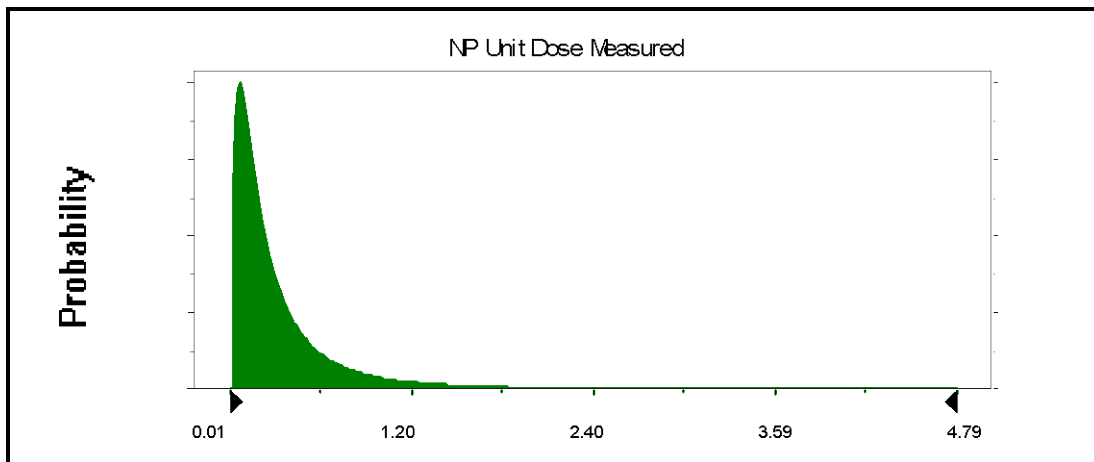


Figure 6. Neutron to photon unit dose—measured.

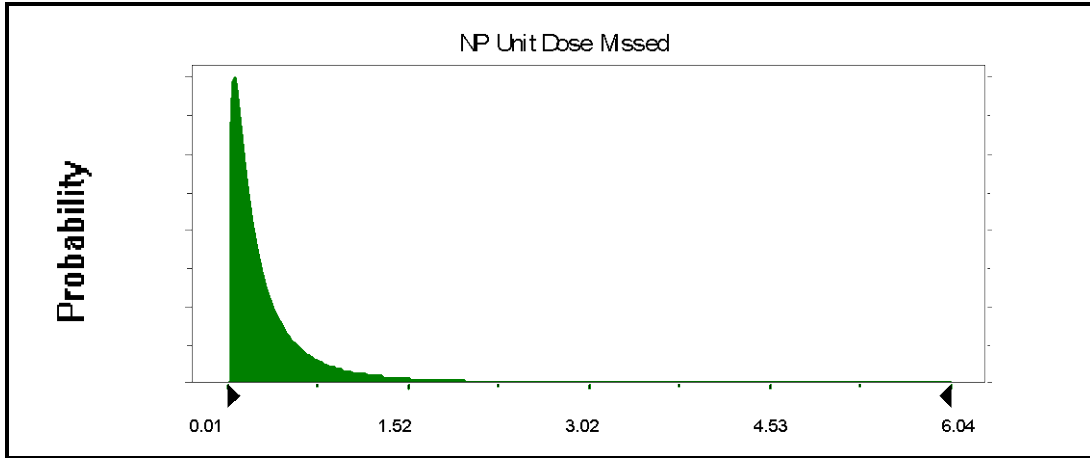


Figure 7. Neutron to photon unit dose—missed.

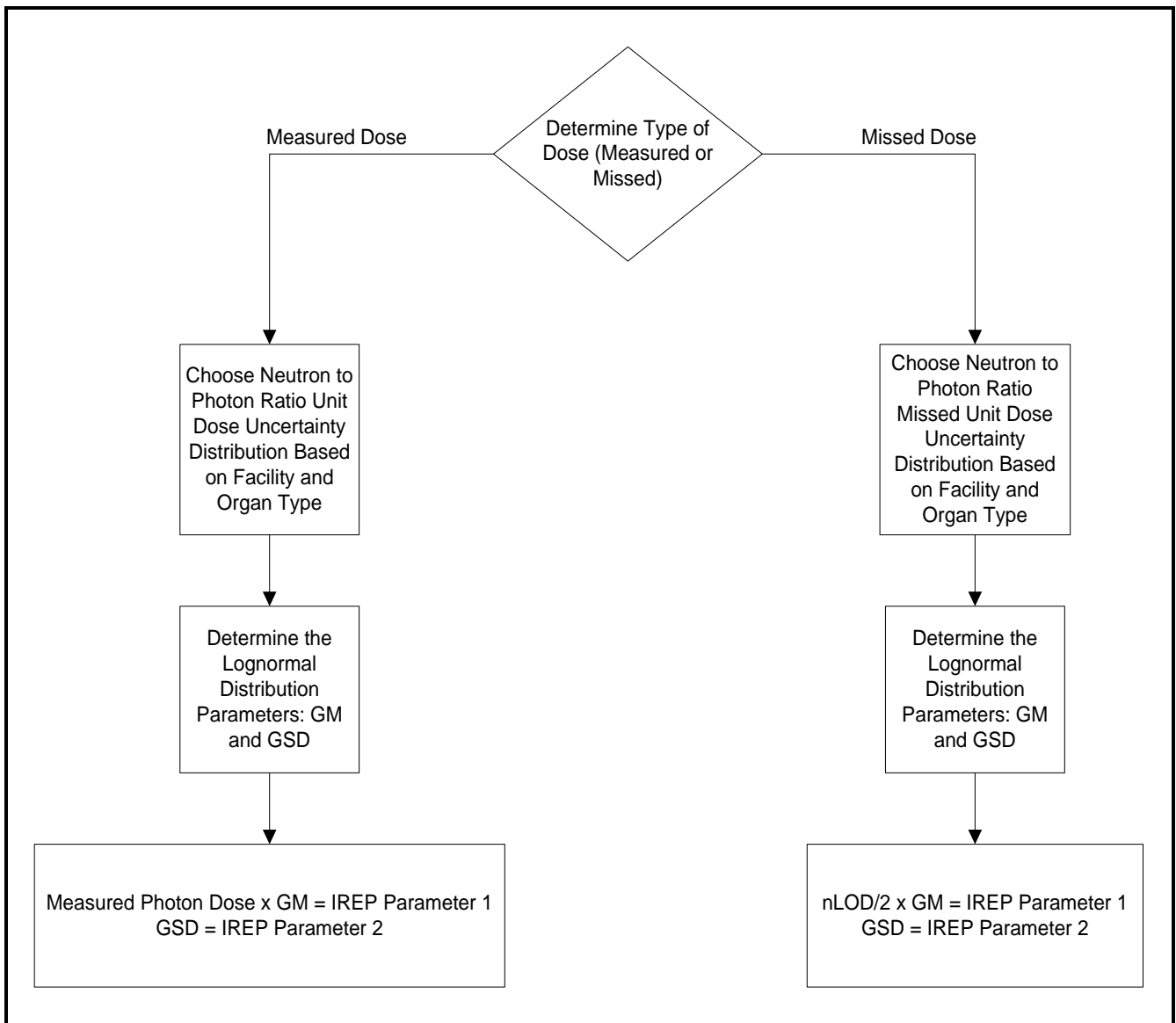


Figure 8. Determination of measured or missed doses using neutron to photon ratios.

Example 3 – Neutron Dose Calculated from Measured Photon Dose

IREP Distribution Choice: Lognormal

IREP Parameter 1: 1.125 (total dose in cSv) \times 0.206 (Figure 5 GM) \times $1.91 = 0.433$ cSv

IREP Parameter 2: GSD from Figure 5 = 2.85

Example 4 – Neutron Dose Calculated from Missed Photon Dose

IREP Distribution Choice: Lognormal

IREP Parameter 1: 0.180 cSv ($nLOD/2$ for data in Table 1) \times 0.208 (Figure 6 GM) \times $1.91 = 0.072$ cSv

IREP Parameter 2: GSD from Figure 6 = 3.07

Tables 5 through 7 show a comparison of results for the efficiency method (precalculated) and custom Monte Carlo simulations for colon, bladder, and lung calculations respectively. Because these are Monte Carlo calculations, small differences between methods are expected. The relative error figure in these tables describes the difference between the efficient method and a custom Monte Carlo calculation.

Table 5. Comparison of Monte Carlo methods for neutron to photon (NP) ratio uncertainty—colon.

Quantity	Efficiency method	Custom Monte Carlo	Relative error
NP ratio measured photon GM	0.443 cSv	0.441 cSv	0.5%
NP ratio measured photon GSD	2.85	2.83	0.7%
NP ratio missed photon GM	0.072 cSv	0.071	1.4%
NP ratio missed photon GSD	3.07	3.04	1%

Table 6. Comparison of Monte Carlo methods for neutron to photon (NP) ratio uncertainty—bladder.

Quantity	Efficiency method	Custom Monte Carlo	Relative error
NP ratio measured photon GM	0.703 cSv	0.701cSv	0.3%
NP ratio measured photon GSD	2.85	2.84	0.4%
NP ratio missed photon GM	0.113 cSv	0.116 cSv	2.6%
NP ratio missed photon GSD	3.06	3.08	0.6%

Table 7. Comparison of Monte Carlo methods for neutron to photon (NP) ratio uncertainty—lung.

Quantity	Efficiency method	Custom Monte Carlo	Relative error
NP ratio measured photon GM	0.494 cSv	0.495 cSv	0.2%
NP ratio measured photon GSD	2.87	2.82	1.8%
NP ratio missed photon GM	0.079 cSv	0.080 cSv	1.3%
NP ratio missed photon GSD	3.07	3.04	1%

REFERENCES

Decisioneering, Inc., *Crystal Ball 2000.2 User Manual*, 2001, Denver, CO.

NIOSH (National Institute for Occupational Safety and Health), 2002, *External Dose Reconstruction Implementation Guidelines*, OCAS-IG-001, Revision 1, Office of Compensation Analysis and Support, Cincinnati, Ohio.

ORAU Team, *Technical Basis Document for the Hanford Site – Occupational External Dosimetry*, ORAUT-TKBS-0006-6 Rev 01 (2004)

ATTACHMENT A
Photons 30-250 keV, H_p(10)

Bladder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.740	0.115	0.000
10	Normal	0.739	0.132	0.000
20	Normal	0.739	0.186	0.000
30	Normal	0.738	0.250	0.000
40	Normal	0.738	0.312	0.000
50	Normal	0.757	0.371	0.000
60	Normal	0.780	0.419	0.000
70	Normal	0.825	0.470	0.000
80	Normal	0.862	0.520	0.000
90	Normal	0.896	0.564	0.000
100	Normal	0.950	0.611	0.000

Bone (red marrow)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.056	0.436	0.601
10	Normal	0.360	0.112	0.000
20	Normal	0.362	0.132	0.000
30	Normal	0.362	0.156	0.000
40	Normal	0.360	0.183	0.000
50	Normal	0.368	0.208	0.000
60	Normal	0.380	0.231	0.000
70	Normal	0.405	0.259	0.000
80	Normal	0.424	0.284	0.000
90	Normal	0.438	0.308	0.000
100	Normal	0.462	0.328	0.000

Bone surfaces				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.831	0.146	0.000
10	Normal	0.832	0.161	0.000
20	Normal	0.834	0.220	0.000
30	Normal	0.830	0.287	0.000
40	Normal	0.834	0.361	0.000
50	Normal	0.849	0.424	0.000
60	Normal	0.879	0.478	0.000
70	Normal	0.932	0.536	0.000
80	Normal	0.969	0.586	0.000
90	Normal	1.013	0.647	0.000
100	Normal	1.066	0.697	0.000

Breast (female)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.892	0.046	0.000
10	Normal	0.891	0.090	0.000
20	Normal	0.894	0.179	0.000
30	Normal	0.892	0.270	0.000
40	Normal	0.893	0.352	0.000
50	Normal	0.914	0.423	0.000
60	Normal	0.941	0.482	0.000
70	Normal	0.998	0.543	0.000
80	Normal	1.043	0.604	0.000
90	Normal	1.085	0.660	0.000
100	Normal	1.146	0.711	0.000

Colon				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.211	0.668	0.902
10	Normal	0.590	0.141	0.000
20	Normal	0.592	0.178	0.000
30	Normal	0.591	0.224	0.000
40	Normal	0.590	0.271	0.000
50	Normal	0.603	0.317	0.000
60	Normal	0.623	0.351	0.000
70	Normal	0.661	0.396	0.000
80	Normal	0.691	0.435	0.000
90	Normal	0.718	0.474	0.000
100	Normal	0.757	0.512	0.000

Esophagus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.050	0.431	0.646
10	Normal	0.370	0.120	0.000
20	Normal	0.372	0.139	0.000
30	Normal	0.370	0.163	0.000
40	Normal	0.372	0.191	0.000
50	Normal	0.381	0.216	0.000
60	Normal	0.392	0.243	0.000
70	Normal	0.416	0.268	0.000
80	Normal	0.433	0.293	0.000
90	Normal	0.453	0.319	0.000
100	Normal	0.477	0.340	0.000

Eye				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.913	1.085	0.000
10	Lognormal	0.908	1.127	0.000
20	Normal	0.916	0.194	0.000
30	Normal	0.915	0.285	0.000
40	Normal	0.916	0.367	0.000
50	Normal	0.936	0.438	0.000
60	Normal	0.966	0.499	0.000
70	Normal	1.023	0.561	0.000
80	Normal	1.070	0.627	0.000
90	Normal	1.113	0.682	0.000
100	Normal	1.174	0.734	0.000

Liver				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.257	0.678	0.897
10	Normal	0.609	0.130	0.000
20	Normal	0.612	0.170	0.000
30	Normal	0.611	0.222	0.000
40	Normal	0.611	0.272	0.000
50	Normal	0.625	0.318	0.000
60	Normal	0.644	0.358	0.000
70	Normal	0.683	0.402	0.000
80	Normal	0.715	0.445	0.000
90	Normal	0.743	0.481	0.000
100	Normal	0.785	0.518	0.000
101	Normal	0.794	0.522	0.000

Lung				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.248	0.633	0.831
10	Normal	0.570	0.121	0.000
20	Normal	0.575	0.161	0.000
30	Normal	0.571	0.205	0.000
40	Normal	0.573	0.254	0.000
50	Normal	0.584	0.296	0.000
60	Normal	0.602	0.333	0.000
70	Normal	0.642	0.376	0.000
80	Normal	0.667	0.411	0.000
90	Normal	0.697	0.450	0.000
100	Normal	0.732	0.482	0.000

Lymphoid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.937	0.231	0.000
10	Normal	0.933	0.245	0.000
20	Normal	0.936	0.292	0.000
30	Normal	0.934	0.366	0.000
40	Normal	0.938	0.439	0.000
50	Normal	0.960	0.509	0.000
60	Normal	0.985	0.569	0.000
70	Normal	1.045	0.631	0.000
80	Normal	1.091	0.700	0.000
90	Normal	1.138	0.761	0.000
100	Normal	1.203	0.819	0.000

Ovaries				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.129	0.603	0.834
10	Normal	0.517	0.144	0.000
20	Normal	0.521	0.172	0.000
30	Normal	0.517	0.209	0.000
40	Normal	0.519	0.249	0.000
50	Normal	0.533	0.288	0.000
60	Normal	0.547	0.323	0.000
70	Normal	0.583	0.361	0.000
80	Normal	0.603	0.392	0.000
90	Normal	0.629	0.427	0.000
100	Normal	0.668	0.458	0.000

Remainder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.171	0.572	0.751
10	Normal	0.497	0.120	0.000
20	Normal	0.498	0.149	0.000
30	Normal	0.498	0.189	0.000
40	Normal	0.498	0.228	0.000
50	Normal	0.513	0.267	0.000
60	Normal	0.525	0.298	0.000
70	Normal	0.556	0.333	0.000
80	Normal	0.582	0.368	0.000
90	Normal	0.605	0.400	0.000
100	Normal	0.644	0.433	0.000

Skin				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.625	0.047	0.000
10	Normal	0.624	0.071	0.000
20	Normal	0.626	0.130	0.000
30	Normal	0.625	0.193	0.000
40	Normal	0.625	0.249	0.000
50	Normal	0.640	0.298	0.000
60	Normal	0.659	0.339	0.000
70	Normal	0.699	0.383	0.000
80	Normal	0.731	0.426	0.000
90	Normal	0.760	0.464	0.000
100	Normal	0.802	0.500	0.000

Stomach				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.397	0.809	1.020
10	Normal	0.741	0.133	0.000
20	Normal	0.743	0.186	0.000
30	Normal	0.744	0.252	0.000
40	Normal	0.746	0.317	0.000
50	Normal	0.761	0.373	0.000
60	Normal	0.784	0.422	0.000
70	Normal	0.830	0.472	0.000
80	Normal	0.869	0.525	0.000
90	Normal	0.906	0.574	0.000
100	Normal	0.955	0.615	0.000

Testes				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.007	0.051	0.000
10	Normal	1.006	0.101	0.000
20	Normal	1.009	0.202	0.000
30	Normal	1.008	0.305	0.000
40	Normal	1.008	0.397	0.000
50	Normal	1.032	0.477	1.032
60	Normal	1.063	0.544	0.000
70	Normal	1.127	0.613	0.000
80	Normal	1.178	0.683	0.000
90	Normal	1.225	0.745	0.000
100	Normal	1.295	0.804	0.000

Thymus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.885	0.100	0.000
10	Normal	0.883	0.126	0.000
20	Normal	0.885	0.200	0.000
30	Normal	0.884	0.285	0.000
40	Normal	0.886	0.360	0.000
50	Normal	0.908	0.433	0.000
60	Normal	0.934	0.491	0.000
70	Normal	0.988	0.551	0.000
80	Normal	0.988	0.551	0.000
90	Normal	1.075	0.664	0.000
100	Normal	1.139	0.722	0.000

Thyroid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.960	0.069	0.000
10	Normal	0.958	0.108	0.000
20	Normal	0.961	0.199	0.000
30	Normal	0.960	0.296	0.000
40	Normal	0.961	0.383	0.000
50	Normal	0.984	0.459	0.000
60	Normal	1.012	0.522	0.000
70	Normal	1.074	0.587	0.000
80	Normal	1.122	0.654	0.000
90	Normal	1.167	0.714	1.167
100	Normal	1.234	0.771	0.000

Uterus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.178	0.632	0.860
10	Normal	0.556	0.139	0.000
20	Normal	0.557	0.170	0.000
30	Normal	0.556	0.215	0.000
40	Normal	0.557	0.260	0.000
50	Normal	0.569	0.301	0.000
60	Normal	0.587	0.335	0.000
70	Normal	0.620	0.373	0.000
80	Normal	0.650	0.414	0.000
90	Normal	0.676	0.450	0.000
100	Normal	0.714	0.484	0.000

ATTACHMENT B
Photons Greater Than 250 keV, H_p(10)

Bladder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.907	0.046	0.000
10	Normal	0.905	0.091	0.000
20	Normal	0.908	0.182	0.000
30	Normal	0.907	0.275	0.000
40	Normal	0.908	0.357	0.000
50	Normal	0.929	0.430	0.000
60	Normal	0.957	0.490	0.000
70	Normal	1.014	0.552	0.000
80	Normal	1.060	0.614	0.000
90	Normal	1.102	0.674	0.000
100	Normal	1.165	0.723	0.000

Bone (red marrow)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.709	0.071	0.000
10	Normal	0.706	0.093	0.000
20	Normal	0.708	0.156	0.000
30	Normal	0.708	0.224	0.000
40	Normal	0.707	0.287	0.000
50	Normal	0.723	0.341	0.000
60	Normal	0.746	0.388	0.000
70	Normal	0.792	0.438	0.000
80	Normal	0.828	0.487	0.000
90	Normal	0.859	0.531	0.000
100	Normal	0.907	0.571	0.000

Bone surfaces				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.777	0.052	0.000
10	Normal	0.776	0.084	0.000
20	Normal	0.778	0.160	0.000
30	Normal	0.777	0.237	0.000
40	Normal	0.778	0.309	0.000
50	Normal	0.795	0.370	0.000
60	Normal	0.820	0.421	0.000
70	Normal	0.869	0.475	0.000
80	Normal	0.907	0.526	0.000
90	Normal	0.945	0.577	0.000
100	Normal	0.998	0.622	0.000

Breast (female)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.952	0.049	0.000
10	Normal	0.951	0.096	0.000
20	Normal	0.954	0.191	0.000
30	Normal	0.952	0.288	0.000
40	Normal	0.954	0.376	0.000
50	Normal	0.975	0.451	0.000
60	Normal	1.005	0.515	0.000
70	Normal	1.065	0.580	0.000
80	Normal	1.113	0.645	0.000
90	Normal	1.158	0.705	0.000
100	Normal	1.224	0.760	0.000

Colon				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.855	0.047	0.000
10	Normal	0.854	0.087	0.000
20	Normal	0.857	0.173	0.000
30	Normal	0.855	0.260	0.000
40	Normal	0.856	0.338	0.000
50	Normal	0.876	0.406	0.000
60	Normal	0.902	0.462	0.000
70	Normal	0.956	0.521	0.000
80	Normal	1.000	0.580	0.000
90	Normal	1.039	0.633	0.000
100	Normal	1.098	0.683	0.000

Esophagus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.732	0.069	0.000
10	Normal	0.731	0.094	0.000
20	Normal	0.734	0.159	0.000
30	Normal	0.732	0.229	0.000
40	Normal	0.733	0.295	0.000
50	Normal	0.750	0.352	0.000
60	Normal	0.773	0.402	0.000
70	Normal	0.819	0.451	0.000
80	Normal	0.855	0.501	0.000
90	Normal	0.891	0.548	0.000
100	Normal	0.941	0.589	0.000

Eye				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.902	0.051	0.000
10	Normal	0.901	0.093	0.000
20	Normal	0.903	0.183	0.000
30	Normal	0.902	0.275	0.000
40	Normal	0.903	0.357	0.000
50	Normal	0.923	0.428	0.000
60	Normal	0.952	0.488	0.000
70	Normal	1.009	0.549	0.000
80	Normal	1.055	0.613	0.000
90	Normal	1.097	0.668	0.000
100	Normal	1.158	0.720	0.000

Liver				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.862	0.050	0.000
10	Normal	0.861	0.089	0.000
20	Normal	0.864	0.175	0.000
30	Normal	0.862	0.263	0.000
40	Normal	0.863	0.341	0.000
50	Normal	0.883	0.410	0.000
60	Normal	0.910	0.467	0.000
70	Normal	0.964	0.526	0.000
80	Normal	1.008	0.586	0.000
90	Normal	1.048	0.639	0.000
100	Normal	1.108	0.689	0.000

Lung				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.835	0.051	0.000
10	Normal	0.834	0.088	0.000
20	Normal	0.838	0.171	0.000
30	Normal	0.835	0.254	0.000
40	Normal	0.837	0.331	0.000
50	Normal	0.855	0.397	0.000
60	Normal	0.881	0.452	0.000
70	Normal	0.935	0.510	0.000
80	Normal	0.976	0.566	0.000
90	Normal	1.016	0.620	0.000
100	Normal	1.073	0.667	0.000

Lymphoid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.937	0.231	0.000
10	Normal	0.933	0.245	0.000
20	Normal	0.936	0.292	0.000
30	Normal	0.934	0.366	0.000
40	Normal	0.938	0.439	0.000
50	Normal	0.960	0.509	0.000
60	Normal	0.985	0.569	0.000
70	Normal	1.045	0.631	0.000
80	Normal	1.091	0.700	0.000
90	Normal	1.138	0.761	0.000
100	Normal	1.203	0.819	0.000

Ovaries				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.845	1.074	0.000
10	Normal	0.846	0.095	0.000
20	Normal	0.849	0.176	0.000
30	Normal	0.847	0.260	0.000
40	Normal	0.848	0.337	0.000
50	Normal	0.869	0.404	0.000
60	Normal	0.894	0.461	0.000
70	Normal	0.949	0.519	0.000
80	Normal	0.990	0.576	0.000
90	Normal	1.030	0.629	0.000
100	Normal	1.090	0.678	0.000

Remainder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.780	0.052	0.000
10	Normal	0.778	0.085	0.000
20	Normal	0.781	0.160	0.000
30	Normal	0.780	0.239	0.000
40	Normal	0.780	0.309	0.000
50	Normal	0.799	0.372	0.000
60	Normal	0.822	0.423	0.000
70	Normal	0.872	0.476	0.000
80	Normal	0.911	0.530	0.000
90	Normal	0.947	0.579	0.000
100	Normal	1.003	0.625	0.000

Skin				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.822	0.058	0.000
10	Normal	0.821	0.091	0.000
20	Normal	0.823	0.170	0.000
30	Normal	0.822	0.252	0.000
40	Normal	0.823	0.327	0.000
50	Normal	0.842	0.391	0.000
60	Normal	0.867	0.446	0.000
70	Normal	0.919	0.503	0.000
80	Normal	0.961	0.560	0.000
90	Normal	0.999	0.610	0.000
100	Normal	1.056	0.657	0.000

Stomach				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.913	0.046	0.000
10	Normal	0.911	0.091	0.000
20	Normal	0.914	0.183	0.000
30	Normal	0.913	0.276	0.000
40	Normal	0.914	0.360	0.000
50	Normal	0.935	0.432	0.000
60	Normal	0.963	0.493	0.000
70	Normal	1.021	0.555	0.000
80	Normal	1.067	0.618	0.000
90	Normal	1.110	0.675	0.000
100	Normal	1.173	0.728	0.000

Testes				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.963	0.053	0.000
10	Normal	0.962	0.098	0.000
20	Normal	0.964	0.194	0.000
30	Normal	0.963	0.292	0.000
40	Normal	0.964	0.380	0.000
50	Normal	0.987	0.457	0.000
60	Normal	1.016	0.521	0.000
70	Normal	1.077	0.586	0.000
80	Normal	1.126	0.653	0.000
90	Normal	1.170	0.712	0.000
100	Normal	1.238	0.770	0.000

Thymus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.920	1.063	0.000
10	Normal	0.920	0.097	0.000
20	Normal	0.922	0.188	0.000
30	Normal	0.921	0.281	0.000
40	Normal	0.922	0.364	0.000
50	Normal	0.944	0.439	0.000
60	Normal	0.972	0.499	0.000
70	Normal	1.030	0.562	0.000
80	Normal	1.077	0.626	0.000
90	Normal	1.120	0.682	0.000
100	Normal	1.185	0.738	0.000

Thyroid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.992	0.059	0.000
10	Normal	0.990	0.104	0.000
20	Normal	0.994	0.202	0.000
30	Normal	0.992	0.303	0.000
40	Normal	1.017	0.472	0.000
50	Normal	1.035	0.393	0.000
60	Normal	1.047	0.538	0.000
70	Normal	1.110	0.605	0.000
80	Normal	1.160	0.674	0.000
90	Normal	1.207	0.736	0.000
100	Normal	1.276	0.794	0.000

Uterus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.796	0.042	0.000
10	Normal	0.795	0.080	0.000
20	Normal	0.797	0.160	0.000
30	Normal	0.796	0.241	0.000
40	Normal	0.797	0.314	0.000
50	Normal	0.830	0.395	0.000
60	Normal	0.840	0.430	0.000
70	Normal	0.890	0.484	0.000
80	Normal	0.930	0.540	0.000
90	Normal	0.968	0.589	0.000
100	Normal	1.023	0.635	0.000

ATTACHMENT C
Photons Less than 30 keV, H_p(10)

Bladder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.000	0.162	0.448
10	Normal	0.198	0.090	0.000
20	Normal	0.197	0.097	0.000
30	Normal	0.197	0.108	0.000
40	Normal	0.197	0.121	0.000
50	Normal	0.203	0.137	0.000
60	Normal	0.209	0.148	0.000
70	Lognormal	0.155	2.725	0.000
80	Lognormal	0.158	2.766	0.000
90	Lognormal	0.159	2.972	0.000
100	Lognormal	0.168	2.999	0.000

Bone (red marrow)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.035	1.324	0.000
10	Lognormal	0.035	1.341	0.000
20	Lognormal	0.034	1.422	0.000
30	Lognormal	0.033	1.573	0.000
40	Normal	0.036	0.018	0.000
50	Normal	0.037	0.020	0.000
60	Normal	0.038	0.023	0.000
70	Normal	0.041	0.026	0.000
80	Normal	0.043	0.028	0.000
90	Normal	0.044	0.030	0.000
100	Normal	0.046	0.032	0.000

Bone surfaces				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.251	1.385	0.000
10	Lognormal	0.251	1.397	0.000
20	Lognormal	0.247	1.472	0.000
30	Lognormal	0.238	1.608	0.000
40	Normal	0.265	0.136	0.000
50	Normal	0.269	0.155	0.000
60	Normal	0.279	0.173	0.000
70	Normal	0.296	0.192	0.000
80	Normal	0.307	0.206	0.000
90	Normal	0.322	0.228	0.000
100	Normal	0.338	0.245	0.000

Breast (female)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	1.292	1.344	0.000
10	Lognormal	1.288	1.366	0.000
20	Lognormal	1.272	1.435	0.000
30	Lognormal	1.220	1.582	0.000
40	Lognormal	1.174	1.811	0.000
50	Normal	1.380	0.775	0.000
60	Normal	1.432	0.879	0.000
70	Normal	1.513	0.965	0.000
80	Normal	1.569	1.051	0.000
90	Normal	1.651	1.160	0.000
100	Normal	1.730	1.224	0.000

Colon				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.000	0.056	0.240
10	Lognormal	0.081	1.866	0.000
20	Lognormal	0.080	1.936	0.000
30	Lognormal	0.077	2.050	0.000
40	Lognormal	0.073	2.253	0.000
50	Lognormal	0.071	2.534	0.000
60	Lognormal	0.071	2.651	0.000
70	Lognormal	0.072	2.830	0.000
80	Lognormal	0.074	2.888	0.000
90	Lognormal	0.074	3.120	0.000
100	Lognormal	0.077	3.100	0.000

Esophagus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.000	0.009	0.059
10	Lognormal	0.017	1.992	0.000
20	Lognormal	0.017	2.037	0.000
30	Lognormal	0.016	2.138	0.000
40	Lognormal	0.016	2.334	0.000
50	Lognormal	0.015	2.588	0.000
60	Lognormal	0.015	2.797	0.000
70	Lognormal	0.016	2.903	0.000
80	Lognormal	0.016	2.952	0.000
90	Lognormal	0.016	3.200	0.000
100	Lognormal	0.017	3.134	0.000

Eye				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	10.601	1.951	0.000
10	Lognormal	10.472	1.984	0.000
20	Lognormal	10.205	2.039	0.000
30	Lognormal	9.873	2.158	0.000
40	Lognormal	9.466	2.323	0.000
50	Lognormal	9.112	2.586	0.000
60	Lognormal	9.146	2.743	0.000
70	Lognormal	9.316	2.908	0.000
80	Lognormal	9.546	2.992	0.000
90	Lognormal	9.596	3.174	0.000
100	Lognormal	9.954	3.170	0.000

Liver				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.000	0.087	0.320
10	Normal	0.127	0.061	0.000
20	Lognormal	0.109	1.849	0.000
30	Lognormal	0.105	1.987	0.000
40	Lognormal	0.100	2.216	0.000
50	Lognormal	0.096	2.476	0.000
60	Lognormal	0.096	2.599	0.000
70	Lognormal	0.099	2.710	0.000
80	Lognormal	0.101	2.875	0.000
90	Lognormal	0.102	3.036	0.000
100	Lognormal	0.107	3.036	0.000

Lung				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.000	0.076	0.285
10	Normal	0.116	0.057	0.000
20	Lognormal	0.100	1.905	0.000
30	Lognormal	0.095	1.987	0.000
40	Lognormal	0.091	2.200	0.000
50	Lognormal	0.087	2.465	0.000
60	Lognormal	0.087	2.609	0.000
70	Lognormal	0.091	2.789	0.000
80	Lognormal	0.092	2.836	0.000
90	Lognormal	0.095	3.019	0.000
100	Lognormal	0.096	3.034	0.000

Lymphoid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.937	0.231	0.000
10	Normal	0.933	0.245	0.000
20	Normal	0.936	0.292	0.000
30	Normal	0.934	0.366	0.000
40	Normal	0.938	0.439	0.000
50	Normal	0.960	0.509	0.000
60	Normal	0.985	0.569	0.000
70	Normal	1.045	0.631	0.000
80	Normal	1.091	0.700	0.000
90	Normal	1.138	0.761	0.000
100	Normal	1.203	0.819	0.000

Ovaries				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.000	0.032	0.152
10	Lognormal	0.049	1.905	0.000
20	Lognormal	0.049	1.954	0.000
30	Lognormal	0.047	2.076	0.000
40	Lognormal	0.045	2.257	0.000
50	Lognormal	0.043	2.575	0.000
60	Lognormal	0.043	2.695	0.000
70	Lognormal	0.045	2.842	0.000
80	Lognormal	0.045	2.901	0.000
90	Lognormal	0.045	3.066	0.000
100	Lognormal	0.048	3.100	0.000

Remainder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.092	1.474	0.000
10	Lognormal	0.091	1.491	0.000
20	Lognormal	0.089	1.545	0.000
30	Lognormal	0.086	1.695	0.000
40	Lognormal	0.082	1.898	0.000
50	Normal	0.101	0.061	0.000
60	Normal	0.103	0.067	0.000
70	Normal	0.109	0.074	0.000
80	Lognormal	0.083	2.571	0.000
90	Normal	0.119	0.088	0.000
100	Lognormal	0.089	2.744	0.000

Skin				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.566	1.576	28.130
10	Lognormal	7.432	2.147	0.000
20	Lognormal	7.281	2.182	0.000
30	Lognormal	7.093	2.309	0.000
40	Lognormal	6.704	2.511	0.000
50	Lognormal	6.504	2.760	0.000
60	Normal	6.496	2.897	0.000
70	Lognormal	6.623	3.054	0.000
80	Lognormal	6.812	3.133	0.000
90	Normal	6.820	3.315	0.000
100	Lognormal	7.163	3.267	0.000

Stomach				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.000	0.162	0.460
10	Normal	0.199	0.092	0.000
20	Normal	0.200	0.100	0.000
30	Lognormal	0.167	1.937	0.000
40	Lognormal	0.160	2.151	0.000
50	Normal	0.205	0.138	0.000
60	Lognormal	0.152	2.590	0.000
70	Lognormal	0.156	2.714	0.000
80	Lognormal	0.160	2.809	0.000
90	Lognormal	0.163	3.001	0.000
100	Lognormal	0.169	2.991	0.000

Testes				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	1.566	1.410	0.000
10	Lognormal	1.552	1.428	0.000
20	Lognormal	1.522	1.494	0.000
30	Lognormal	1.482	1.633	0.000
40	Lognormal	1.402	1.857	0.000
50	Normal	1.702	1.023	0.000
60	Normal	1.750	1.119	0.000
70	Normal	1.841	1.231	0.000
80	Lognormal	2.538	0.000	0.000
90	Normal	1.997	1.450	0.000
100	Lognormal	1.506	2.704	0.000

Thymus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.302	0.130	0.000
10	Normal	0.301	0.133	0.000
20	Normal	0.300	0.144	0.000
30	Normal	0.301	0.163	0.000
40	Normal	0.302	0.180	0.000
50	Normal	0.311	0.205	0.000
60	Normal	0.319	0.224	0.000
70	Lognormal	0.236	2.700	0.000
80	Lognormal	0.242	2.817	0.000
90	Lognormal	0.245	2.954	0.000
100	Lognormal	0.258	2.975	0.000

Thyroid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.500	0.140	0.000
10	Normal	0.496	0.149	0.000
20	Normal	0.500	0.175	0.000
30	Normal	0.499	0.211	0.000
40	Normal	0.499	0.249	0.000
50	Normal	0.513	0.286	0.000
60	Normal	0.526	0.318	0.000
70	Normal	0.559	0.351	0.000
80	Normal	0.584	0.389	0.000
90	Normal	0.607	0.422	0.000
100	Normal	0.644	0.454	0.000

Uterus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.000	0.039	0.212
10	Lognormal	0.067	1.900	0.000
20	Lognormal	0.066	1.959	0.000
30	Lognormal	0.063	2.089	0.000
40	Lognormal	0.060	2.295	0.000
50	Lognormal	0.058	2.579	0.000
60	Lognormal	0.058	2.691	0.000
70	Lognormal	0.060	2.810	0.000
80	Lognormal	0.061	2.943	0.000
90	Lognormal	0.061	3.140	0.000
100	Lognormal	0.064	3.114	0.000

ATTACHMENT D
Photons 30-250 keV, Exposure (R)

Bladder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.406	1.159	1.661
10	Normal	1.068	0.253	0.000
20	Normal	1.068	0.318	0.000
30	Normal	1.065	0.400	0.000
40	Normal	1.066	0.485	0.000
50	Normal	1.095	0.569	0.000
60	Normal	1.127	0.636	0.000
70	Normal	1.192	0.712	0.000
80	Normal	1.245	0.783	0.000
90	Normal	1.294	0.848	0.000
100	Normal	1.374	0.920	0.000

Bone (red marrow)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.056	0.569	0.792
10	Normal	0.466	0.151	0.000
20	Normal	0.468	0.176	0.000
30	Normal	0.469	0.207	0.000
40	Normal	0.467	0.241	0.000
50	Normal	0.477	0.274	0.000
60	Normal	0.492	0.303	0.000
70	Normal	0.524	0.340	0.000
80	Normal	0.549	0.373	0.000
90	Normal	0.567	0.403	0.000
100	Normal	0.597	0.430	0.000

Bone surfaces				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.226	0.309	0.000
10	Normal	1.229	0.325	0.000
20	Normal	1.230	0.397	0.000
30	Normal	1.223	0.479	0.000
40	Normal	1.231	0.583	0.000
50	Normal	1.251	0.674	0.000
60	Normal	1.296	0.753	0.000
70	Normal	1.375	0.840	0.000
80	Normal	1.427	0.910	0.000
90	Normal	1.495	1.005	0.000
100	Normal	1.570	1.082	0.000

Breast (female)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.208	0.141	0.000
10	Normal	1.207	0.177	0.000
20	Normal	1.211	0.275	0.000
30	Normal	1.207	0.388	0.000
40	Normal	1.212	0.497	0.000
50	Normal	1.237	0.589	0.000
60	Normal	1.277	0.672	0.000
70	Normal	1.352	0.753	0.000
80	Normal	1.410	0.834	0.000
90	Normal	1.472	0.915	0.000
100	Normal	1.552	0.982	0.000

Colon				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.215	0.962	1.417
10	Normal	0.855	0.240	0.000
20	Normal	0.857	0.289	0.000
30	Normal	0.856	0.350	0.000
40	Normal	0.855	0.416	0.000
50	Normal	0.873	0.481	0.000
60	Normal	0.902	0.528	0.000
70	Normal	0.957	0.595	0.000
80	Normal	1.000	0.653	0.000
90	Normal	1.039	0.710	0.000
100	Normal	1.096	0.767	0.000

Esophagus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.049	0.609	0.906
10	Normal	0.514	0.174	0.000
20	Normal	0.517	0.199	0.000
30	Normal	0.514	0.232	0.000
40	Normal	0.517	0.270	0.000
50	Normal	0.529	0.305	0.000
60	Normal	0.545	0.342	0.000
70	Normal	0.578	0.377	0.000
80	Normal	0.601	0.412	0.000
90	Normal	0.629	0.448	0.000
100	Normal	0.662	0.477	0.000

Eye				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	1.227	1.070	0.000
10	Normal	1.227	0.134	0.000
20	Normal	1.231	0.253	0.000
30	Normal	1.229	0.378	0.000
40	Normal	1.230	0.488	0.000
50	Normal	1.258	0.584	0.000
60	Normal	1.297	0.666	0.000
70	Normal	1.374	0.750	0.000
80	Normal	1.437	0.838	0.000
90	Normal	1.494	0.913	0.000
100	Normal	1.578	0.982	0.000

Liver				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.877	0.218	0.000
10	Normal	0.874	0.229	0.000
20	Normal	0.878	0.279	0.000
30	Normal	0.876	0.348	0.000
40	Normal	0.877	0.416	0.000
50	Normal	0.897	0.481	0.000
60	Normal	0.925	0.537	0.000
70	Normal	0.980	0.602	0.000
80	Normal	1.026	0.665	0.000
90	Normal	1.067	0.716	0.000
100	Normal	1.127	0.771	0.000

Lung				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.250	0.903	1.284
10	Normal	0.808	0.209	0.000
20	Normal	0.815	0.259	0.000
30	Normal	0.808	0.315	0.000
40	Normal	0.812	0.381	0.000
50	Normal	0.826	0.439	0.000
60	Normal	0.852	0.491	0.000
70	Normal	0.911	0.555	0.000
80	Normal	0.943	0.602	0.000
90	Normal	0.987	0.659	0.000
100	Normal	1.035	0.706	0.000

Lymphoid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.937	0.231	0.000
10	Normal	0.933	0.245	0.000
20	Normal	0.936	0.292	0.000
30	Normal	0.934	0.366	0.000
40	Normal	0.938	0.439	0.000
50	Normal	0.960	0.509	0.000
60	Normal	0.985	0.569	0.000
70	Normal	1.045	0.631	0.000
80	Normal	1.091	0.700	0.000
90	Normal	1.138	0.761	0.000
100	Normal	1.203	0.819	0.000

Ovaries				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.134	0.869	1.227
10	Normal	0.735	0.225	0.000
20	Normal	0.740	0.263	0.000
30	Normal	0.733	0.313	0.000
40	Normal	0.737	0.367	0.000
50	Normal	0.757	0.422	0.000
60	Normal	0.777	0.472	0.000
70	Normal	0.828	0.526	0.000
80	Normal	0.856	0.571	0.000
90	Normal	0.894	0.621	0.000
100	Normal	0.949	0.666	0.000

Remainder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.175	0.813	1.133
10	Normal	0.701	0.197	0.000
20	Normal	0.702	0.232	0.000
30	Normal	0.703	0.286	0.000
40	Normal	0.702	0.339	0.000
50	Normal	0.724	0.393	0.000
60	Normal	0.740	0.436	0.000
70	Normal	0.783	0.485	0.000
80	Normal	0.821	0.535	0.000
90	Normal	0.852	0.580	0.000
100	Normal	0.909	0.628	0.000

Skin				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.820	0.092	0.000
10	Normal	0.820	0.115	0.000
20	Normal	0.822	0.185	0.000
30	Normal	0.822	0.263	0.000
40	Normal	0.822	0.335	0.000
50	Normal	0.840	0.398	0.000
60	Normal	0.866	0.453	0.000
70	Normal	0.918	0.511	0.000
80	Normal	0.960	0.567	0.000
90	Normal	0.998	0.617	0.000
100	Normal	1.054	0.664	0.000

Stomach				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.413	1.161	1.677
10	Normal	1.071	0.257	0.000
20	Normal	1.074	0.321	0.000
30	Normal	1.075	0.405	0.000
40	Normal	1.079	0.495	0.000
50	Normal	1.100	0.572	0.000
60	Normal	1.133	0.643	0.000
70	Normal	1.199	0.716	0.000
80	Normal	1.257	0.792	0.000
90	Normal	1.312	0.866	0.000
100	Normal	1.380	0.925	0.000

Testes				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.390	0.166	0.000
10	Normal	1.387	0.207	0.000
20	Normal	1.388	0.319	0.000
30	Normal	1.389	0.449	0.000
40	Normal	1.387	0.568	0.000
50	Normal	1.424	0.683	0.000
60	Normal	1.466	0.773	0.000
70	Normal	1.550	0.866	0.000
80	Normal	1.624	0.962	0.000
90	Normal	1.684	1.046	0.000
100	Normal	1.788	1.137	0.000

Thymus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.249	0.231	0.000
10	Normal	1.246	0.256	0.000
20	Normal	1.246	0.338	0.000
30	Normal	1.247	0.446	0.000
40	Normal	1.249	0.542	0.000
50	Normal	1.282	0.647	0.000
60	Normal	1.317	0.726	0.000
70	Normal	1.392	0.812	0.000
80	Normal	1.459	0.900	0.000
90	Normal	1.514	0.968	0.000
100	Normal	1.609	1.059	0.000

Thyroid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.325	0.193	0.000
10	Normal	1.319	0.228	0.000
20	Normal	1.326	0.326	0.000
30	Normal	1.324	0.446	0.000
40	Normal	1.325	0.560	0.000
50	Normal	1.359	0.664	0.000
60	Normal	1.396	0.750	0.000
70	Normal	1.481	0.837	0.000
80	Normal	1.548	0.933	0.000
90	Normal	1.610	1.017	0.000
100	Normal	1.705	1.097	0.000

Uterus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.188	0.906	1.346
10	Normal	0.806	0.232	0.000
20	Normal	0.807	0.274	0.000
30	Normal	0.806	0.334	0.000
40	Normal	0.807	0.397	0.000
50	Normal	0.826	0.456	0.000
60	Normal	0.852	0.504	0.000
70	Normal	0.899	0.561	0.000
80	Normal	0.942	0.621	0.000
90	Normal	0.981	0.675	0.000
100	Normal	1.036	0.725	0.000

ATTACHMENT E
Photons Greater Than 250 keV, Exposure (R)

Bladder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.941	1.081	0.000
10	Lognormal	0.936	1.123	0.000
20	Normal	0.944	0.198	0.000
30	Normal	0.942	0.291	0.000
40	Normal	0.943	0.376	0.000
50	Normal	0.966	0.451	0.000
60	Normal	0.995	0.513	0.000
70	Normal	1.054	0.578	0.000
80	Normal	1.101	0.642	0.000
90	Normal	1.145	0.700	0.000
100	Normal	1.212	0.757	0.000

Bone (red marrow)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.723	0.048	0.000
10	Normal	0.721	0.078	0.000
20	Normal	0.724	0.149	0.000
30	Normal	0.723	0.222	0.000
40	Normal	0.723	0.287	0.000
50	Normal	0.740	0.344	0.000
60	Normal	0.762	0.392	0.000
70	Normal	0.809	0.442	0.000
80	Normal	0.845	0.492	0.000
90	Normal	0.878	0.537	0.000
100	Normal	0.928	0.578	0.000

Bone surfaces				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.786	1.064	0.000
10	Normal	0.787	0.083	0.000
20	Normal	0.789	0.161	0.000
30	Normal	0.787	0.239	0.000
40	Normal	0.789	0.312	0.000
50	Normal	0.806	0.374	0.000
60	Normal	0.831	0.427	0.000
70	Normal	0.881	0.480	0.000
80	Normal	0.920	0.533	0.000
90	Normal	0.958	0.584	0.000
100	Normal	1.011	0.630	0.000

Breast (female)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.984	1.074	0.000
10	Lognormal	0.979	1.120	0.000
20	Normal	0.989	0.204	0.000
30	Normal	0.986	0.302	0.000
40	Normal	0.988	0.393	0.000
50	Normal	1.010	0.470	0.000
60	Normal	1.042	0.537	0.000
70	Normal	1.104	0.603	0.000
80	Normal	1.152	0.670	0.000
90	Normal	1.200	0.734	0.000
100	Normal	1.267	0.789	0.000

Colon				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.883	1.065	0.000
10	Normal	0.884	0.094	0.000
20	Normal	0.887	0.181	0.000
30	Normal	0.886	0.270	0.000
40	Normal	0.886	0.351	0.000
50	Normal	0.907	0.421	0.000
60	Normal	0.934	0.479	0.000
70	Normal	0.990	0.540	0.000
80	Normal	1.035	0.601	0.000
90	Normal	1.076	0.657	0.000
100	Normal	1.137	0.708	0.000

Esophagus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.750	1.061	0.000
10	Normal	0.750	0.079	0.000
20	Normal	0.753	0.153	0.000
30	Normal	0.752	0.229	0.000
40	Normal	0.753	0.297	0.000
50	Normal	0.770	0.357	0.000
60	Normal	0.793	0.407	0.000
70	Normal	0.841	0.458	0.000
80	Normal	0.879	0.510	0.000
90	Normal	0.914	0.557	0.000
100	Normal	0.966	0.600	0.000

Eye				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.937	1.093	0.000
10	Lognormal	0.932	1.133	0.000
20	Normal	0.941	0.202	0.000
30	Normal	0.940	0.296	0.000
40	Normal	0.940	0.378	0.000
50	Normal	0.962	0.451	0.000
60	Normal	0.992	0.514	0.000
70	Normal	1.051	0.578	0.000
80	Normal	1.099	0.646	0.000
90	Normal	1.142	0.702	0.000
100	Normal	1.206	0.755	0.000

Liver				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.888	1.064	0.000
10	Normal	0.888	0.094	0.000
20	Normal	0.891	0.181	0.000
30	Normal	0.889	0.272	0.000
40	Normal	0.890	0.352	0.000
50	Normal	0.911	0.423	0.000
60	Normal	0.938	0.482	0.000
70	Normal	0.995	0.543	0.000
80	Normal	1.040	0.605	0.000
90	Normal	1.081	0.659	0.000
100	Normal	1.143	0.711	0.000

Lung				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.865	1.056	0.000
10	Normal	0.865	0.088	0.000
20	Normal	0.869	0.175	0.000
30	Normal	0.867	0.263	0.000
40	Normal	0.868	0.342	0.000
50	Normal	0.888	0.411	0.000
60	Normal	0.914	0.468	0.000
70	Normal	0.970	0.528	0.000
80	Normal	1.013	0.587	0.000
90	Normal	1.054	0.642	0.000
100	Normal	1.113	0.691	0.000

Lymphoid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.937	0.231	0.000
10	Normal	0.933	0.245	0.000
20	Normal	0.936	0.292	0.000
30	Normal	0.934	0.366	0.000
40	Normal	0.938	0.439	0.000
50	Normal	0.960	0.509	0.000
60	Normal	0.985	0.569	0.000
70	Normal	1.045	0.631	0.000
80	Normal	1.091	0.700	0.000
90	Normal	1.138	0.761	0.000
100	Normal	1.203	0.819	0.000

Ovaries				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.837	1.062	0.000
10	Normal	0.837	0.088	0.000
20	Normal	0.840	0.171	0.000
30	Normal	0.838	0.255	0.000
40	Normal	0.839	0.331	0.000
50	Normal	0.859	0.398	0.000
60	Normal	0.885	0.454	0.000
70	Normal	0.938	0.512	0.000
80	Normal	0.980	0.568	0.000
90	Normal	1.019	0.621	0.000
100	Normal	1.078	0.670	0.000

Remainder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.800	0.042	0.000
10	Normal	0.798	0.081	0.000
20	Normal	0.801	0.161	0.000
30	Normal	0.800	0.242	0.000
40	Normal	0.800	0.315	0.000
50	Normal	0.819	0.379	0.000
60	Normal	0.844	0.432	0.000
70	Normal	0.894	0.487	0.000
80	Normal	0.935	0.542	0.000
90	Normal	0.972	0.592	0.000
100	Normal	1.028	0.638	0.000

Skin				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.842	0.043	0.000
10	Normal	0.841	0.084	0.000
20	Normal	0.843	0.169	0.000
30	Normal	0.842	0.255	0.000
40	Normal	0.843	0.332	0.000
50	Normal	0.862	0.399	0.000
60	Normal	0.888	0.455	0.000
70	Normal	0.942	0.512	0.000
80	Normal	0.984	0.570	0.000
90	Normal	1.024	0.623	0.000
100	Normal	1.082	0.671	0.000

Stomach				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.953	1.081	0.000
10	Lognormal	0.947	1.124	0.000
20	Normal	0.957	0.200	0.000
30	Normal	0.956	0.295	0.000
40	Normal	0.958	0.383	0.000
50	Normal	0.979	0.457	0.000
60	Normal	1.008	0.521	0.000
70	Normal	1.068	0.585	0.000
80	Normal	1.117	0.652	0.000
90	Normal	1.163	0.713	0.000
100	Normal	1.227	0.766	0.000

Testes				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	1.010	1.096	0.000
10	Lognormal	1.004	1.136	0.000
20	Normal	1.014	0.218	0.000
30	Normal	1.014	0.318	0.000
40	Normal	1.013	0.407	0.000
50	Normal	1.039	0.491	0.000
60	Normal	1.070	0.556	0.000
70	Normal	1.133	0.624	0.000
80	Normal	1.186	0.695	0.000
90	Normal	1.230	0.756	0.000
100	Normal	1.305	0.821	0.000

Thymus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.972	1.111	0.000
10	Lognormal	0.966	1.146	0.000
20	Normal	0.977	0.217	0.000
30	Normal	0.977	0.312	0.000
40	Normal	0.978	0.395	0.000
50	Normal	1.002	0.476	0.000
60	Normal	1.031	0.539	0.000
70	Normal	1.091	0.606	0.000
80	Normal	1.142	0.674	0.000
90	Normal	1.187	0.730	0.000
100	Normal	1.258	0.795	0.000

Thyroid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	1.033	1.099	0.000
10	Lognormal	1.026	1.139	0.000
20	Normal	1.040	0.226	0.000
30	Normal	1.038	0.327	0.000
40	Normal	1.039	0.420	0.000
50	Normal	1.064	0.502	0.000
60	Normal	1.095	0.571	0.000
70	Normal	1.161	0.640	0.000
80	Normal	1.213	0.714	0.000
90	Normal	1.262	0.779	0.000
100	Normal	1.336	0.840	0.000

Uterus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.824	1.068	0.000
10	Normal	0.825	0.090	0.000
20	Normal	0.828	0.169	0.000
30	Normal	0.826	0.253	0.000
40	Normal	0.827	0.328	0.000
50	Normal	0.847	0.394	0.000
60	Normal	0.872	0.448	0.000
70	Normal	0.924	0.504	0.000
80	Normal	0.966	0.562	0.000
90	Normal	1.005	0.614	0.000
100	Normal	1.062	0.662	0.000

ATTACHMENT F
Photons Less Than 30 keV, Exposure (R)

Bladder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.006	0.171	0.454
10	Normal	0.206	0.089	0.000
20	Normal	0.205	0.097	0.000
30	Lognormal	0.173	1.858	0.000
40	Lognormal	0.165	2.069	0.000
50	Normal	0.211	0.139	0.000
60	Normal	0.216	0.150	0.000
70	Lognormal	0.163	2.654	0.000
80	Lognormal	0.166	2.706	0.000
90	Lognormal	0.167	2.909	0.000
100	Lognormal	0.177	2.928	0.000

Bone (red marrow)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.031	0.012	0.000
10	Normal	0.031	0.013	0.000
20	Lognormal	0.027	1.661	0.000
30	Lognormal	0.027	1.782	0.000
40	Lognormal	0.025	1.994	0.000
50	Normal	0.031	0.020	0.000
60	Lognormal	0.024	2.426	0.000
70	Lognormal	0.025	2.582	0.000
80	Lognormal	0.026	2.644	0.000
90	Lognormal	0.026	2.843	0.000
100	Lognormal	0.027	2.814	0.000

Bone surfaces				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.240	0.097	0.000
10	Normal	0.241	0.099	0.000
20	Normal	0.241	0.110	0.000
30	Lognormal	0.207	1.787	0.000
40	Lognormal	0.198	2.006	0.000
50	Lognormal	0.189	2.284	0.000
60	Lognormal	0.191	2.425	0.000
70	Normal	0.270	0.191	0.000
80	Lognormal	0.199	2.624	0.000
90	Lognormal	0.201	2.838	0.000
100	Lognormal	0.209	2.833	0.000

Breast (female)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.536	0.144	0.000
10	Normal	0.537	0.153	0.000
20	Normal	0.538	0.180	0.000
30	Normal	0.535	0.218	0.000
40	Normal	0.540	0.262	0.000
50	Normal	0.549	0.298	0.000
60	Normal	0.568	0.338	0.000
70	Normal	0.601	0.373	0.000
80	Normal	0.624	0.407	0.000
90	Normal	0.656	0.448	0.000
100	Normal	0.688	0.476	0.000

Colon				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.001	0.070	0.242
10	Normal	0.101	0.048	0.000
20	Normal	0.101	0.052	0.000
30	Lognormal	0.083	1.995	0.000
40	Lognormal	0.079	2.200	0.000
50	Lognormal	0.076	2.482	0.000
60	Lognormal	0.076	2.601	0.000
70	Lognormal	0.078	2.778	0.000
80	Lognormal	0.080	2.837	0.000
90	Lognormal	0.080	3.067	0.000
100	Lognormal	0.083	3.047	0.000

Esophagus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.000	0.013	0.059
10	Lognormal	0.019	1.893	0.000
20	Lognormal	0.019	1.939	0.000
30	Lognormal	0.018	2.043	0.000
40	Lognormal	0.017	2.251	0.000
50	Lognormal	0.017	2.498	0.000
60	Lognormal	0.017	2.704	0.000
70	Lognormal	0.017	2.811	0.000
80	Lognormal	0.017	2.862	0.000
90	Lognormal	0.018	3.106	0.000
100	Lognormal	0.018	3.044	0.000

Eye				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.889	0.103	0.000
10	Normal	0.887	0.129	0.000
20	Normal	0.888	0.202	0.000
30	Normal	0.888	0.288	0.000
40	Normal	0.889	0.364	0.000
50	Normal	0.907	0.432	0.000
60	Normal	0.936	0.491	0.000
70	Normal	0.992	0.552	0.000
80	Normal	1.038	0.617	0.000
90	Normal	1.080	0.670	0.000
100	Normal	1.138	0.720	0.000

Liver				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.134	0.060	0.000
10	Normal	0.133	0.061	0.000
20	Lognormal	0.116	1.786	0.000
30	Lognormal	0.111	1.925	0.000
40	Lognormal	0.106	2.152	0.000
50	Lognormal	0.102	2.415	0.000
60	Lognormal	0.102	2.542	0.000
70	Lognormal	0.105	2.655	0.000
80	Lognormal	0.107	2.813	0.000
90	Lognormal	0.108	2.978	0.000
100	Lognormal	0.113	2.974	0.000

Lung				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.002	0.091	0.289
10	Normal	0.124	0.056	0.000
20	Normal	0.126	0.063	0.000
30	Lognormal	0.104	1.916	0.000
40	Lognormal	0.099	2.129	0.000
50	Lognormal	0.095	2.397	0.000
60	Lognormal	0.095	2.541	0.000
70	Lognormal	0.099	2.710	0.000
80	Lognormal	0.100	2.770	0.000
90	Lognormal	0.101	2.988	0.000
100	Lognormal	0.104	2.964	0.000

Lymphoid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.937	0.231	0.000
10	Normal	0.933	0.245	0.000
20	Normal	0.936	0.292	0.000
30	Normal	0.934	0.366	0.000
40	Normal	0.938	0.439	0.000
50	Normal	0.960	0.509	0.000
60	Normal	0.985	0.569	0.000
70	Normal	1.045	0.631	0.000
80	Normal	1.091	0.700	0.000
90	Normal	1.138	0.761	0.000
100	Normal	1.203	0.819	0.000

Ovaries				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.000	0.044	0.154
10	Normal	0.064	0.031	0.000
20	Normal	0.064	0.033	0.000
30	Lognormal	0.052	1.996	0.000
40	Lognormal	0.050	2.180	0.000
50	Normal	0.065	0.045	0.000
60	Lognormal	0.048	2.618	0.000
70	Lognormal	0.050	2.765	0.000
80	Lognormal	0.050	2.826	0.000
90	Lognormal	0.051	2.993	0.000
100	Lognormal	0.053	3.023	0.000

Remainder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.091	0.040	0.000
10	Normal	0.091	0.041	0.000
20	Lognormal	0.079	1.728	0.000
30	Lognormal	0.077	1.874	0.000
40	Lognormal	0.073	2.055	0.000
50	Lognormal	0.071	2.360	0.000
60	Lognormal	0.070	2.489	0.000
70	Lognormal	0.072	2.611	0.000
80	Lognormal	0.074	2.728	0.000
90	Lognormal	0.074	2.895	0.000
100	Lognormal	0.079	2.894	0.000

Skin				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.487	0.054	0.000
10	Normal	0.487	0.068	0.000
20	Normal	0.488	0.109	0.000
30	Normal	0.488	0.156	0.000
40	Normal	0.488	0.199	0.000
50	Normal	0.499	0.236	0.000
60	Normal	0.515	0.269	0.000
70	Normal	0.545	0.303	0.000
80	Normal	0.570	0.337	0.000
90	Normal	0.593	0.366	0.000
100	Normal	0.626	0.394	0.000

Stomach				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.006	0.175	0.466
10	Normal	0.208	0.091	0.000
20	Normal	0.209	0.100	0.000
30	Lognormal	0.178	1.868	0.000
40	Lognormal	0.170	2.087	0.000
50	Normal	0.214	0.140	0.000
60	Lognormal	0.162	2.526	0.000
70	Lognormal	0.166	2.649	0.000
80	Lognormal	0.170	2.745	0.000
90	Lognormal	0.172	2.939	0.000
100	Lognormal	0.179	2.926	0.000

Testes				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.604	0.167	0.000
10	Normal	0.601	0.176	0.000
20	Normal	0.600	0.207	0.000
30	Normal	0.602	0.251	0.000
40	Normal	0.600	0.293	0.000
50	Normal	0.619	0.344	0.000
60	Normal	0.637	0.380	0.000
70	Normal	0.670	0.421	0.000
80	Normal	0.704	0.464	0.000
90	Normal	0.728	0.499	0.000
100	Normal	0.777	0.547	0.000

Thymus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.315	0.128	0.000
10	Normal	0.314	0.131	0.000
20	Normal	0.312	0.144	0.000
30	Normal	0.313	0.164	0.000
40	Normal	0.314	0.182	0.000
50	Normal	0.324	0.208	0.000
60	Normal	0.332	0.228	0.000
70	Lognormal	0.250	2.623	0.000
80	Lognormal	0.256	2.736	0.000
90	Lognormal	0.259	2.879	0.000
100	Lognormal	0.273	2.892	0.000

Thyroid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.465	0.151	0.000
10	Normal	0.462	0.158	0.000
20	Normal	0.465	0.180	0.000
30	Normal	0.464	0.212	0.000
40	Normal	0.465	0.246	0.000
50	Normal	0.478	0.280	0.000
60	Normal	0.489	0.310	0.000
70	Normal	0.520	0.341	0.000
80	Normal	0.543	0.377	0.000
90	Normal	0.566	0.408	0.000
100	Normal	0.600	0.439	0.000

Uterus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Triangular	0.000	0.055	0.215
10	Normal	0.086	0.042	0.000
20	Lognormal	0.073	1.874	0.000
30	Lognormal	0.070	2.006	0.000
40	Lognormal	0.067	2.213	0.000
50	Lognormal	0.065	2.497	0.000
60	Lognormal	0.065	2.613	0.000
70	Lognormal	0.066	2.732	0.000
80	Lognormal	0.067	2.863	0.000
90	Lognormal	0.068	3.058	0.000
100	Lognormal	0.071	3.034	0.000

ATTACHMENT G
Neutrons 0.1-2 MeV, Deep Dose Equivalent

Bladder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.806	1.116	0.000
10	Lognormal	0.803	1.150	0.000
20	Normal	0.817	0.183	0.000
30	Normal	0.815	0.257	0.000
40	Normal	0.819	0.328	0.000
50	Normal	0.830	0.389	0.000
60	Normal	0.860	0.445	0.000
70	Normal	0.916	0.507	0.000
80	Normal	0.953	0.558	0.000
90	Normal	0.995	0.605	0.000
100	Normal	1.038	0.648	0.000

Bone (red marrow)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.373	1.148	0.000
10	Lognormal	0.371	1.177	0.000
20	Normal	0.379	0.090	0.000
30	Normal	0.379	0.124	0.000
40	Normal	0.381	0.155	0.000
50	Normal	0.386	0.185	0.000
60	Normal	0.399	0.210	0.000
70	Normal	0.425	0.238	0.000
80	Normal	0.443	0.263	0.000
90	Normal	0.462	0.284	0.000
100	Normal	0.483	0.306	0.000

Bone surfaces				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.443	1.107	0.000
10	Lognormal	0.440	1.144	0.000
20	Normal	0.447	0.098	0.000
30	Normal	0.447	0.140	0.000
40	Normal	0.449	0.178	0.000
50	Normal	0.455	0.213	0.000
60	Normal	0.471	0.244	0.000
70	Normal	0.501	0.275	0.000
80	Normal	0.523	0.306	0.000
90	Normal	0.544	0.329	0.000
100	Normal	0.569	0.355	0.000

Breast (female)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.111	0.101	0.000
10	Normal	1.109	0.138	0.000
20	Normal	1.115	0.238	0.000
30	Normal	1.114	0.345	0.000
40	Normal	1.122	0.444	0.000
50	Normal	1.136	0.529	0.000
60	Normal	1.177	0.604	0.000
70	Normal	1.250	0.685	0.000
80	Normal	1.304	0.757	0.000
90	Normal	1.364	0.824	0.000
100	Normal	1.422	0.883	0.000

Colon				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.507	1.149	0.000
10	Lognormal	0.504	1.180	0.000
20	Normal	0.514	0.124	0.000
30	Normal	0.514	0.169	0.000
40	Normal	0.516	0.212	0.000
50	Normal	0.524	0.251	0.000
60	Normal	0.542	0.286	0.000
70	Normal	0.577	0.325	0.000
80	Normal	0.602	0.356	0.000
90	Normal	0.627	0.386	0.000
100	Normal	0.656	0.413	0.000

Esophagus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.427	1.197	0.000
10	Lognormal	0.427	1.219	0.000
20	Lognormal	0.423	1.312	0.000
30	Normal	0.438	0.153	0.000
40	Normal	0.441	0.188	0.000
50	Normal	0.445	0.219	0.000
60	Normal	0.462	0.248	0.000
70	Normal	0.491	0.282	0.000
80	Normal	0.513	0.313	0.000
90	Normal	0.535	0.337	0.000
100	Normal	0.557	0.359	0.000

Eye				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.280	0.096	0.000
10	Normal	1.277	0.147	0.000
20	Normal	1.287	0.267	0.000
30	Normal	1.286	0.392	0.000
40	Normal	1.293	0.504	0.000
50	Normal	1.309	0.604	0.000
60	Normal	1.355	0.690	0.000
70	Normal	1.443	0.787	0.000
80	Normal	1.504	0.869	0.000
90	Normal	1.569	0.941	0.000
100	Normal	1.637	1.012	0.000

Liver				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.649	1.131	0.000
10	Normal	0.654	0.099	0.000
20	Normal	0.658	0.150	0.000
30	Normal	0.657	0.211	0.000
40	Normal	0.660	0.266	0.000
50	Normal	0.670	0.316	0.000
60	Normal	0.694	0.362	0.000
70	Normal	0.737	0.408	0.000
80	Normal	0.769	0.452	0.000
90	Normal	0.801	0.489	0.000
100	Normal	0.838	0.524	0.000

Lung				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.566	1.161	0.000
10	Lognormal	0.561	1.192	0.000
20	Normal	0.573	0.140	0.000
30	Normal	0.573	0.192	0.000
40	Normal	0.576	0.238	0.000
50	Normal	0.585	0.281	0.000
60	Normal	0.605	0.320	0.000
70	Normal	0.642	0.361	0.000
80	Normal	0.671	0.401	0.000
90	Normal	0.699	0.432	0.000
100	Normal	0.732	0.463	0.000

Lymphoid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.279	0.096	0.000
10	Normal	1.278	0.146	0.000
20	Normal	1.284	0.265	0.000
30	Normal	1.285	0.392	0.000
40	Normal	1.293	0.506	0.000
50	Normal	1.309	0.603	0.000
60	Normal	1.356	0.690	0.000
70	Normal	1.439	0.782	0.000
80	Normal	1.504	0.869	0.000
90	Normal	1.570	0.944	0.000
100	Normal	1.637	1.010	0.000

Ovaries				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.439	1.163	0.000
10	Lognormal	0.437	1.193	0.000
20	Lognormal	0.432	1.290	0.000
30	Normal	0.445	0.149	0.000
40	Normal	0.448	0.186	0.000
50	Normal	0.453	0.218	0.000
60	Normal	0.471	0.249	0.000
70	Normal	0.500	0.284	0.000
80	Normal	0.521	0.312	0.000
90	Normal	0.544	0.337	0.000
100	Normal	0.567	0.359	0.000

Remainder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.540	1.130	0.000
10	Lognormal	0.536	1.163	0.000
20	Normal	0.546	0.125	0.000
30	Normal	0.545	0.175	0.000
40	Normal	0.549	0.222	0.000
50	Normal	0.555	0.261	0.000
60	Normal	0.576	0.301	0.000
70	Normal	0.612	0.341	0.000
80	Normal	0.638	0.375	0.000
90	Normal	0.666	0.408	0.000
100	Normal	0.694	0.434	0.000

Skin				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.853	1.065	0.000
10	Normal	0.853	0.092	0.000
20	Normal	0.859	0.175	0.000
30	Normal	0.859	0.260	0.000
40	Normal	0.864	0.335	0.000
50	Normal	0.875	0.401	0.000
60	Normal	0.906	0.460	0.000
70	Normal	0.963	0.523	0.000
80	Normal	1.005	0.579	0.000
90	Normal	1.049	0.627	0.000
100	Normal	1.094	0.673	0.000

Stomach				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.829	1.116	0.000
10	Normal	0.831	0.116	0.000
20	Normal	0.837	0.186	0.000
30	Normal	0.838	0.266	0.000
40	Normal	0.841	0.335	0.000
50	Normal	0.852	0.398	0.000
60	Normal	0.882	0.457	0.000
70	Normal	0.938	0.517	0.000
80	Normal	0.982	0.575	0.000
90	Normal	1.021	0.620	0.000
100	Normal	1.066	0.662	0.000

Testes				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.280	0.097	0.000
10	Normal	1.277	0.146	0.000
20	Normal	1.284	0.266	0.000
30	Normal	1.285	0.392	0.000
40	Normal	1.292	0.505	0.000
50	Normal	1.309	0.603	0.000
60	Normal	1.354	0.689	0.000
70	Normal	1.439	0.783	0.000
80	Normal	1.504	0.869	0.000
90	Normal	1.569	0.943	0.000
100	Normal	1.637	1.010	0.000

Thymus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.281	0.097	0.000
10	Normal	1.278	0.146	0.000
20	Normal	1.286	0.267	0.000
30	Normal	1.285	0.392	0.000
40	Normal	1.292	0.503	0.000
50	Normal	1.308	0.602	0.000
60	Normal	1.355	0.689	0.000
70	Normal	1.441	0.785	0.000
80	Normal	1.503	0.868	0.000
90	Normal	1.568	0.939	0.000
100	Normal	1.636	1.009	0.000

Thyroid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.050	0.108	0.000
10	Normal	1.048	0.142	0.000
20	Normal	1.055	0.231	0.000
30	Normal	1.055	0.331	0.000
40	Normal	1.059	0.421	0.000
50	Normal	1.076	0.503	0.000
60	Normal	1.113	0.575	0.000
70	Normal	1.183	0.650	0.000
80	Normal	1.235	0.719	0.000
90	Normal	1.286	0.779	0.000
100	Normal	1.346	0.839	0.000

Uterus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.439	1.164	0.000
10	Lognormal	0.437	1.192	0.000
20	Lognormal	0.432	1.293	0.000
30	Normal	0.446	0.150	0.000
40	Normal	0.447	0.186	0.000
50	Normal	0.454	0.218	0.000
60	Normal	0.470	0.249	0.000
70	Normal	0.500	0.282	0.000
80	Normal	0.522	0.313	0.000
90	Normal	0.543	0.337	0.000
100	Normal	0.567	0.359	0.000

ATTACHMENT H
Neutrons 2-20 MeV, Deep Dose Equivalent

Bladder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	1.100	1.100	0.000
10	Lognormal	1.095	1.138	0.000
20	Normal	1.113	0.241	0.000
30	Normal	1.110	0.345	0.000
40	Normal	1.117	0.442	0.000
50	Normal	1.131	0.526	0.000
60	Normal	1.171	0.602	0.000
70	Normal	1.248	0.686	0.000
80	Normal	1.299	0.756	0.000
90	Normal	1.356	0.820	0.000
100	Normal	1.414	0.878	0.000

Bone (red marrow)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.682	0.076	0.000
10	Normal	0.681	0.096	0.000
20	Normal	0.686	0.153	0.000
30	Normal	0.685	0.217	0.000
40	Normal	0.689	0.275	0.000
50	Normal	0.699	0.329	0.000
60	Normal	0.722	0.374	0.000
70	Normal	0.769	0.425	0.000
80	Normal	0.802	0.470	0.000
90	Normal	0.836	0.508	0.000
100	Normal	0.875	0.547	0.000

Bone surfaces				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.660	0.055	0.000
10	Normal	0.659	0.079	0.000
20	Normal	0.663	0.139	0.000
30	Normal	0.663	0.204	0.000
40	Normal	0.665	0.260	0.000
50	Normal	0.675	0.312	0.000
60	Normal	0.699	0.358	0.000
70	Normal	0.743	0.406	0.000
80	Normal	0.776	0.450	0.000
90	Normal	0.808	0.485	0.000
100	Normal	0.844	0.522	0.000

Breast (female)				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.109	0.119	0.000
10	Normal	1.107	0.152	0.000
20	Normal	1.113	0.246	0.000
30	Normal	1.112	0.351	0.000
40	Normal	1.121	0.449	0.000
50	Normal	1.135	0.533	0.000
60	Normal	1.175	0.608	0.000
70	Normal	1.248	0.688	0.000
80	Normal	1.302	0.761	0.000
90	Normal	1.362	0.829	0.000
100	Normal	1.420	0.887	0.000

Colon				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.880	0.110	0.000
10	Normal	0.880	0.117	0.000
20	Normal	0.886	0.194	0.000
30	Normal	0.886	0.277	0.000
40	Normal	0.890	0.353	0.000
50	Normal	0.903	0.420	0.000
60	Normal	0.934	0.482	0.000
70	Normal	0.994	0.548	0.000
80	Normal	1.037	0.603	0.000
90	Normal	1.081	0.654	0.000
100	Normal	1.129	0.700	0.000

Esophagus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.844	0.094	0.000
10	Normal	0.844	0.118	0.000
20	Normal	0.849	0.190	0.000
30	Normal	0.849	0.270	0.000
40	Normal	0.854	0.342	0.000
50	Normal	0.864	0.404	0.000
60	Normal	0.895	0.461	0.000
70	Normal	0.952	0.526	0.000
80	Normal	0.994	0.584	0.000
90	Normal	1.037	0.631	0.000
100	Normal	1.080	0.673	0.000

Eye				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.207	0.134	0.000
10	Normal	1.205	0.170	0.000
20	Normal	1.215	0.272	0.000
30	Normal	1.213	0.384	0.000
40	Normal	1.220	0.487	0.000
50	Normal	1.235	0.581	0.000
60	Normal	1.279	0.661	0.000
70	Normal	1.363	0.754	0.000
80	Normal	1.419	0.830	0.000
90	Normal	1.481	0.898	0.000
100	Normal	1.545	0.967	0.000

Liver				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	0.984	1.090	0.000
10	Normal	0.987	0.122	0.000
20	Normal	0.993	0.209	0.000
30	Normal	0.993	0.306	0.000
40	Normal	0.997	0.392	0.000
50	Normal	1.011	0.467	0.000
60	Normal	1.048	0.536	0.000
70	Normal	1.113	0.607	0.000
80	Normal	1.161	0.673	0.000
90	Normal	1.211	0.728	0.000
100	Normal	1.265	0.781	0.000

Lung				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.947	0.084	0.000
10	Normal	0.944	0.118	0.000
20	Normal	0.950	0.202	0.000
30	Normal	0.950	0.294	0.000
40	Normal	0.955	0.376	0.000
50	Normal	0.969	0.448	0.000
60	Normal	1.002	0.513	0.000
70	Normal	1.065	0.582	0.000
80	Normal	1.112	0.646	0.000
90	Normal	1.159	0.699	0.000
100	Normal	1.212	0.749	0.000

Lymphoid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.205	0.133	0.000
10	Normal	1.206	0.169	0.000
20	Normal	1.211	0.268	0.000
30	Normal	1.213	0.383	0.000
40	Normal	1.220	0.490	0.000
50	Normal	1.235	0.580	0.000
60	Normal	1.279	0.661	0.000
70	Normal	1.356	0.746	0.000
80	Normal	1.419	0.830	0.000
90	Normal	1.482	0.903	0.000
100	Normal	1.545	0.965	0.000

Ovaries				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.852	0.099	0.000
10	Normal	0.851	0.124	0.000
20	Normal	0.855	0.194	0.000
30	Normal	0.855	0.273	0.000
40	Normal	0.860	0.345	0.000
50	Normal	0.870	0.409	0.000
60	Normal	0.903	0.468	0.000
70	Normal	0.959	0.533	0.000
80	Normal	1.001	0.588	0.000
90	Normal	1.044	0.636	0.000
100	Normal	1.089	0.679	0.000

Remainder				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.870	0.080	0.000
10	Lognormal	0.861	1.137	0.000
20	Normal	0.874	0.187	0.000
30	Normal	0.872	0.270	0.000
40	Normal	0.878	0.347	0.000
50	Normal	0.889	0.412	0.000
60	Normal	0.921	0.474	0.000
70	Normal	0.980	0.538	0.000
80	Normal	1.021	0.593	0.000
90	Normal	1.066	0.644	0.000
100	Normal	1.111	0.688	0.000

Skin				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.898	0.080	0.000
10	Normal	0.896	0.113	0.000
20	Normal	0.901	0.193	0.000
30	Normal	0.902	0.280	0.000
40	Normal	0.907	0.358	0.000
50	Normal	0.919	0.427	0.000
60	Normal	0.951	0.487	0.000
70	Normal	1.011	0.554	0.000
80	Normal	1.056	0.613	0.000
90	Normal	1.102	0.664	0.000
100	Normal	1.149	0.712	0.000

Stomach				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Lognormal	1.094	1.099	0.000
10	Normal	1.096	0.140	0.000
20	Normal	1.103	0.237	0.000
30	Normal	1.105	0.345	0.000
40	Normal	1.109	0.437	0.000
50	Normal	1.123	0.520	0.000
60	Normal	1.163	0.598	0.000
70	Normal	1.237	0.677	0.000
80	Normal	1.294	0.753	0.000
90	Normal	1.346	0.812	0.000
100	Normal	1.405	0.868	0.000

Testes				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.208	0.134	0.000
10	Normal	1.204	0.169	0.000
20	Normal	1.210	0.270	0.000
30	Normal	1.212	0.384	0.000
40	Normal	1.220	0.489	0.000
50	Normal	1.234	0.579	0.000
60	Normal	1.276	0.659	0.000
70	Normal	1.356	0.748	0.000
80	Normal	1.418	0.831	0.000
90	Normal	1.481	0.901	0.000
100	Normal	1.544	0.964	0.000

Thymus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.116	0.116	0.000
10	Normal	1.113	0.149	0.000
20	Normal	1.121	0.246	0.000
30	Normal	1.119	0.351	0.000
40	Normal	1.126	0.446	0.000
50	Normal	1.140	0.532	0.000
60	Normal	1.180	0.607	0.000
70	Normal	1.256	0.692	0.000
80	Normal	1.310	0.764	0.000
90	Normal	1.367	0.825	0.000
100	Normal	1.425	0.887	0.000

Thyroid				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	1.114	0.115	0.000
10	Normal	1.112	0.151	0.000
20	Normal	1.120	0.245	0.000
30	Normal	1.120	0.351	0.000
40	Normal	1.124	0.447	0.000
50	Normal	1.141	0.534	0.000
60	Normal	1.180	0.610	0.000
70	Normal	1.255	0.690	0.000
80	Normal	1.311	0.763	0.000
90	Normal	1.365	0.827	0.000
100	Normal	1.428	0.890	0.000

Uterus				
Percent error	Dose distribution	Parameter 1	Parameter 2	Parameter 3
5	Normal	0.853	0.099	0.000
10	Normal	0.851	0.124	0.000
20	Normal	0.856	0.195	0.000
30	Normal	0.855	0.274	0.000
40	Normal	0.858	0.346	0.000
50	Normal	0.871	0.409	0.000
60	Normal	0.903	0.469	0.000
70	Normal	0.960	0.531	0.000
80	Normal	1.001	0.589	0.000
90	Normal	1.042	0.637	0.000
100	Normal	1.089	0.678	0.000

**ATTACHMENT I
Missed Dose**

Photons less than 30 keV Hp(10)				
Organ	Dose distribution	Parameter 1	Parameter 2	Parameter 3
Bladder	Lognormal	0.176	2.003	0.000
Bone (red marrow)	Lognormal	0.035	1.651	0.000
Bone surfaces	Lognormal	0.251	1.697	0.000
Breast (female)	Lognormal	1.292	1.664	0.000
Colon	Lognormal	0.081	2.102	0.000
Esophagus	Lognormal	0.018	2.199	0.000
Eye	Lognormal	10.605	2.191	0.000
Liver	Lognormal	0.111	2.085	0.000
Lung	Lognormal	0.100	2.071	0.000
Lymphoid	Lognormal	0.907	1.631	0.000
Ovaries	Lognormal	0.050	2.140	0.000
Remainder	Lognormal	0.092	1.766	0.000
Skin	Lognormal	7.414	2.382	0.000
Stomach	Lognormal	0.178	2.001	0.000
Testes	Lognormal	1.567	1.715	0.000
Thymus	Lognormal	0.268	1.982	0.000
Thyroid	Lognormal	0.478	1.681	0.000
Uterus	Lognormal	0.067	2.140	0.000

Photons 30 to 250 keV Hp(10)				
Organ	Dose distribution	Parameter 1	Parameter 2	Parameter 3
Bladder	Lognormal	0.731	1.559	0.000
Bone (red marrow)	Lognormal	0.344	1.733	0.000
Bone surfaces	Lognormal	0.818	1.573	0.000
Breast (female)	Lognormal	0.891	1.517	0.000
Colon	Lognormal	0.573	1.619	0.000
Esophagus	Lognormal	0.349	1.753	0.000
Eye	Lognormal	0.913	1.524	0.000
Liver	Lognormal	0.598	1.600	0.000
Lung	Lognormal	0.558	1.592	0.000
Lymphoid	Lognormal	0.907	1.631	0.000
Ovaries	Lognormal	0.499	1.676	0.000
Remainder	Lognormal	0.486	1.624	0.000
Skin	Lognormal	0.623	1.522	0.000
Stomach	Lognormal	0.736	1.560	0.000
Testes	Lognormal	1.006	1.517	0.000
Thymus	Lognormal	0.879	1.537	0.000
Thyroid	Lognormal	0.958	1.522	0.000
Uterus	Lognormal	0.538	1.632	0.000

Photons greater than 250 keV Hp(10)				
Organ	Dose distribution	Parameter 1	Parameter 2	Parameter 3
Bladder	Lognormal	0.910	1.517	0.000
Bone (red marrow)	Lognormal	0.709	1.532	0.000
Bone surfaces	Lognormal	0.779	1.521	0.000
Breast (female)	Lognormal	0.956	1.517	0.000
Colon	Lognormal	0.858	1.517	0.000
Esophagus	Lognormal	0.733	1.528	0.000
Eye	Lognormal	0.905	1.518	0.000
Liver	Lognormal	0.865	1.519	0.000
Lung	Lognormal	0.838	1.519	0.000
Lymphoid	Lognormal	0.912	1.631	0.000
Ovaries	Lognormal	0.850	1.522	0.000
Remainder	Lognormal	0.782	1.521	0.000
Skin	Lognormal	0.824	1.521	0.000
Stomach	Lognormal	0.916	1.517	0.000
Testes	Lognormal	0.967	1.518	0.000
Thymus	Lognormal	0.924	1.519	0.000
Thyroid	Lognormal	0.996	1.519	0.000
Uterus	Lognormal	0.799	1.517	0.000

Photons less than 30 keV (R)				
Organ	Dose distribution	Parameter 1	Parameter 2	Parameter 3
Bladder	Lognormal	0.186	1.928	0.000
Bone (red marrow)	Lognormal	0.028	1.852	0.000
Bone surfaces	Lognormal	0.219	1.877	0.000
Breast (female)	Lognormal	0.518	1.662	0.000
Colon	Lognormal	0.088	2.049	0.000
Esophagus	Lognormal	0.019	2.104	0.000
Eye	Lognormal	0.888	1.537	0.000
Liver	Lognormal	0.118	2.018	0.000
Lung	Lognormal	0.109	1.997	0.000
Lymphoid	Lognormal	0.912	1.631	0.000
Ovaries	Lognormal	0.056	2.061	0.000
Remainder	Lognormal	0.082	1.938	0.000
Skin	Lognormal	0.487	1.535	0.000
Stomach	Lognormal	0.190	1.936	0.000
Testes	Lognormal	0.582	1.672	0.000
Thymus	Lognormal	0.285	1.905	0.000
Thyroid	Lognormal	0.440	1.739	0.000
Uterus	Lognormal	0.074	2.058	0.000

Photons 30 to 250 keV (R)				
Organ	Dose distribution	Parameter 1	Parameter 2	Parameter 3
Bladder	Lognormal	1.043	1.611	0.000
Bone (red marrow)	Lognormal	0.443	1.763	0.000
Bone surfaces	Lognormal	1.185	1.640	0.000
Breast (female)	Lognormal	1.200	1.539	0.000
Colon	Lognormal	0.818	1.675	0.000
Esophagus	Lognormal	0.481	1.786	0.000
Eye	Lognormal	1.227	1.520	0.000
Liver	Lognormal	0.846	1.658	0.000
Lung	Lognormal	0.780	1.644	0.000
Lymphoid	Lognormal	0.907	1.631	0.000
Ovaries	Lognormal	0.700	1.723	0.000
Remainder	Lognormal	0.677	1.675	0.000
Skin	Lognormal	0.815	1.535	0.000
Stomach	Lognormal	1.050	1.614	0.000
Testes	Lognormal	1.381	1.540	0.000
Thymus	Lognormal	1.226	1.581	0.000
Thyroid	Lognormal	1.311	1.554	0.000
Uterus	Lognormal	0.769	1.687	0.000

Photons greater than 250 keV (R)				
Organ	Dose distribution	Parameter 1	Parameter 2	Parameter 3
Bladder	Lognormal	0.941	1.523	0.000
Bone (red marrow)	Lognormal	0.722	1.521	0.000
Bone surfaces	Lognormal	0.786	1.520	0.000
Breast (female)	Lognormal	0.984	1.521	0.000
Colon	Lognormal	0.884	1.519	0.000
Esophagus	Lognormal	0.751	1.519	0.000
Eye	Lognormal	0.937	1.527	0.000
Liver	Lognormal	0.888	1.520	0.000
Lung	Lognormal	0.865	1.518	0.000
Lymphoid	Lognormal	0.907	1.631	0.000
Ovaries	Lognormal	0.837	1.519	0.000
Remainder	Lognormal	0.799	1.517	0.000
Skin	Lognormal	0.841	1.517	0.000
Stomach	Lognormal	0.954	1.523	0.000
Testes	Lognormal	1.011	1.528	0.000
Thymus	Lognormal	0.972	1.533	0.000
Thyroid	Lognormal	1.034	1.529	0.000
Uterus	Lognormal	0.825	1.520	0.000

Neutrons 0.1 to 2 MeV				
Organ	Dose distribution	Parameter 1	Parameter 2	Parameter 3
Bladder	Lognormal	0.808	1.537	0.000
Bone (red marrow)	Lognormal	0.374	1.552	0.000
Bone surfaces	Lognormal	0.444	1.533	0.000
Breast (female)	Lognormal	1.109	1.532	0.000
Colon	Lognormal	0.508	1.548	0.000
Esophagus	Lognormal	0.428	1.574	0.000
Eye	Lognormal	1.279	1.524	0.000
Liver	Lognormal	0.650	1.542	0.000
Lung	Lognormal	0.567	1.550	0.000
Lymphoid	Lognormal	1.277	1.525	0.000
Ovaries	Lognormal	0.440	1.551	0.000
Remainder	Lognormal	0.541	1.540	0.000
Skin	Lognormal	0.855	1.521	0.000
Stomach	Lognormal	0.830	1.537	0.000
Testes	Lognormal	1.279	1.525	0.000
Thymus	Lognormal	1.279	1.526	0.000
Thyroid	Lognormal	1.046	1.536	0.000
Uterus	Lognormal	0.440	1.552	0.000

Neutrons 2 to20 MeV				
Organ	Dose distribution	Parameter 1	Parameter 2	Parameter 3
Bladder	Lognormal	1.102	1.532	0.000
Bone (red marrow)	Lognormal	0.679	1.540	0.000
Bone surfaces	Lognormal	0.659	1.527	0.000
Breast (female)	Lognormal	1.105	1.539	0.000
Colon	Lognormal	0.880	1.532	0.000
Esophagus	Lognormal	0.840	1.539	0.000
Eye	Lognormal	1.202	1.536	0.000
Liver	Lognormal	0.986	1.528	0.000
Lung	Lognormal	0.946	1.526	0.000
Lymphoid	Lognormal	1.200	1.537	0.000
Ovaries	Lognormal	0.848	1.536	0.000
Remainder	Lognormal	0.868	1.529	0.000
Skin	Lognormal	0.896	1.528	0.000
Stomach	Lognormal	1.096	1.531	0.000
Testes	Lognormal	1.203	1.537	0.000
Thymus	Lognormal	1.112	1.536	0.000
Thyroid	Lognormal	1.110	1.536	0.000
Uterus	Lognormal	0.849	1.538	0.000