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TABLES OF ENERGY-DEPOSITION DISTRIBUTIONS IN WATER PHANTOMS IRRADIATED BY POINT-MONODIRECTIONAL ELECTRON BEAMS WITH ENERGIES FROM 1 TO 60 MeV, AND APPLICATIONS TO BROAD BEAMS

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ABSTRACT

This report presents tables of elementary three-dimensional absorbed-dose distributions in a water phantom irradiated by monoenergetic, point-monodirectional electron beams. Such distributions have been obtained by the Monte Carlo method for 14 beam energies from 1 MeV to 60 MeV. The tabulated results can be applied to the determination of absorbed-dose distributions from parallel beams of arbitrary finite cross section. The beam of interest is treated as a superposition of point-monodirectional beams, and the absorbed-dose distribution is obtained as a corresponding superposition of elementary absorbed-dose distributions. By way of example, the tabulated data are used to obtain (1) depth-dose curves and practical ranges in broad-beam geometry, and (2) central-axis depth-dose curves, radial distributions of absorbed dose, and isodose patterns for beams with finite circular cross section.

Key Words: Dosimetry; electrons; Monte Carlo; point-monodirectional beams; superposition; treatment planning.

This report is based in part on a paper presented at the Electron Dosimetry and Arc Therapy Symposium, Wisconsin Clinical Cancer Center, University of Wisconsin, Madison, Wisconsin, September 10-11, 1981.

1. INTRODUCTION

The determination of absorbed-dose distributions from electron beams, with the accuracy required by treatment planning, is a complex problem whose solution is facilitated when experimental dosimetry is supported by calculations. Flexible, approximate, analytical methods are required as well as detailed transport calculations. Among the latter, the Monte Carlo method (track simulation) is probably the most expeditious if not the most economical approach, because it requires the fewest assumptions and approximations and allows the fullest utilization of the available cross sections for the interactions of electrons with matter. The Monte Carlo calculations fall into two categories. The first category consists of special-purpose calculations that simulate as closely as feasible the beam and medium configurations encountered in practice. The second category consists of calculations for schematized and somewhat oversimplified configurations, and is useful for general surveys and parametric studies; it also can provide benchmark results for testing experimental dosimetry methods, and may be useful for checking the validity of assumptions made in approximate analytical treatments.

The present paper describes Monte Carlo calculations that fall into the second category. Attention is focussed on the application of the superposition method [1-4][1] to the calculation of absorbed-dose distributions in a homogeneous water phantom. According to this method, the electron beam of interest is treated as a superposition of point-monodirectional beams, and the spatial distribution of absorbed dose is obtained by a corresponding summation over the elementary absorbed-dose distributions from point-monodirectional beams.

Such elementary distributions have been obtained for monoenergetic point-monodirectional beams with energies from 1 MeV to 60 MeV. Some of the characteristics of these elementary distributions are described here, and examples are given of the application of these results to other beam geometries.

2. ELEMENTARY ABSORBED-DOSE DISTRIBUTIONS

2.1. Definitions. The phantom is assumed to be a homogeneous semi-infinite medium that occupies the region $z \geqslant 0$. A point-monodirectional (i.e., a narrow pencil) beam of electrons with kinetic energy T_0, traveling along the z-axis, is assumed to be incident perpendicularly[2] onto the surface of the phantom. The Monte Carlo method has been used to obtain the elementary distribution function $F(\rho,z)$, defined such that $F(\rho,z)d\rho dz$ represents the average fraction of the incident beam energy that is deposited at depths between z and $z + dz$ and at radial distances from the z-axis between ρ and $\rho + d\rho$. The absorbed dose at a point (ρ,z) is given by $(T_0/d)\, F(\rho,z)/2\pi\rho$, where d is the density of the medium.

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[1]Figures in brackets indicate literature references at the end of this paper.

[2]The assumption of perpendicular incidence is appropriate for electron beams that have been broadened by scanning, but does not take into account the angular dispersion of a beam broadened by a scattering foil. In principle it is possible to consider elementary point-monodirectional beams incident at various angles, and to treat the angular dispersion by an appropriate summation over such elementary beams.

2.2. Method. The Monte Carlo model, which has been described earlier [5-7], takes into account the transport of energy by the primary electrons from the beam, and by all generations of secondary electrons and photons. The transport of electrons is simulated by dividing their tracks into many small segments, and sampling the multiple-scattering angular distribution in each successive segment from the Goudsmit-Saunderson distribution and the energy loss from the Landau distribution. The histories of bremsstrahlung photons emitted by the electrons are followed by sampling individual Compton-scattering, pair-production and photo-electric absorption events. The electrons set in motion in these interactions, and the secondary electrons resulting in ionization events, are treated in the same manner as the primary electrons. The energy deposition along the electron tracks is scored and classified to obtain the distribution $F(\rho,z)$.

2.3 Ranges. When graphing or tabulating elementary absorbed-dose distributions, or other distributions derived from them, one finds it useful to express the distances ρ and z in units of the CSDA range[3] r_0. When this is done, the distributions corresponding to different beam energies T_0 "scale" in the sense that the explicit dependence on T_0 is minimized, which in turn facilitates interpolation with respect to T_0.

In the treatment of energy loss by ionization and excitation in the Monte Carlo calculations whose results are reported here, the stopping properties of water were characterized by a mean excitation energy $I = 65.1$ eV, and the density effect (reduction of stopping power due to the polarization of the medium) was evaluated according to the prescription of Sternheimer and Peierls [8]. In recent work on stopping power we were led to the conclusion that improved accuracy would be obtained with a mean energy $I = 75.0$ eV, and with the density-effect correction derived by Ashley [9] from experimental optical data for water. The old ranges that correspond to the cross sections used in the Monte Carlo calculations are compared in Table 1 with the new ranges that would result from the use of a mean excitation energy $I = 75.0$ eV and Ashley's density-effect calculations. The new ranges are larger than the old ranges by 0.3% at 60 MeV, 1.2% at 10 MeV and 1.7% at 1 MeV. Inasmuch as these differences are small, it does not appear necessary to repeat the Monte Carlo calculations with the improved cross-section input data. It seems adequate to assume that the absorbed-dose distributions, as functions of ρ/r_0 and z/r_0, remain unchanged, so that it is merely necessary to use the appropriate new range values when expressing the absorbed-dose distributions as functions of ρ and z.

2.4. Elementary Absorbed-Dose Distributions from Point-Monodirectional Beams. A typical elementary distribution of absorbed energy from a 20-MeV point-monodirectional beam, is shown in Fig. 1. The information is equivalent to that contained in the distribution $F(\rho,z)$ as defined above, but the representation is slightly modified. The histogram in the upper right-hand corner is a depth-dose curve in the form of a plot of the dimensionless quantity $(r_0/T_0)\mathcal{D}$ *vs.* the scaled depth z/r_0, where $\mathcal{D}$ is the energy deposition per unit depth

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[3]The CSDA range r_0, evaluated in the continuous-slowing-down approximation, represents a rectified path length over which the electron kinetic energy is reduced from T_0 to zero. It is calculated as an integral with respect to energy over the reciprocal of the total stopping power.

(obtained by integrating $F(\rho,z)$ over all ρ). The other histograms show, for the six indicated (shaded) depth intervals, the radial distribution of deposited energy, as a function of the scaled distance ρ/r_0 from the z-axis. Each radial histogram bin represents the fraction of the energy deposited in the indicated ring around the z-axis. Each radial histogram is normalized to unit area.

Figure 2 gives elementary absorbed-dose distributions in a different form, in terms of the normalized cumulative distribution

$$\Phi(\rho,z) = \int_0^{\rho} F(\rho',z)d\rho' \Big/ \int_0^{\infty} F(\rho',z)d\rho' \quad . \tag{1}$$

For point-monodirectional beams with energies of 5, 10, 20, and 40 MeV, contours are given as functions of the scaled depth z/r_0 along which Φ has the value of 20, 40, 60, 80, 90, or 95%. For example, the curve of Φ_{90} *vs.* z/r_0 indicates the radial distance from the z-axis within which 90% of the energy is deposited at each depth.

Figure 3 shows plots of $\ln(1 - \Phi)$ *vs.* $(\rho/r_0)^2$, at various depths in a medium irradiated with 10- and 20-MeV point-monodirectional beams. The quantity $1 - \Phi$ represents the fraction of the energy at a given depth that is deposited at radial distances greater than ρ/r_0. If the radial distribution of deposited energy were Gaussian, an approximation made in certain approximate dosimetry calculations, then the curves in Fig. 3 would be straight lines. This is not the case, but a straight-line approximation might be adequate over the radial region around the z-axis in which $\sim 3/4$ of the energy is absorbed.

2.5. Tables of Elementary Absorbed-Dose Distributions. Monte Carlo results for the distribution $F(\rho,z)$ are given in Tables A1 and A2 at the end of this paper for 14 beam energies between 1 MeV and 60 MeV. At each energy, the spatial distribution of deposited energy was obtained by analyzing the sampled electron-photon cascade from 10,000 incident electrons. Energy deposition was scored in annular volume elements. The depth and radial boundaries of these volume elements were expressed as fractions of the CSDA range r_0, and the fractions were kept the same for each beam energy in order to take advantage of the scaling of the distributions.

Table A1 gives the distribution as a function of the depth only,

$$H_n = 100 \int_{z_{n-1}}^{z_n} dz \int_0^{\infty} d\rho' \, F(\rho',z) \quad , \tag{2}$$

where $z_n = n\, r_0/20$, $n = 1,2,\ldots 20$. It should be noted that the quantity $T_0\, H_n/(z_n - z_{n-1})$ is an approximation to $100\,\mathcal{D}(z)$, where $\mathcal{D}(z)$ is the energy deposition per unit depth at $z = (z_n + z_{n-1})/2$.

Table A2 gives the normalized cumulative radial distribution

$$\Psi_n(\rho) = 100 \frac{\int_{z_{n-1}}^{z_n} dz \int_0^{\rho} d\rho' F(\rho',z)}{\int_{z_{n-1}}^{z_n} dz \int_0^{\infty} d\rho' F(\rho',z)} \quad , \tag{3}$$

which is an approximation to the quantity $100\ \Phi(\rho,z)$ defined by Eq (1).

3. SUPERPOSITION METHOD

Let the incident electron beam be characterized by an intensity distribution $Q_0(x_0,y_0)$, such that $Q_0(x_0,y_0)dx_0dy_0$ represents the number of point-monodirectional beams incident perpendicularly onto the surface of the phantom at lateral positions between x_0 and $x_0 + dx_0$ and between y_0 and $y_0 + dy_0$. Let $D(x,y,z)$ be the absorbed dose at the point (x,y,z), obtained by summing over the absorbed-dose distributions from the point-monodirectional beams. To facilitate the summation, we replace the coordinates x_0, y_0 by cylindrical coordinates ρ,φ, such that

$$Q_0(x_0,y_0)dx_0dy_0 = Q_0(x + \rho\cos\varphi, y + \rho\sin\varphi)\rho d\rho d\varphi = Q(\rho,\varphi)\rho d\rho d\varphi \quad . \tag{4}$$

The absorbed dose can then be written as

$$D(x,y,z) = \frac{T_0}{d} \int_0^{\infty} \rho d\rho \int_0^{2\pi} d\varphi\ Q(\rho,\varphi)\ \frac{F(\rho,z)}{2\pi\rho} \quad . \tag{5}$$

It is useful to introduce the beam-geometry function

$$G(x,y,\rho) = \frac{1}{2\pi} \int_0^{2\pi} d\varphi\ Q(\rho,\varphi) \quad , \tag{6}$$

in terms of which the expression for the absorbed dose can be re-written in the form

$$D(x,y,z) = \frac{T_0}{d} \int_0^{\infty} G(x,y,\rho)\ F(\rho,z)d\rho \quad . \tag{7}$$

We note that the absorbed dose is an integral over two factors: one of them, G, depends only on the beam geometry relative to the point (x,y,z); the other, F, is the elementary energy-deposition function available from our Monte Carlo calculations. Of particular importance is the uniform beam of finite cross section, characterized by a beam intensity distribution Q that is constant over a certain field size, and zero elsewhere. This will be discussed in Section 5.

4. BROAD-BEAM DEPTH-DOSE DISTRIBUTIONS

We now consider the case of a uniform broad beam of unlimited lateral extent, i.e., a beam with intensity distribution $Q(\rho,\varphi)$ = constant. Depth-dose distributions from such beams (for beam energies between 1 MeV to 60 MeV) are shown in Fig. 4 and are given numerically in Table 2. These plots were obtained by drawing smooth curves through Monte-Carlo-generated histograms similar to the histogram for a 20-MeV beam shown in the upper right-hand corner of Fig. 1. The depth-dose curves are given in scaled form, as plots of the dimensionless quantity $(r_0/T_0)\mathcal{D}$ *vs.* the scaled depth z/r_0, with $\mathcal{D}$ again the energy deposited per unit depth. The curves extend beyond the depth $z = r_0$ because of the combined effect of energy-loss straggling and the transport of energy by secondary bremsstrahlung photons. The higher the beam energy, the more noticeable is the bremsstrahlung tail of the depth dose curves, which is due to radiation produced by electrons within the phantom.

It is customary to obtain the practical range by fitting a straight line to a portion of the depth-dose curve beyond the peak. As illustrated in Fig. 5, one can extend the straight line to the depth where the extrapolated dose is zero, obtaining the practical range r_p; or one can extend the line to the depth where it meets the bremsstrahlung tail, obtaining the practical range r_p^*. We have analyzed the depth-dose curves in Fig. 4 in this manner, obtaining first the ratios r_p/r_0 and r_p^*/r_0 at several energies, and then the practical ranges r_p and r_p^* with the use of appropriate r_0-values. Linear least squares fits were made of the ratios r_p/T_0 and r_p^*/T_0 as functions of $1/T_0$, which lead to the following relations (with r_p and r_p^* in cm of H_2O, and T_0 in MeV):

$$\left.\begin{aligned} r_p &= 0.501\ T_0 - 0.110 \\ r_p^* &= 0.496\ T_0 - 0.104 \end{aligned}\right\} \text{ using "old" range values } r_0 \text{ from Table 1} \qquad (8)$$

$$\left.\begin{aligned} r_p &= 0.505\ T_0 - 0.106 \\ r_p^* &= 0.500\ T_0 - 0.101 \end{aligned}\right\} \text{ using "new" range values } r_0 \text{ from Table 1} \qquad (9)$$

It is estimated that the practical ranges have an overall uncertainty of $\sim 2\%$.

In a further analysis of the depth-dose curves in Fig. 4, we have determined the depths z_{50} at which the curves have fallen to 50% of their peak value. The relationship between z_{50} and the beam energy T_0 is almost, but not quite, linear. In Fig. 6 we give the ratio T_0/z_{50} as a function of z_{50}, and the reciprocal ratio z_{50}/T_0 as a function of T_0, from which one can determine T_0 as a function of z_{50} and *vice versa*. Two sets of curves are given in Fig. 6, one (solid curves) obtained with the "new" ranges, and the other (dashed curves) with the old ranges from Table 1.

5. DOSE DISTRIBUTIONS FROM BEAMS WITH CIRCULAR CROSS SECTIONS

The geometry factor G given by Eq (6) can be evaluated numerically when the beam intensity Q is variable, and often analytically when Q has a constant value Q_c over a prescribed "field size" and vanishes elsewhere. A particularly simple case is that of a circular field of radius R, for which we shall give some illustrative results. Let $D(\rho,z)$ denote the absorbed dose at a depth z in the phantom and at a radial distance ρ from the axis of the incident beam. The expression[4] for the absorbed dose, obtained by summing over a distribution of point-monodirectional beams, is

$$D(\rho,z) = \frac{T_0}{d}\int_0^\infty d\rho'\; G(\rho,\rho')\; F(\rho',z) \quad . \tag{10}$$

By some simple geometric considerations it can be shown that $G(\rho,\rho')$ is given by the following equations:

$$\begin{aligned} &\text{If } \rho = 0 && 0 \leqslant \rho' \leqslant R && G = Q_c \\ & && \rho > R && G = 0 \end{aligned} \tag{11a}$$

$$\begin{aligned} &\text{If } 0 < \rho < R && 0 \leqslant \rho' \leqslant R - \rho && G = Q_c \\ & && R - \rho < \rho' < R + \rho && G = (Q_c/\pi)\cos^{-1}[(\rho'^2+\rho^2-R^2)/2\rho'\rho] \\ & && R + \rho \leqslant \rho' && G = 0 \end{aligned} \tag{11b}$$

$$\begin{aligned} &\text{If } \rho = R && 0 \leqslant \rho' \leqslant 2R && G = (Q_c/\pi)\cos^{-1}(\rho'/2R) \\ & && 2R < \rho' && G = 0 \end{aligned} \tag{11c}$$

$$\begin{aligned} &\text{If } \rho > R && 0 \leqslant \rho' \leqslant \rho - R && G = 0 \\ & && \rho - R < \rho' < \rho + R && G = (Q_c/\pi)\cos^{-1}[(\rho'^2+\rho^2-R^2)/2\rho'\rho] \\ & && \rho + R \leqslant \rho' && G = 0 \end{aligned} \tag{11d}$$

Figure 7 shows central-axis depth-dose curves $D(0,z)$ calculated from Eqs (10) and (11a) for beams with circular cross sections. A series of depth-dose curves are plotted for a set of increasing beam radii (field sizes), illustrating the transition from narrow-beam to broad-beam conditions. The dependence of the shapes of these curves on the field size can be understood in terms of the competing effects of electron multiple-scattering into and out of the central-axis region. Whereas the outscattering is independent of the field size, the

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[4]This expression is equivalent to Eq (7); however, x and y are replaced by ρ, and ρ is replaced by ρ'.

inscattering increases with field size, which results in a larger buildup and peak and a slower decline beyond the peak for the broad-beam depth-dose curves.

Figure 8 shows the radial distribution of absorbed dose at various depths, for a 20-MeV beam with a radius of 1.25 cm, obtained by application of Eqs (10) and (11a-11d). The radial distributions actually are averaged over small depth intervals. At shallow depths, the radial distributions are almost constant over the irradiated field, and then drop off very rapidly. With increasing depth the drop-off becomes less sharp, due to the effect of multiple scattering. The radial distributions can be used to generate conventional isodose contours. Figure 9 shows isodose patterns derived in this manner for 10- and 20-MeV beams with radii of 2.5 and 5 cm.

6. CONCLUDING REMARKS

The results in this paper are only illustrative. The body of information contained in the calculated absorbed-dose distributions at 14 energies from 1 to 60 MeV remains to be exploited more fully. A very simple and straightforward extension would be to compute depth-dose curves and isodose curves for fields of various sizes and shapes, including beams with distributed energy spectra. A more difficult extension would be to discard the assumption of perpendicular incidence and to take into account the angular dispersion of the incident beam. Finally, it remains to be investigated to what extent the superposition method can be retained when treating inhomogeneous phantoms.

ACKNOWLEDGEMENT

This work was supported by the Department of Energy and by the Office of Naval Research.

REFERENCES

1. J. R. Clarkson, Br. J. Radiol 14, 265 (1941).

2. W. J. Meredith and G. J. Neary, Br. J. Radiol 17, 75 (1944).

3. S. C. Lillicrap, P. Wilson, and J. W. Boag, Phys. Med. Biol. 20, 30 (1975).

4. K. R. Hogstrom, M. D. Mills, and P. R. Almond, Phys. Med. Biol. 26, 445 (1981).

5. M. J. Berger, Methods in Computational Physics, Vol. 1, pp. 135-215, Academic Press, N.Y. 1963.

6. M. J. Berger and S. M. Seltzer, Ann. N.Y. Acad. of Sci. 161, 8 (1969).

7. M. J. Berger and S. M. Seltzer, Phys. Rev. C 2, 621 (1970).

8. R. M. Sternheimer and R. F. Peierls, Phys. Rev. B3, 3681 (1971).

9. J. Ashley, Radiat. Res., in press.

TABLE 1

CSDA Range r_o in Water

T_o (MeV)	r_o (g/cm^2)		Percent Difference
	Old[a]	New[b]	
60	22.65	22.72	0.3
50	19.72	19.79	0.4
40	16.53	16.62	0.5
30	13.05	13.14	0.7
20	9.209	9.295	0.9
15	7.122	7.200	1.1
10	4.902	4.963	1.2
8	3.969	4.021	1.3
6	3.006	3.048	1.4
5	2.512	2.547	1.4
4	2.008	2.037	1.4
3	1.493	1.514	1.4
2	0.9654	0.9802	1.5
1	0.4305	0.4377	1.7

[a]Old: Mean excitation energy 65.1 eV; density effect correction from Sternheimer and Peierls.[8]

[b]New: Mean excitation energy 75 eV; density effect correction from Ashley.[9]

TABLE 2

Scaled distribution of deposited energy per unit depth, for broad parallel monoenergetic beams. To obtain the absorbed dose in units of grays (J/kg), the entries in this table should be multiplied by $1.602 \times 10^{-10}\ N\ T_0/r_0$, where N is the number of electrons incident per cm^2, T_0 is the beam energy in MeV, and r_0 is the electron range in g/cm^2.

z/r_0	Electron Beam Energy, T_0, MeV							
	1.0	1.5	2.0	3.0	4.0	5.0	6.0	8.0
0.00	.747	.794	.815	.836	.846	.850	.843	.837
0.05	.861	.884	.896	.905	.907	.902	.901	.892
0.10	.988	.984	.980	.970	.961	.955	.949	.937
0.15	1.115	1.090	1.071	1.044	1.024	1.008	.995	.974
0.20	1.239	1.190	1.156	1.115	1.085	1.062	1.043	1.015
0.25	1.352	1.287	1.249	1.195	1.155	1.122	1.094	1.050
0.30	1.446	1.389	1.344	1.280	1.231	1.189	1.154	1.098
0.35	1.524	1.481	1.441	1.375	1.317	1.260	1.209	1.139
0.40	1.559	1.516	1.480	1.418	1.365	1.320	1.261	1.178
0.45	1.543	1.527	1.510	1.450	1.405	1.365	1.326	1.242
0.50	1.485	1.482	1.472	1.446	1.415	1.386	1.350	1.274
0.55	1.393	1.396	1.397	1.391	1.384	1.375	1.360	1.302
0.60	1.259	1.288	1.302	1.314	1.320	1.322	1.314	1.280
0.65	1.073	1.115	1.143	1.180	1.203	1.220	1.230	1.228
0.70	.868	.928	.967	1.020	1.055	1.080	1.103	1.130
0.75	.640	.700	.742	.810	.860	.901	.935	.995
0.80	.445	.500	.540	.604	.660	.706	.750	.825
0.85	.275	.315	.347	.403	.452	.497	.540	.618
0.90	.135	.158	.178	.217	.252	.290	.325	.400
0.95	.0515	.0610	.0700	.0900	.109	.131	.154	.210
1.00	.0158	.0191	.0223	.0287	.0360	.0440	.0550	.0895
1.05	.00450	.00530	.00600	.00745	.00910	.0113	.0150	.0250
1.10	.00103	.00127	.00150	.00194	.00250	.00320	.00450	.00850
1.15	.00029	.00041	.00054	.00089	.00135	.00200	.00275	.00460
1.20	.00020	.00032	.00043	.00072	.00110	.00153	.00206	.00339
1.25	.00016	.00026	.00036	.00062	.00096	.00132	.00183	.00311
1.30	.00013	.00022	.00031	.00055	.00084	.00115	.00165	.00285
1.35	.00011	.00018	.00026	.00048	.00074	.00102	.00150	.00255
1.40	.00009	.00015	.00023	.00042	.00056	.00094	.00133	.00225

TABLE 2 (continued)

z/r_o	Electron Beam Energy, T_o, MeV							
	10	12	15	20	30	40	50	60
0.00	.826	.820	.810	.793	.750	.708	.683	.652
0.05	.882	.875	.858	.839	.797	.761	.733	.707
0.10	.926	.910	.894	.871	.831	.799	.767	.743
0.15	.952	.940	.924	.899	.855	.822	.791	.764
0.20	.993	.975	.949	.920	.872	.838	.804	.777
0.25	1.023	.997	.969	.938	.886	.848	.815	.786
0.30	1.053	1.028	.990	.953	.897	.856	.822	.792
0.35	1.087	1.054	1.011	.970	.906	.861	.828	.798
0.40	1.123	1.081	1.033	.983	.913	.866	.830	.801
0.45	1.162	1.111	1.059	1.000	.920	.870	.831	.803
0.50	1.200	1.145	1.086	1.017	.926	.870	.830	.802
0.55	1.226	1.169	1.108	1.035	.930	.868	.828	.799
0.60	1.233	1.180	1.120	1.050	.931	.863	.820	.789
0.65	1.209	1.178	1.121	1.053	.930	.854	.809	.777
0.70	1.145	1.130	1.101	1.045	.921	.891	.794	.760
0.75	1.040	1.062	1.052	1.006	.904	.826	.775	.741
0.80	.897	.946	.966	.937	.877	.801	.750	.720
0.85	.685	.765	.825	.840	.826	.767	.718	.689
0.90	.475	.550	.625	.686	.740	.706	.669	.648
0.95	.275	.340	.413	.500	.610	.620	.603	.597
1.00	.129	.165	.215	.310	.450	.508	.525	.525
1.05	.0400	.0610	.0910	.155	.293	.380	.430	.443
1.10	.0130	.0195	.0343	.0665	.162	.256	.320	.352
1.15	.00670	.01050	.0159	.0275	.078	.151	.220	.254
1.20	.00500	.00700	.0107	.0185	.0425	.0850	.143	.188
1.25	.00465	.00650	.0098	.0160	.0337	.0543	.0950	.1300
1.30	.00435	.00605	.00900	.0146	.0290	.0467	.0657	.0890
1.35	.00400	.00557	.00845	.0139	.0266	.0438	.0550	.0673
1.40	.00355	.00520	.00800	.0135	.0258	.0410	.0525	.0610

FIGURE CAPTIONS

Fig. 1. Distribution of energy deposited by a 20-MeV point-monodirectional beam.

Fig. 2. Curves of scaled radial distance *vs.* depth, along which the normalized cumulative radial distribution of deposited energy is constant.

Fig. 3. Fraction of energy deposited at radial distances greater than ρ/r_0

a. 10-MeV point-monodirectional beam

b. 20-MeV point-monodirectional beam

Fig. 4. Scaled broad-beam depth-dose curves.

Fig. 5. Definition of practical range.

Fig. 6. Relation between incident beam energy T_0 and depth z_{50} at which the broad-beam depth-dose curve has fallen to 50% of its peak value.

Fig. 7. Central-axis depth-dose curves from beams with circular cross section (radius R).

a. Beam energy 10 MeV

b. Beam energy 20 MeV.

Fig. 8. Radial distribution of absorbed dose from a 20-MeV circular beam with radius R = 1.25 cm. Curves shown are averages over indicated depth intervals.

Fig. 9. Isodose curves in a water phantom irradiated with 10- and 20-MeV electron beams with circular field sizes.

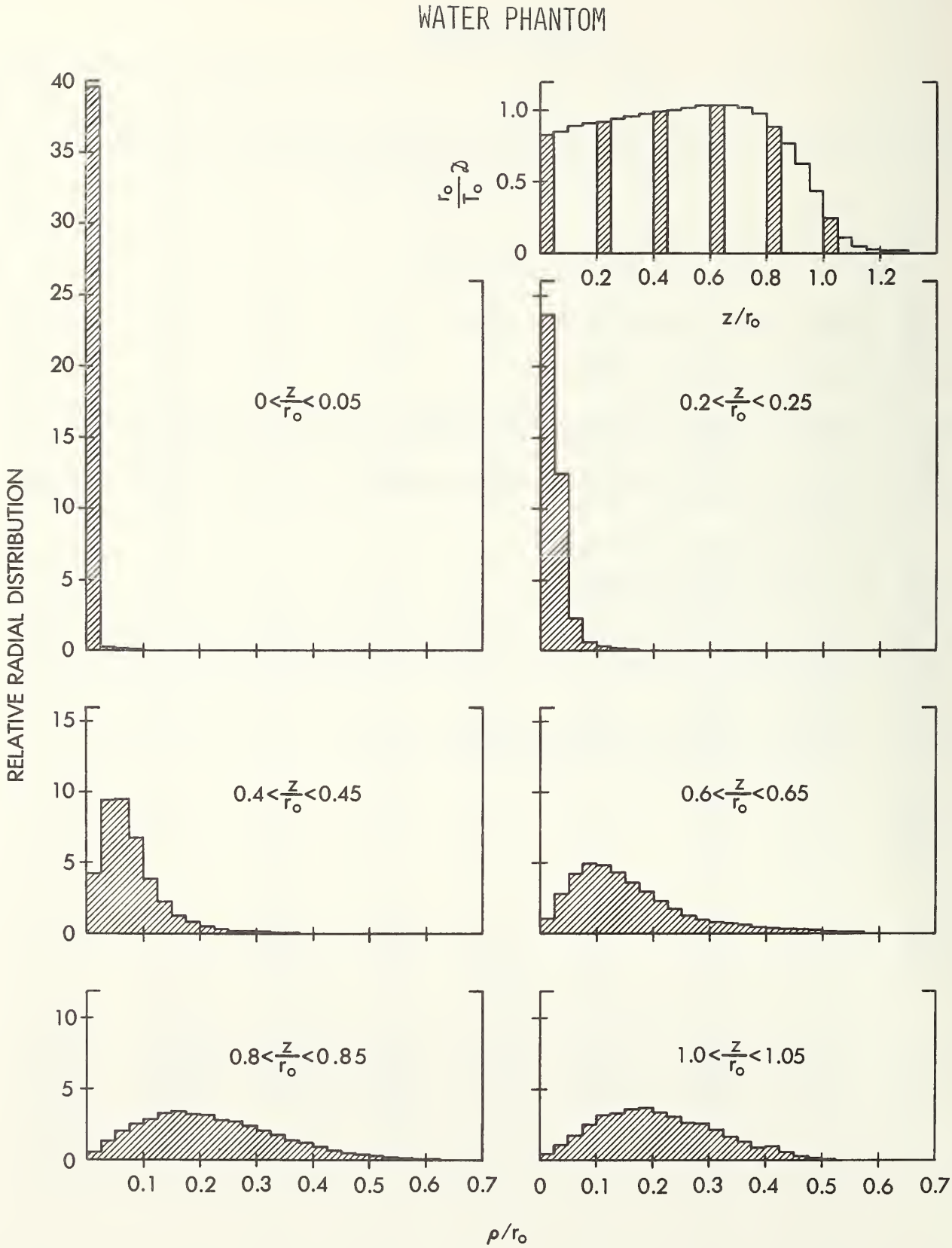
WATER PHANTOM
RELATIVE RADIAL DISTRIBUTION
$\frac{r_o}{T_o}\mathcal{D}$
z/r_o
$0<\frac{z}{r_o}<0.05$
$0.2<\frac{z}{r_o}<0.25$
$0.4<\frac{z}{r_o}<0.45$
$0.6<\frac{z}{r_o}<0.65$
$0.8<\frac{z}{r_o}<0.85$
$1.0<\frac{z}{r_o}<1.05$
ρ/r_o

Fig. 1

WATER PHANTOM

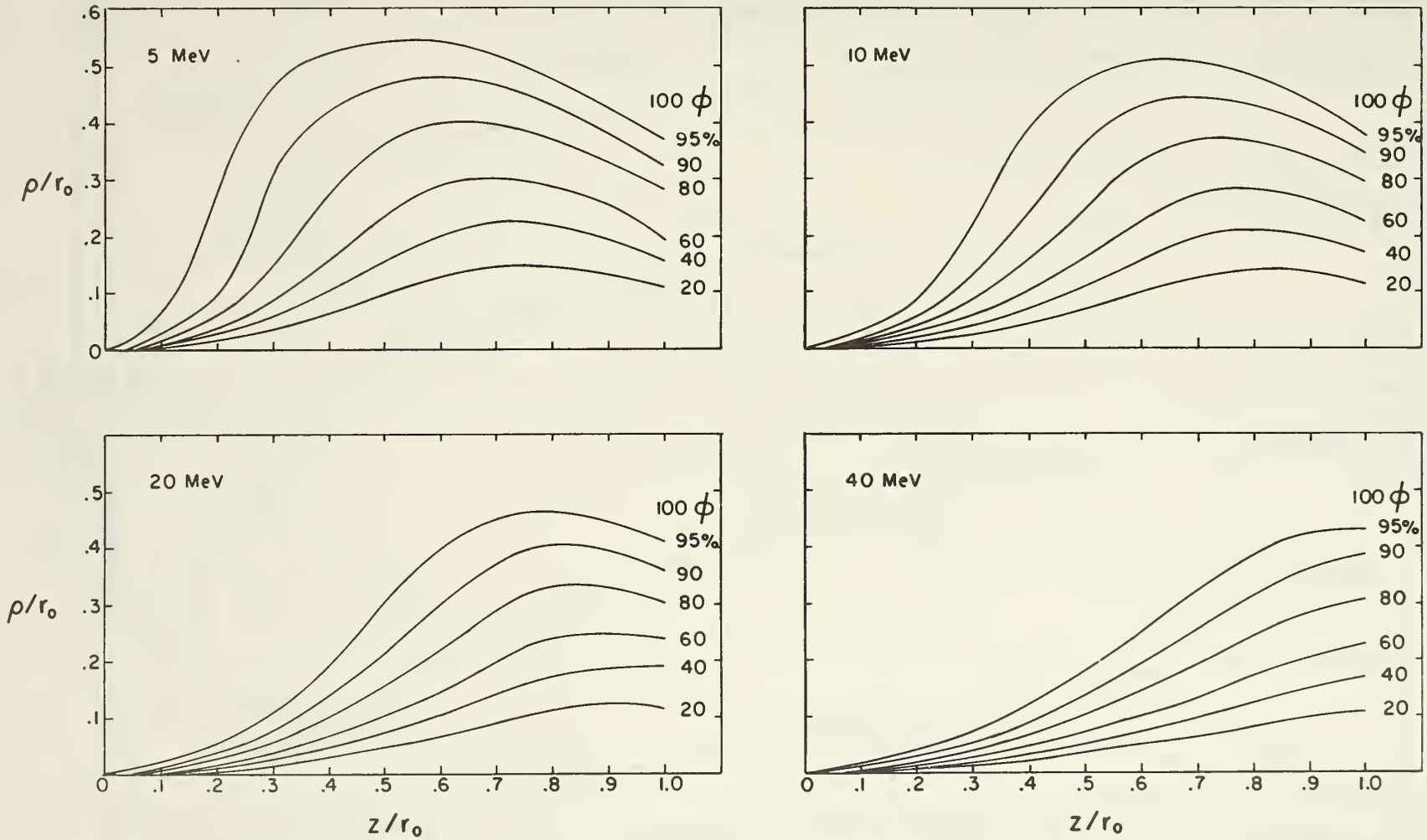

Fig. 2

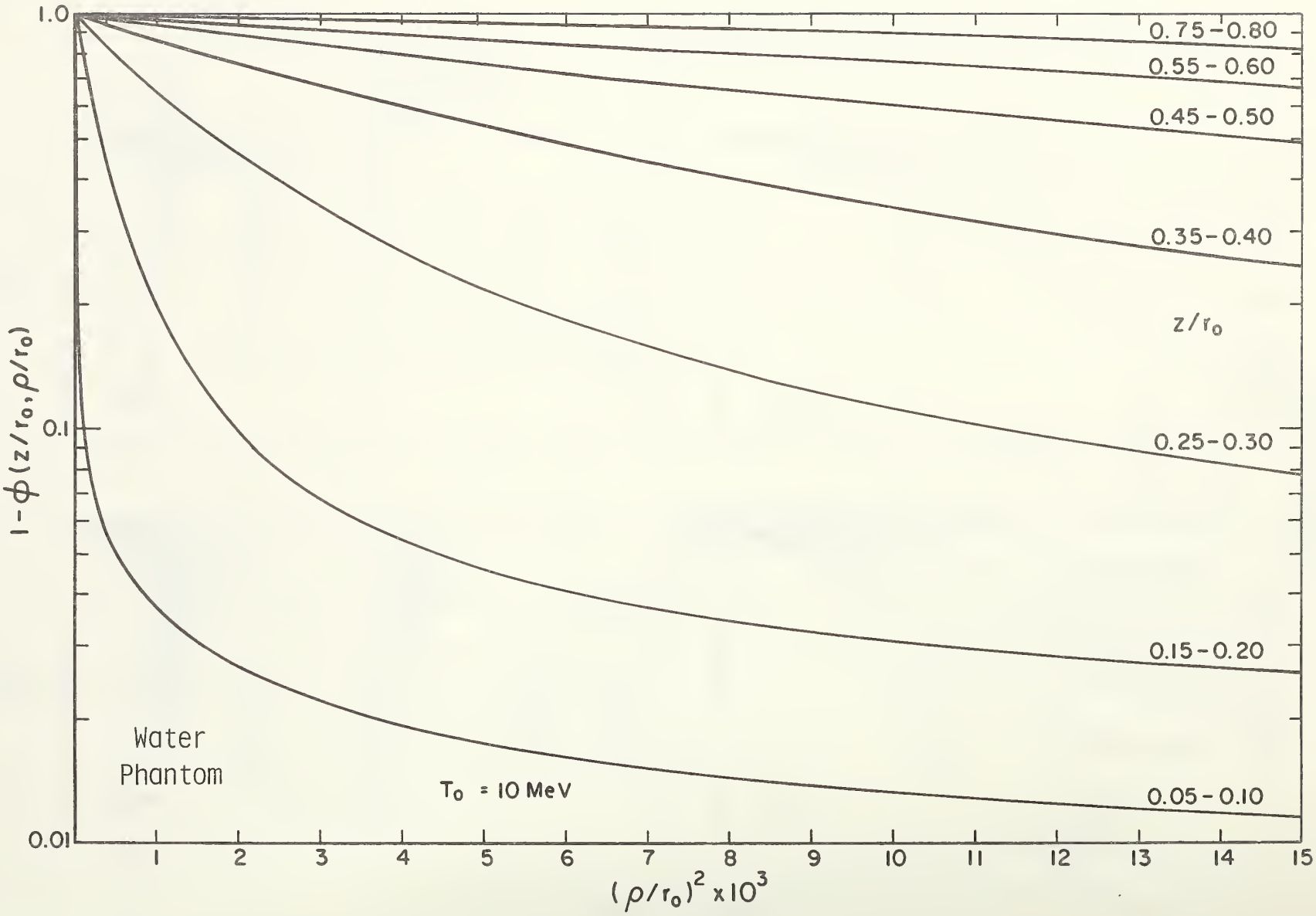
1.0
0.1
0.01
$1-\phi(z/r_0, \rho/r_0)$
0.75-0.80
0.55-0.60
0.45-0.50
0.35-0.40
z/r_0
0.25-0.30
0.15-0.20
0.05-0.10
Water
Phantom
T_0 = 10 MeV
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
$(\rho/r_0)^2 \times 10^3$

Fig. 3a

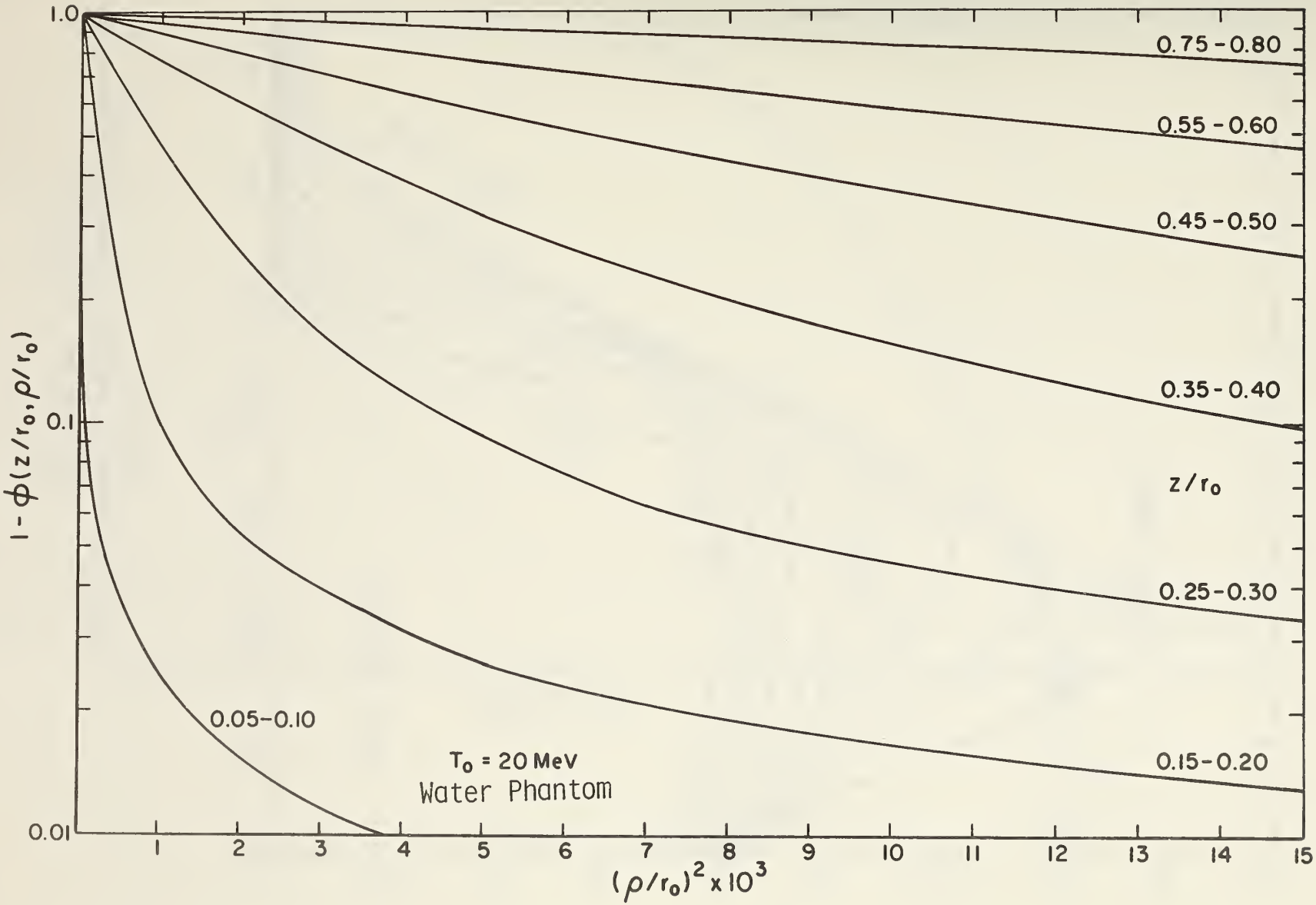
1.0
0.1
0.01
$1 - \phi(z/r_0, \rho/r_0)$
0.75 - 0.80
0.55 - 0.60
0.45 - 0.50
0.35 - 0.40
z/r_0
0.25 - 0.30
0.15 - 0.20
0.05-0.10
T_0 = 20 MeV
Water Phantom
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
$(\rho/r_0)^2 \times 10^3$

Fig. 3b

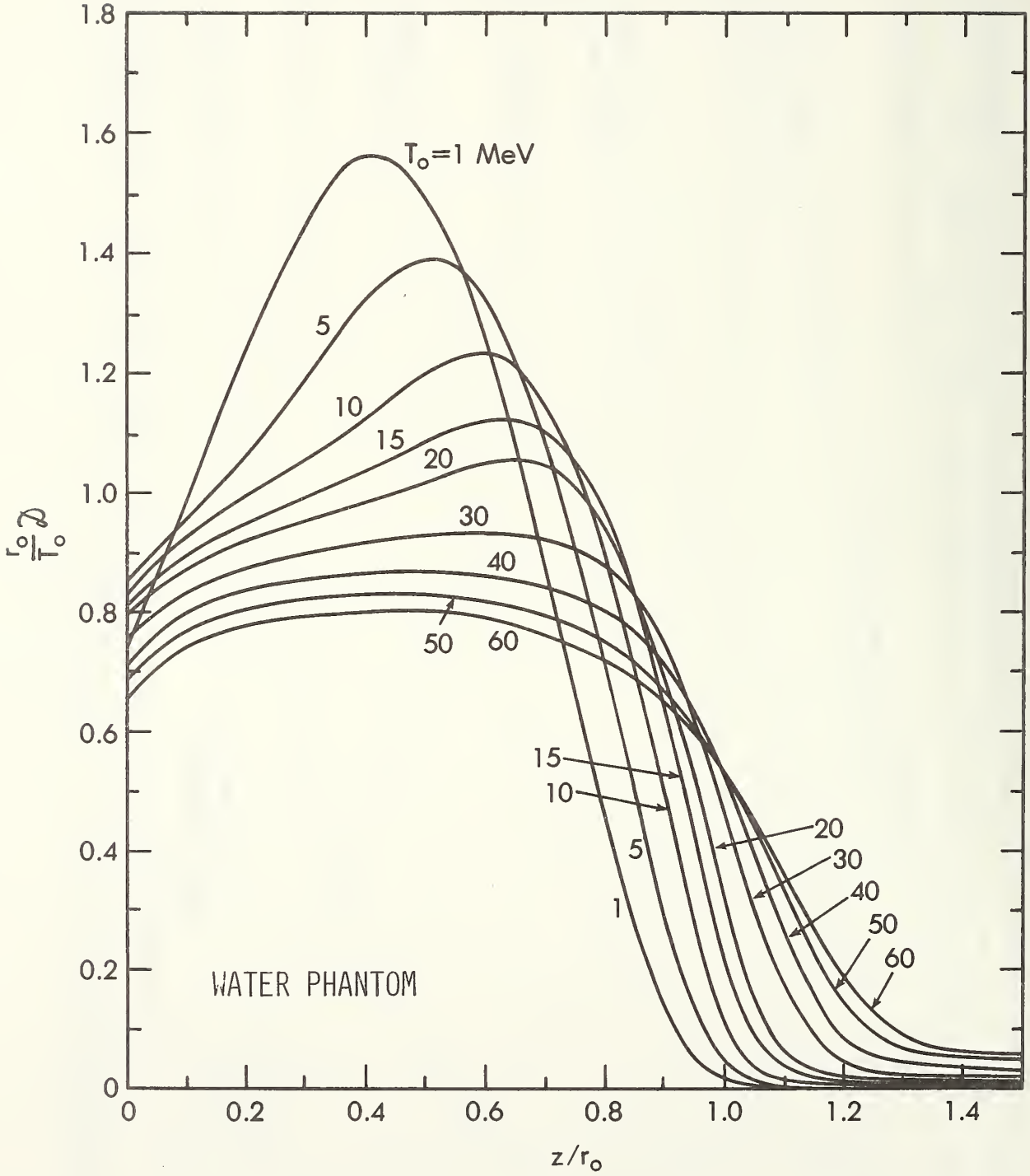
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
$\frac{r_o}{T_o}\mathcal{D}$
z/r_o
T_o=1 MeV
5
10
15
20
30
40
50
60
15
10
5
1
20
30
40
50
60
WATER PHANTOM

Fig. 4

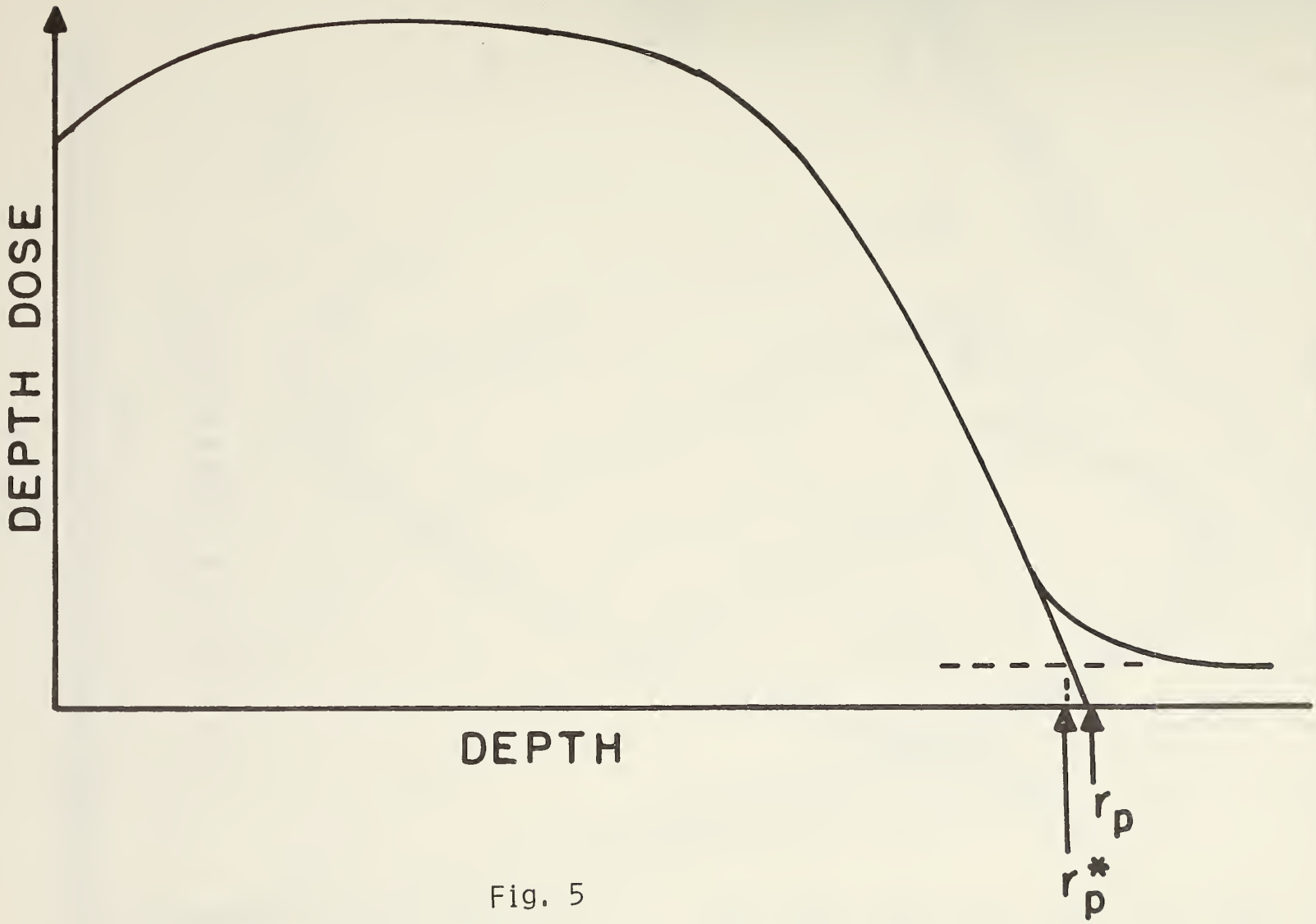

Fig. 5

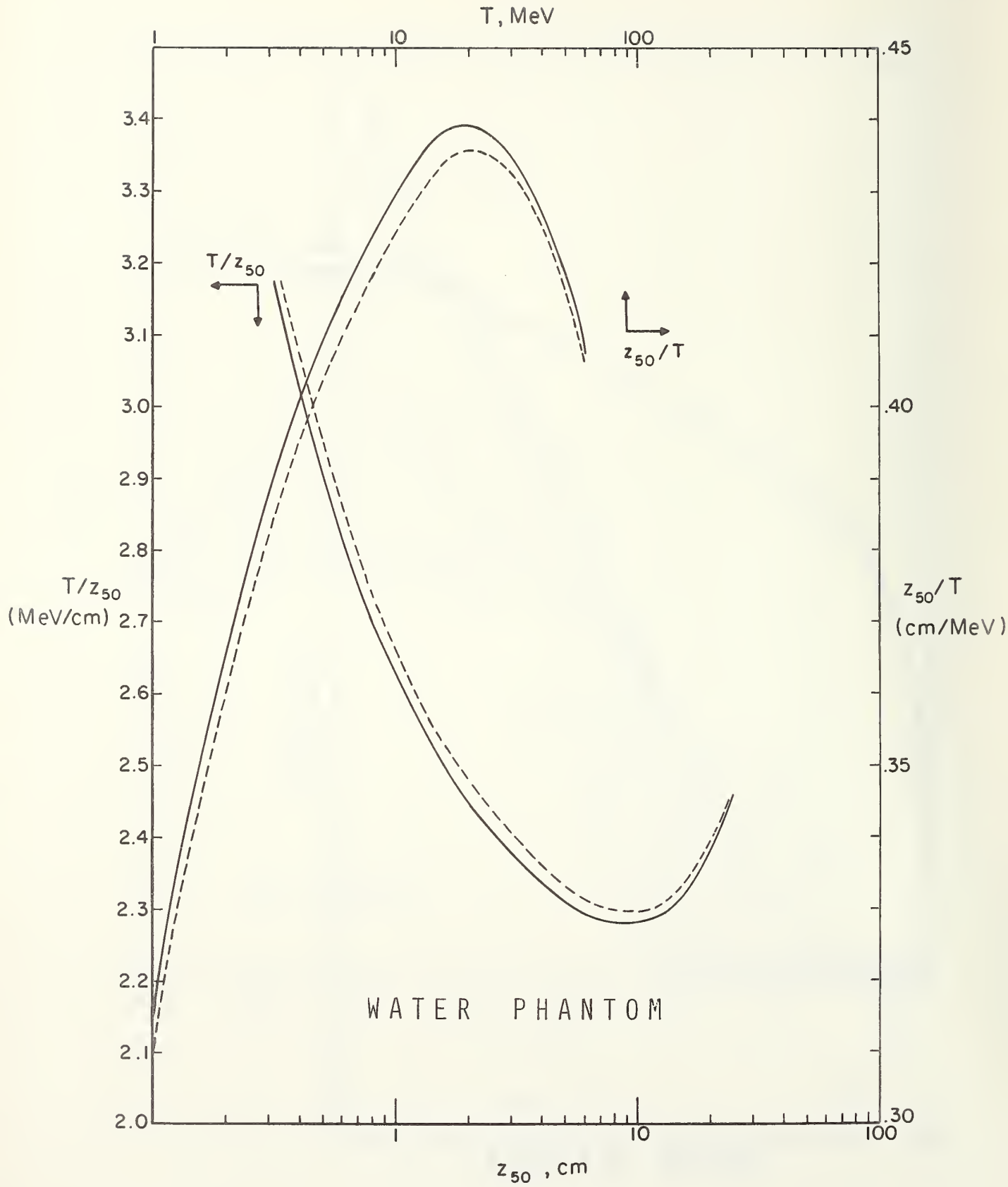
T, MeV
1
10
100
.45
.40
.35
.30
3.4
3.3
3.2
3.1
3.0
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
2.0
T/z50
(MeV/cm)
z50/T
(cm/MeV)
T/z50
z50/T
WATER PHANTOM
1
10
100
z50 , cm

Fig. 6

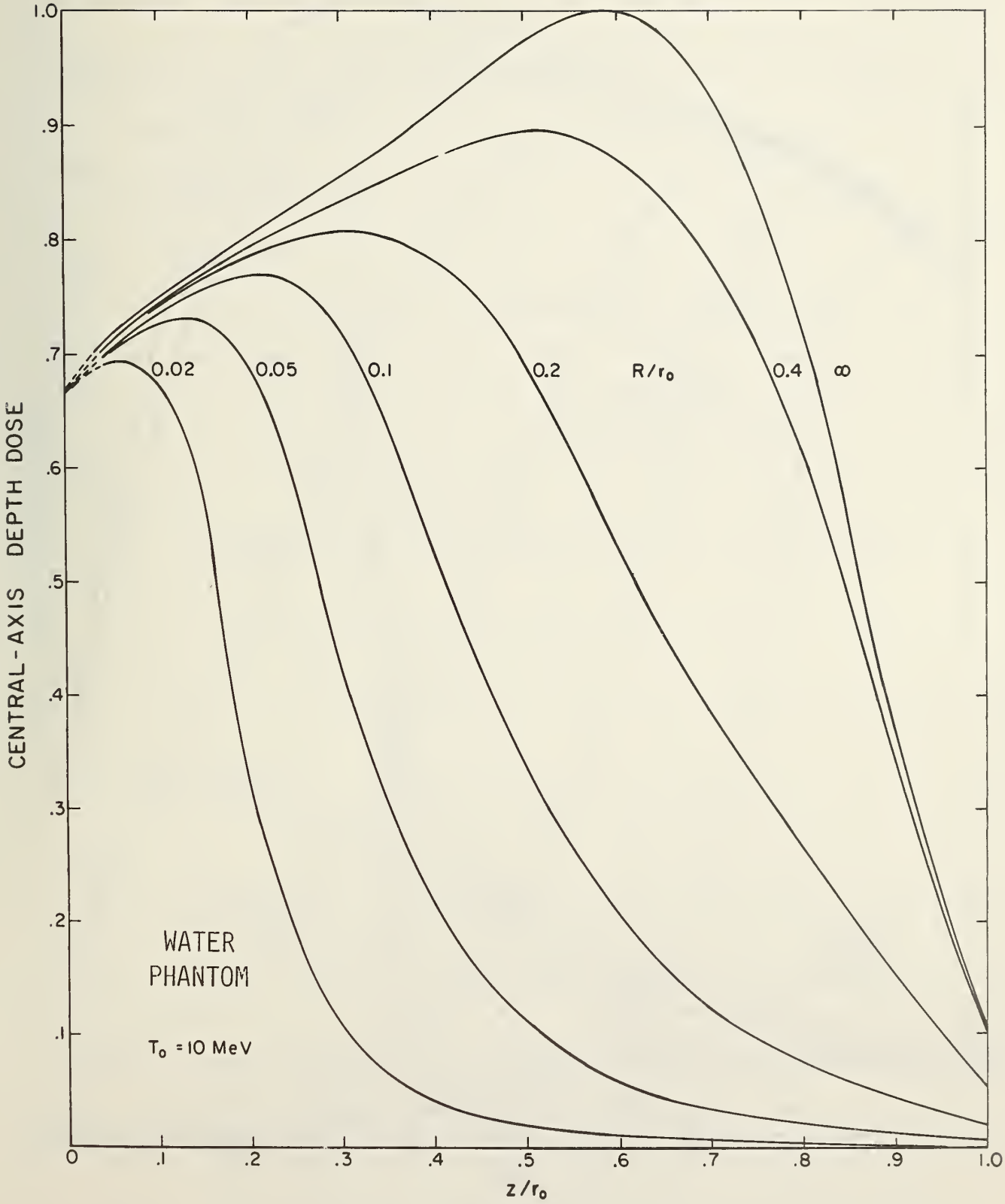
CENTRAL-AXIS DEPTH DOSE
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1.0
z/r₀
0.02
0.05
0.1
0.2
R/r₀
0.4
∞
WATER
PHANTOM
T₀ = 10 MeV

Fig. 7a

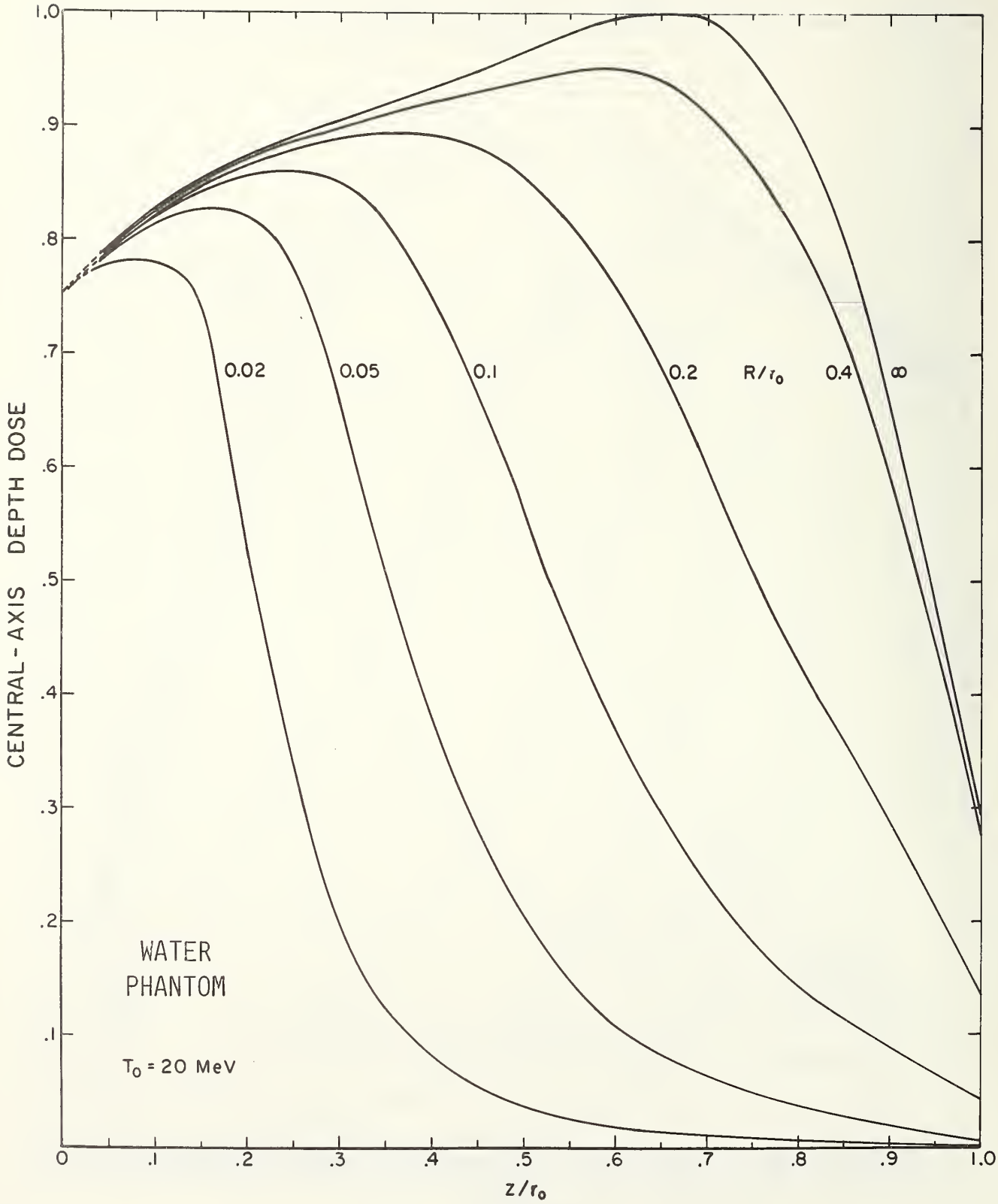
CENTRAL-AXIS DEPTH DOSE
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
.1
.2
.3
.4
.5
.6
.7
.8
.9
1.0
z/r₀
0.02
0.05
0.1
0.2
R/r₀
0.4
∞
WATER
PHANTOM
T₀ = 20 MeV

Fig. 7b

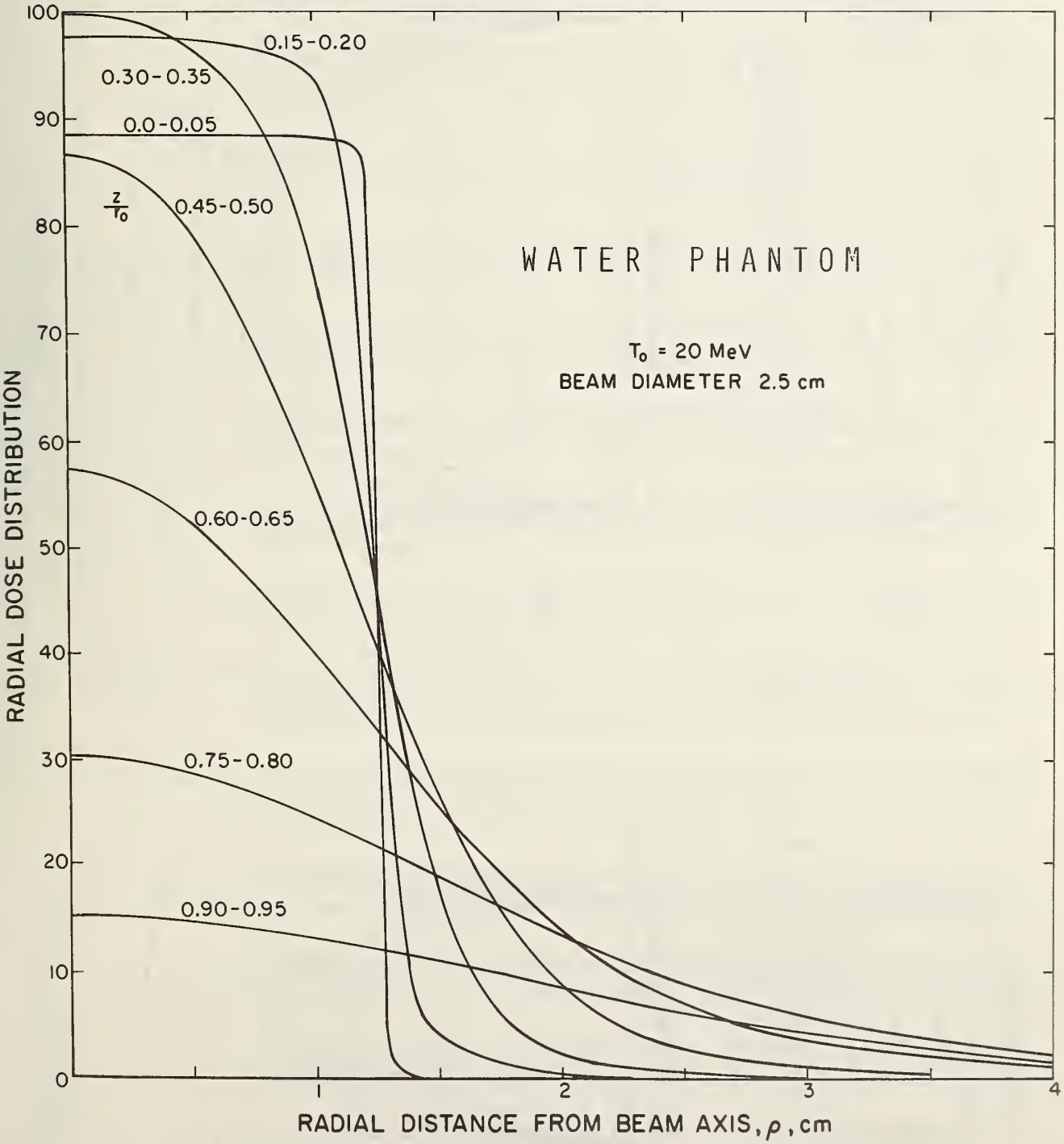
WATER PHANTOM
T_0 = 20 MeV
BEAM DIAMETER 2.5 cm
$\frac{z}{T_0}$
0.15-0.20
0.30-0.35
0.0-0.05
0.45-0.50
0.60-0.65
0.75-0.80
0.90-0.95
RADIAL DOSE DISTRIBUTION
RADIAL DISTANCE FROM BEAM AXIS, ρ, cm
0
10
20
30
40
50
60
70
80
90
100
1
2
3
4

Fig. 8

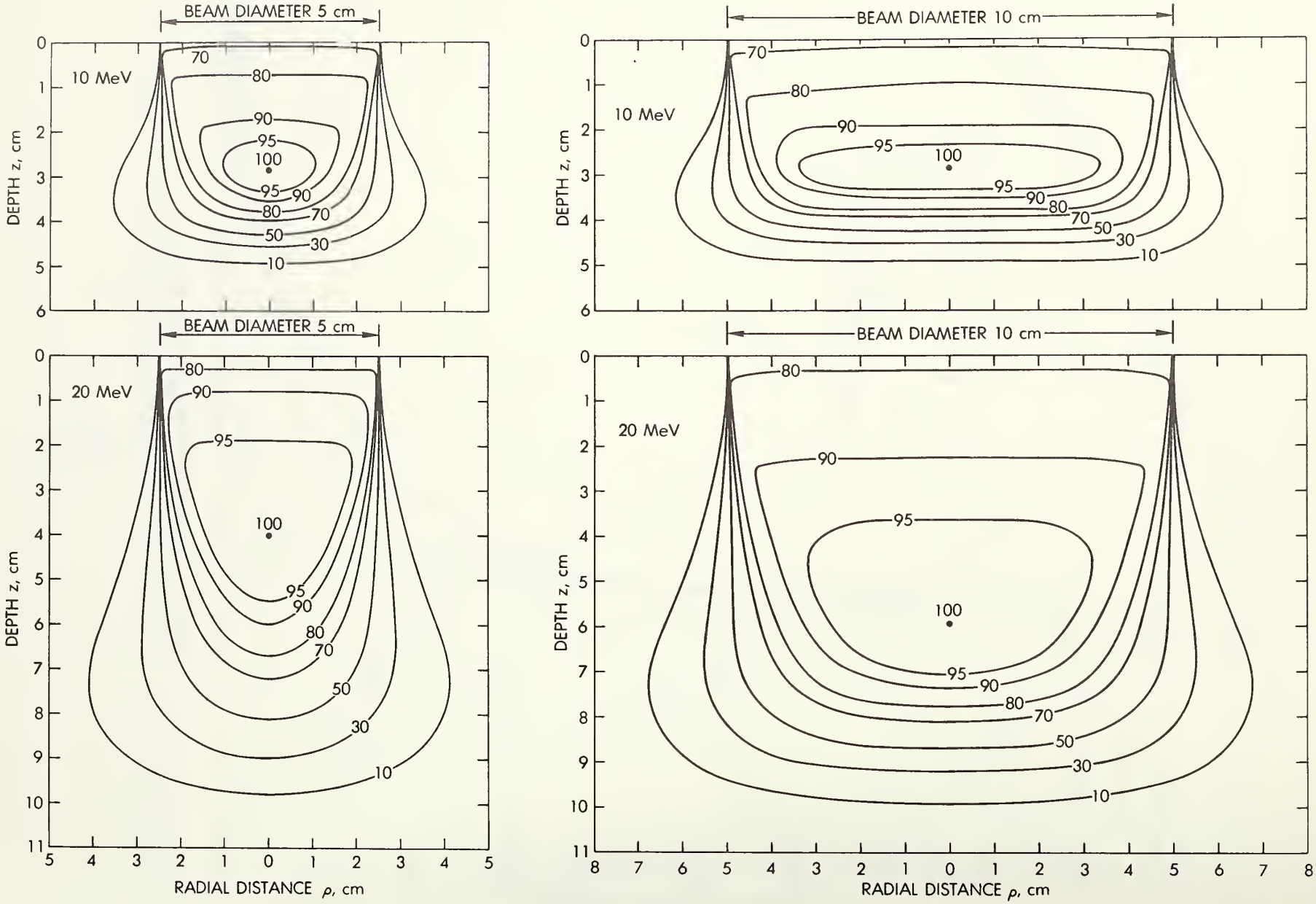
BEAM DIAMETER 5 cm
10 MeV
DEPTH z, cm
70
80
90
95
100
95
90
80
70
50
30
10
BEAM DIAMETER 10 cm
10 MeV
DEPTH z, cm
70
80
90
95
100
95
90
80
70
50
30
10
BEAM DIAMETER 5 cm
20 MeV
DEPTH z, cm
80
90
95
100
95
90
80
70
50
30
10
RADIAL DISTANCE ρ, cm
BEAM DIAMETER 10 cm
20 MeV
DEPTH z, cm
80
90
95
100
95
90
80
70
50
30
10
RADIAL DISTANCE ρ, cm

Fig. 9

TABLE A1. Distribution of energy deposition as a function of depth. The numbers in the column headed "Scaled depth interval" are the depth boundaries in units of the CSDA range r_0. The other columns give the quantity H_n as defined by Eq (2), i.e., the percentage of the beam energy that is deposited in the indicated depth interval.

Energy Deposition as a Function of Depth in Water

Scaled depth interval	Beam energy, MeV													
	60	50	40	30	20	15	10	8	6	5	4	3	2	1
0.0 - 0.05	3.40	3.55	3.68	3.87	4.06	4.16	4.26	4.26	4.29	4.34	4.28	4.29	4.18	4.13
0.05 - 0.10	3.62	3.76	3.93	4.10	4.34	4.46	4.58	4.67	4.70	4.69	4.74	4.73	4.75	4.69
0.10 - 0.15	3.77	3.90	4.07	4.25	4.41	4.58	4.71	4.69	4.81	4.96	4.94	4.90	5.07	5.25
0.15 - 0.20	3.87	4.00	4.13	4.31	4.55	4.65	4.88	4.97	5.07	5.16	5.19	5.30	5.58	5.81
0.20 - 0.25	3.85	4.03	4.20	4.36	4.60	4.76	4.98	5.12	5.26	5.32	5.60	5.84	6.17	6.52
0.25 - 0.30	3.93	4.12	4.26	4.45	4.76	4.88	5.21	5.35	5.52	5.80	6.02	6.30	6.74	7.04
0.30 - 0.35	3.95	4.11	4.27	4.52	4.83	4.99	5.29	5.53	5.82	6.20	6.41	6.74	7.29	7.47
0.35 - 0.40	3.98	4.17	4.32	4.59	4.86	5.15	5.55	5.80	6.21	6.46	6.74	7.18	7.51	7.84
0.40 - 0.45	4.05	4.14	4.36	4.62	4.98	5.26	5.77	6.08	6.47	6.79	7.09	7.28	7.65	7.87
0.45 - 0.50	4.06	4.16	4.36	4.60	5.06	5.39	5.88	6.36	6.73	6.84	7.14	7.27	7.50	7.54
0.50 - 0.55	3.95	4.12	4.36	4.62	5.07	5.41	6.08	6.50	6.88	6.84	7.06	7.18	7.25	7.17
0.55 - 0.60	3.99	4.16	4.33	4.63	5.21	5.62	6.22	6.56	6.77	6.85	6.86	6.85	6.62	6.49
0.60 - 0.65	3.94	4.11	4.32	4.72	5.24	5.64	6.14	6.37	6.38	6.40	6.44	6.32	6.08	5.78
0.65 - 0.70	3.84	4.03	4.29	4.65	5.24	5.56	5.92	6.01	5.92	5.72	5.66	5.52	5.23	4.94
0.70 - 0.75	3.79	3.92	4.18	4.60	5.19	5.42	5.58	5.47	5.28	4.99	4.75	4.58	4.18	3.84
0.75 - 0.80	3.59	3.83	4.03	4.42	4.90	5.03	4.82	4.56	4.31	4.00	3.81	3.55	3.12	2.74
0.80 - 0.85	3.51	3.63	3.86	4.25	4.48	4.44	3.94	3.55	3.19	3.04	2.72	2.34	1.97	1.78
0.85 - 0.90	3.35	3.44	3.67	3.91	3.70	3.55	2.88	2.51	2.13	1.96	1.64	1.41	1.14	0.99
0.90 - 0.95	3.12	3.17	3.31	3.35	2.96	2.61	1.84	1.51	1.18	1.05	0.80	0.66	0.51	0.44
0.95 - 1.00	2.77	2.82	2.86	2.67	2.04	1.54	0.97	0.73	0.53	0.41	0.28	0.22	0.17	0.14
1.00 - 1.05	2.49	2.40	2.25	1.89	1.12	0.75	0.38	0.25	0.15	0.12	0.07	0.06	0.04	0.05
1.05 - 1.10	2.00	1.88	1.61	1.11	0.52	0.28	0.11	0.07	0.05	0.03	0.01	0.01	0.01	0.01
1.10 - 1.15	1.54	1.34	1.02	0.58	0.21	0.11	0.03	0.02	0.02	0.01	0.01	0.00	0.00	0.00
1.15 - 1.20	1.11	0.90	0.56	0.26	0.11	0.07	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.00
1.20 - 1.25	0.79	0.58	0.32	0.18	0.08	0.05	0.03	0.02	0.01	0.01	0.01	0.00	0.00	0.00
1.25 - 1.30	0.54	0.39	0.24	0.15	0.08	0.05	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.0
1.30 - 1.35	0.38	0.29	0.22	0.14	0.07	0.04	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00
1.35 - 1.40	0.32	0.25	0.19	0.13	0.07	0.03	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00
1.40 - 1.45	0.30	0.27	0.17	0.13	0.06	0.04	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00
1.45 - 1.50	0.30	0.25	0.19	0.12	0.06	0.03	0.03	0.01	0.01	0.01	0.00	0.00	0.00	0.00
1.50 - 1.55	0.30	0.25	0.18	0.11	0.07	0.03	0.02	0.02	0.01	0.01	0.01	0.00	0.00	0.00
1.55 - 1.60	0.27	0.23	0.17	0.11	0.06	0.03	0.02	0.01	0.01	0.00	0.00	0.00	0.00	0.0
1.60 - 1.65	0.29	0.23	0.17	0.11	0.06	0.04	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00
1.65 - 1.70	0.25	0.22	0.15	0.12	0.05	0.03	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.0
1.70 - 1.75	0.27	0.22	0.15	0.10	0.05	0.04	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.0
1.75 - 1.80	0.26	0.22	0.15	0.09	0.06	0.03	0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.00
1.80 - 1.85	0.24	0.21	0.15	0.09	0.05	0.03	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.00
1.85 - 1.90	0.24	0.21	0.15	0.09	0.04	0.03	0.02	0.01	0.00	0.01	0.01	0.00	0.00	0.00
1.90 - 1.95	0.24	0.23	0.14	0.09	0.05	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.0
1.95 - 2.00	0.24	0.21	0.15	0.08	0.04	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.0

TABLE A2. Normalized cumulative radial distribution of deposited energy. The numbers in the column headed ""Scaled radius" represent the scaled radial distance from the z-axis, ρ/r_0. The "Scaled depth intervals" have the same meaning as in Table A1. The entries for each depth interval are the quantities $\Psi_n(\rho)$ as defined by Eq (3). The percentage of the incident beam energy deposited in the indicated depth interval, at radial distances $\leqslant \rho$, is equal to $H_n \Psi_n(\rho)/100$, where H_n is given in Table A1.

TABLE A2

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 60 MeV

Scaled radius	Scaled depth interval 0.0–0.05	0.05–0.10	0.10–0.15	0.15–0.20	0.20–0.25	0.25–0.30	0.30–0.35	0.35–0.40	0.40–0.45	0.45–0.50	0.50–0.55	0.55–0.60
0.005	95.09	89.04	59.45	26.77	12.58	6.36	3.70	2.44	1.30	1.11	0.70	0.48
0.010	97.42	94.10	87.98	66.79	39.67	23.42	13.31	8.53	5.35	3.97	2.75	1.90
0.015	98.42	96.04	93.50	85.17	64.90	42.71	27.80	18.12	11.76	8.62	6.09	4.38
0.020	98.97	97.23	95.13	91.75	80.05	60.41	41.85	28.79	20.09	14.88	10.34	7.68
0.025	99.29	97.92	96.26	94.16	87.98	73.68	55.82	40.33	29.07	21.49	15.43	11.69
0.030	99.48	98.49	97.14	95.42	91.88	82.54	66.80	51.28	38.22	29.00	21.04	16.31
0.035	99.60	98.85	97.74	96.25	93.73	87.69	75.42	60.98	47.52	36.43	27.50	21.41
0.040	99.68	99.11	98.17	96.85	94.90	90.89	81.86	69.08	55.80	43.91	34.07	27.00
0.045	99.74	99.28	98.48	97.31	95.85	92.74	86.16	75.64	62.92	51.15	40.61	32.44
0.050	99.76	99.45	98.77	97.60	96.48	94.12	89.20	80.44	69.28	57.28	46.62	38.15
0.060	99.79	99.62	99.12	98.20	97.42	95.80	92.82	87.09	78.78	68.58	58.05	49.31
0.070	99.81	99.69	99.33	98.62	98.00	96.71	94.79	91.04	85.22	76.76	67.56	58.79
0.080	99.82	99.75	99.47	99.00	98.49	97.44	96.00	93.49	89.37	82.89	75.12	66.73
0.090	99.83	99.78	99.58	99.22	98.80	97.86	96.85	95.03	92.18	87.25	80.94	73.24
0.100	99.83	99.79	99.65	99.34	99.01	98.28	97.44	95.92	93.88	90.29	85.15	78.43
0.110	99.84	99.80	99.68	99.42	99.15	98.56	97.88	96.59	95.07	92.35	88.40	82.60
0.120	99.84	99.81	99.71	99.49	99.24	98.85	98.31	97.18	95.97	93.82	90.64	85.95
0.130	99.84	99.81	99.72	99.60	99.32	99.00	98.56	97.58	96.68	94.98	92.56	88.53
0.140	99.84	99.81	99.73	99.62	99.41	99.14	98.74	97.95	97.19	95.75	93.95	90.60
0.150	99.84	99.82	99.75	99.64	99.48	99.21	98.86	98.21	97.55	96.31	94.93	92.21
0.160	99.84	99.82	99.76	99.65	99.52	99.27	99.01	98.42	97.81	96.77	95.68	93.41
0.170	99.85	99.82	99.77	99.66	99.55	99.34	99.14	98.63	98.05	97.11	96.19	94.43
0.180	99.85	99.82	99.79	99.68	99.56	99.37	99.22	98.78	98.23	97.48	96.65	95.23
0.190	99.85	99.83	99.79	99.70	99.57	99.43	99.31	98.93	98.45	97.71	97.11	95.68
0.200	99.85	99.83	99.80	99.71	99.60	99.44	99.34	99.03	98.60	97.94	97.41	96.23
0.220	99.86	99.84	99.81	99.73	99.62	99.47	99.48	99.16	98.87	98.24	97.88	97.00
0.240	99.86	99.84	99.81	99.75	99.64	99.51	99.57	99.32	99.02	98.55	98.25	97.58
0.260	99.87	99.85	99.82	99.77	99.66	99.53	99.61	99.45	99.16	98.75	98.54	98.00
0.280	99.88	99.86	99.83	99.78	99.68	99.55	99.63	99.53	99.31	98.95	98.76	98.26
0.300	99.88	99.86	99.83	99.79	99.71	99.56	99.64	99.57	99.41	99.09	98.92	98.54
0.320	99.89	99.87	99.84	99.79	99.73	99.57	99.67	99.62	99.46	99.21	99.03	98.72
0.340	99.89	99.87	99.85	99.80	99.77	99.58	99.69	99.66	99.50	99.30	99.14	98.90
0.360	99.90	99.88	99.86	99.81	99.79	99.60	99.71	99.69	99.54	99.36	99.22	99.02
0.380	99.90	99.89	99.86	99.81	99.80	99.61	99.73	99.71	99.58	99.43	99.31	99.14
0.400	99.91	99.89	99.87	99.82	99.82	99.64	99.76	99.73	99.61	99.50	99.35	99.24
0.420	99.91	99.90	99.88	99.83	99.84	99.65	99.76	99.75	99.64	99.54	99.42	99.34
0.440	99.92	99.90	99.88	99.84	99.85	99.67	99.77	99.77	99.66	99.58	99.48	99.44
0.460	99.92	99.90	99.90	99.85	99.86	99.69	99.79	99.78	99.69	99.60	99.55	99.50
0.480	99.93	99.91	99.90	99.86	99.87	99.70	99.80	99.79	99.71	99.63	99.60	99.55
0.500	99.93	99.91	99.91	99.86	99.87	99.72	99.81	99.80	99.75	99.66	99.63	99.59
0.550	99.94	99.93	99.92	99.88	99.89	99.76	99.85	99.82	99.80	99.72	99.68	99.70
0.600	99.95	99.94	99.93	99.91	99.90	99.79	99.87	99.85	99.83	99.78	99.73	99.74
0.650	99.95	99.95	99.94	99.92	99.92	99.83	99.89	99.90	99.86	99.84	99.81	99.78
0.700	99.96	99.97	99.95	99.93	99.93	99.86	99.91	99.92	99.88	99.88	99.87	99.82
0.750	99.97	99.97	99.96	99.94	99.94	99.89	99.93	99.94	99.91	99.91	99.91	99.87
0.800	99.98	99.98	99.98	99.95	99.95	99.92	99.95	99.96	99.95	99.93	99.95	99.92
0.850	99.98	99.99	99.98	99.97	99.97	99.94	99.96	99.97	99.97	99.94	99.96	99.95
0.900	99.99	99.99	99.99	99.98	99.97	99.97	99.96	99.98	99.98	99.97	99.97	99.97
0.950	100.00	100.00	100.00	99.98	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.99
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 60 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.43	0.28	0.19	0.25	0.12	0.20	0.14	0.15	0.09	0.06	0.13	0.07
0.010	1.30	1.04	0.90	0.82	0.67	0.56	0.50	0.45	0.26	0.34	0.30	0.44
0.015	2.97	2.20	2.11	1.77	1.47	1.26	0.98	0.86	0.65	0.65	0.63	0.96
0.020	5.62	4.04	3.63	3.10	2.41	2.21	1.64	1.50	1.13	1.20	1.14	1.46
0.025	8.72	6.42	5.58	4.69	3.68	3.10	2.52	2.16	1.76	1.79	1.66	2.13
0.030	12.52	9.38	7.81	6.48	5.13	4.13	3.41	2.91	2.45	2.41	2.55	3.14
0.035	16.66	12.53	10.34	8.67	6.91	5.51	4.48	3.83	3.33	3.04	3.37	4.26
0.040	20.73	16.25	13.01	10.93	8.77	7.09	5.79	4.80	4.36	3.96	4.10	4.96
0.045	25.18	19.92	16.11	13.39	10.83	8.74	7.19	5.98	5.38	5.05	5.00	6.06
0.050	29.73	23.82	19.45	15.99	12.80	10.33	8.62	7.42	6.61	5.98	6.22	7.19
0.060	39.18	31.52	26.46	21.72	17.59	14.14	11.71	10.51	9.13	7.97	8.76	9.95
0.070	48.47	39.74	33.47	28.01	23.08	18.34	15.79	13.96	12.19	10.66	11.58	12.50
0.080	56.37	47.56	40.35	34.34	28.93	23.32	19.92	17.69	15.41	13.30	14.34	15.04
0.090	63.95	54.85	46.91	40.35	34.52	28.48	24.24	21.44	18.75	16.35	17.10	18.29
0.100	70.04	61.77	53.03	46.40	40.04	33.74	28.94	25.72	22.78	19.47	20.11	21.14
0.110	75.06	67.53	58.99	52.04	45.63	38.47	33.48	29.88	26.59	23.40	23.42	24.40
0.120	79.47	72.52	64.46	57.40	50.71	43.43	38.13	34.03	30.55	27.18	26.55	27.51
0.130	83.04	76.72	69.28	62.37	55.32	48.19	42.69	38.18	34.30	31.06	30.32	30.55
0.140	85.93	80.24	73.52	66.71	59.71	53.05	47.03	42.60	37.93	34.91	34.38	34.12
0.150	88.05	83.35	77.31	70.56	63.60	56.89	51.01	46.68	41.93	38.56	37.84	37.78
0.160	89.84	86.08	80.54	74.09	67.41	60.86	55.10	50.58	46.15	42.11	41.62	41.31
0.170	91.54	88.12	83.61	77.28	71.18	64.52	58.64	54.40	49.56	45.85	44.60	44.81
0.180	92.81	89.76	86.01	80.07	74.40	67.89	62.13	57.74	53.13	49.17	47.60	47.71
0.190	93.87	91.28	87.93	82.82	77.65	71.24	65.22	60.76	56.59	52.45	51.12	51.32
0.200	94.67	92.48	89.60	84.86	80.43	74.04	68.46	63.75	59.78	56.04	54.13	54.65
0.220	95.81	94.33	92.33	88.64	84.82	79.55	74.41	69.77	65.67	62.20	60.88	60.76
0.240	96.68	95.69	94.10	91.40	88.23	83.66	79.45	75.12	71.23	67.70	66.61	65.93
0.260	97.32	96.58	95.41	93.41	91.01	87.29	83.36	79.52	76.26	72.76	71.61	70.71
0.280	97.79	97.21	96.48	94.82	93.10	89.53	86.76	83.12	80.47	77.23	76.12	74.98
0.300	98.12	97.72	97.28	95.97	94.60	91.73	89.41	86.44	83.92	81.01	80.12	79.19
0.320	98.42	98.09	97.84	96.76	95.88	93.40	91.61	89.35	86.85	84.16	83.18	83.35
0.340	98.64	98.38	98.17	97.49	96.73	94.67	93.51	91.46	89.54	87.18	86.01	85.86
0.360	98.78	98.65	98.46	97.93	97.40	95.72	94.87	93.22	91.70	90.05	88.51	88.06
0.380	98.94	98.85	98.67	98.26	97.85	96.55	95.80	94.55	93.42	91.89	90.54	90.28
0.400	99.10	98.99	98.84	98.56	98.18	97.26	96.66	95.62	94.59	93.70	92.54	91.93
0.420	99.22	99.15	98.97	98.74	98.49	97.72	97.27	96.43	95.66	94.83	93.97	93.39
0.440	99.35	99.30	99.07	98.89	98.79	98.07	97.76	97.07	96.30	95.80	95.04	94.95
0.460	99.43	99.40	99.23	99.03	98.96	98.39	98.08	97.57	96.89	96.58	96.02	95.69
0.480	99.50	99.52	99.30	99.20	99.14	98.64	98.42	97.96	97.37	97.10	96.74	96.35
0.500	99.57	99.56	99.37	99.32	99.26	98.85	98.68	98.33	97.81	97.61	97.35	96.76
0.550	99.67	99.68	99.53	99.56	99.47	99.27	99.15	98.89	98.55	98.27	98.03	97.91
0.600	99.77	99.73	99.68	99.70	99.61	99.51	99.45	99.24	98.97	98.95	98.61	98.41
0.650	99.80	99.80	99.75	99.78	99.74	99.62	99.65	99.48	99.32	99.26	99.07	98.80
0.700	99.84	99.85	99.81	99.83	99.80	99.70	99.73	99.63	99.54	99.45	99.28	99.00
0.750	99.87	99.89	99.86	99.87	99.86	99.80	99.80	99.71	99.64	99.61	99.47	99.24
0.800	99.91	99.91	99.90	99.90	99.90	99.86	99.87	99.80	99.78	99.71	99.60	99.37
0.850	99.94	99.94	99.94	99.93	99.93	99.91	99.92	99.86	99.86	99.78	99.71	99.47
0.900	99.97	99.96	99.97	99.96	99.97	99.95	99.94	99.91	99.92	99.85	99.84	99.65
0.950	99.99	99.99	99.99	99.98	99.98	99.98	99.97	99.95	99.96	99.92	99.94	99.80
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 50 MeV

Scaled radius	Scaled depth interval 0.0–0.05	0.05–0.10	0.10–0.15	0.15–0.20	0.20–0.25	0.25–0.30	0.30–0.35	0.35–0.40	0.40–0.45	0.45–0.50	0.50–0.55	0.55–0.60
0.005	94.79	88.29	55.04	22.93	10.51	5.44	3.15	2.14	0.98	0.75	0.54	0.34
0.010	97.23	93.84	86.43	60.80	34.66	19.75	11.49	7.35	4.26	3.28	2.26	1.41
0.015	98.28	95.85	92.83	82.32	59.13	37.63	23.73	15.63	9.86	7.04	4.86	3.13
0.020	98.79	96.96	94.95	90.17	75.28	55.52	36.95	25.54	17.19	12.06	8.56	6.00
0.025	99.17	97.69	96.07	93.25	84.63	68.93	50.34	35.87	25.16	18.21	12.88	9.51
0.030	99.39	98.21	96.97	94.79	89.75	78.61	61.92	46.56	33.93	24.92	17.81	13.28
0.035	99.50	98.57	97.54	95.77	92.05	85.47	70.91	56.44	42.41	32.60	23.47	17.57
0.040	99.57	98.83	98.08	96.49	93.59	89.25	78.08	64.62	50.74	39.53	29.57	21.82
0.045	99.62	99.03	98.40	97.09	94.74	91.76	83.59	71.16	58.27	46.45	35.41	26.92
0.050	99.66	99.22	98.66	97.44	95.58	93.37	87.16	77.20	64.39	52.99	41.34	31.96
0.060	99.71	99.44	98.98	98.00	96.77	95.26	91.93	85.04	74.79	63.38	52.56	41.98
0.070	99.72	99.57	99.21	98.44	97.51	96.32	94.29	89.66	82.13	72.26	62.11	51.29
0.080	99.74	99.66	99.37	98.74	97.91	97.19	95.72	92.53	87.25	79.48	70.09	59.58
0.090	99.74	99.71	99.50	98.96	98.22	97.69	96.74	94.18	90.72	84.64	76.26	66.64
0.100	99.75	99.75	99.57	99.09	98.54	98.05	97.37	95.40	92.85	88.43	81.39	72.76
0.110	99.77	99.78	99.62	99.17	98.82	98.36	97.75	96.32	94.23	91.11	85.45	77.56
0.120	99.77	99.79	99.64	99.21	98.96	98.61	98.14	96.96	95.14	93.01	88.51	81.41
0.130	99.77	99.81	99.66	99.32	99.13	98.80	98.39	97.43	96.00	94.32	90.85	84.94
0.140	99.78	99.81	99.67	99.34	99.22	98.97	98.61	97.88	96.63	95.22	92.55	87.42
0.150	99.78	99.83	99.70	99.38	99.31	99.08	98.78	98.14	97.14	95.97	93.79	89.61
0.160	99.79	99.83	99.70	99.41	99.37	99.16	98.95	98.33	97.49	96.47	94.83	91.26
0.170	99.79	99.83	99.71	99.42	99.40	99.27	99.08	98.53	97.84	96.89	95.47	92.61
0.180	99.79	99.84	99.74	99.44	99.45	99.35	99.17	98.70	98.07	97.24	96.04	93.52
0.190	99.80	99.84	99.75	99.45	99.46	99.39	99.26	98.87	98.32	97.60	96.60	94.27
0.200	99.80	99.84	99.75	99.46	99.47	99.43	99.33	99.01	98.47	97.82	96.95	95.11
0.220	99.82	99.85	99.77	99.47	99.49	99.54	99.43	99.19	98.69	98.21	97.57	96.22
0.240	99.83	99.86	99.79	99.50	99.50	99.65	99.50	99.30	98.91	98.42	98.02	96.91
0.260	99.83	99.86	99.80	99.53	99.51	99.67	99.55	99.38	99.12	98.60	98.33	97.46
0.280	99.84	99.87	99.81	99.55	99.53	99.67	99.61	99.46	99.27	98.81	98.62	97.84
0.300	99.85	99.87	99.82	99.57	99.56	99.69	99.66	99.55	99.38	98.98	98.77	98.16
0.320	99.86	99.87	99.83	99.60	99.57	99.71	99.69	99.59	99.46	99.15	98.90	98.43
0.340	99.86	99.88	99.84	99.62	99.58	99.73	99.73	99.62	99.50	99.28	99.08	98.65
0.360	99.86	99.89	99.85	99.64	99.58	99.74	99.75	99.67	99.57	99.36	99.20	98.87
0.380	99.87	99.89	99.86	99.65	99.59	99.76	99.77	99.70	99.61	99.45	99.28	99.02
0.400	99.87	99.89	99.87	99.67	99.60	99.77	99.78	99.72	99.65	99.53	99.36	99.17
0.420	99.88	99.90	99.87	99.68	99.61	99.79	99.79	99.75	99.67	99.58	99.44	99.25
0.440	99.88	99.90	99.88	99.69	99.62	99.81	99.81	99.76	99.70	99.62	99.50	99.36
0.460	99.88	99.91	99.88	99.74	99.64	99.83	99.82	99.78	99.73	99.66	99.58	99.41
0.480	99.89	99.91	99.89	99.77	99.66	99.84	99.85	99.79	99.78	99.70	99.62	99.49
0.500	99.89	99.92	99.89	99.81	99.68	99.86	99.86	99.81	99.79	99.72	99.66	99.54
0.550	99.91	99.93	99.91	99.86	99.74	99.87	99.89	99.85	99.83	99.79	99.73	99.66
0.600	99.93	99.95	99.93	99.89	99.77	99.88	99.91	99.87	99.86	99.83	99.80	99.76
0.650	99.97	99.96	99.94	99.91	99.81	99.90	99.93	99.90	99.89	99.86	99.85	99.80
0.700	99.97	99.96	99.95	99.93	99.85	99.92	99.94	99.92	99.91	99.89	99.88	99.84
0.750	99.98	99.97	99.96	99.94	99.87	99.94	99.96	99.94	99.94	99.91	99.91	99.88
0.800	99.98	99.98	99.96	99.95	99.90	99.95	99.97	99.96	99.95	99.93	99.94	99.91
0.850	99.99	99.99	99.97	99.96	99.93	99.97	99.98	99.97	99.97	99.96	99.96	99.95
0.900	99.99	99.99	99.98	99.96	99.96	99.99	99.99	99.98	99.98	99.98	99.97	99.98
0.950	100.00	100.00	99.99	99.98	99.98	100.00	99.99	99.99	99.99	99.99	99.99	99.99
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 50 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.36	0.35	0.15	0.21	0.13	0.07	0.09	0.09	0.07	0.11	0.14	0.02
0.010	1.11	1.15	0.62	0.62	0.49	0.34	0.27	0.28	0.24	0.28	0.45	0.31
0.015	2.48	2.22	1.59	1.16	0.87	0.67	0.65	0.64	0.62	0.53	0.86	0.79
0.020	4.57	3.80	2.80	2.11	1.63	1.34	1.24	1.07	1.13	1.01	1.36	1.26
0.025	7.26	5.57	4.31	3.31	2.63	2.17	1.94	1.56	1.66	1.68	1.83	2.00
0.030	10.32	7.73	6.01	4.67	3.70	3.06	2.73	2.24	2.16	2.29	2.57	2.73
0.035	13.60	10.46	8.03	6.33	5.00	4.12	3.61	3.04	2.79	2.90	3.25	3.58
0.040	17.60	13.26	10.35	8.13	6.42	5.16	4.56	3.92	3.70	3.68	4.05	4.29
0.045	21.06	16.52	12.75	9.99	8.05	6.37	5.55	4.83	4.46	4.43	4.80	5.59
0.050	25.07	19.83	15.51	11.99	9.84	7.74	6.56	5.83	5.29	5.40	5.71	6.33
0.060	33.63	26.51	21.31	16.76	13.71	10.79	9.29	7.99	7.64	7.71	7.63	8.74
0.070	42.46	33.97	27.76	21.71	17.97	14.48	12.00	10.63	10.14	10.04	9.98	11.51
0.080	50.58	41.38	34.11	26.97	22.45	18.23	15.39	13.85	12.99	12.50	12.38	14.45
0.090	57.52	48.41	40.40	32.86	27.14	22.25	19.01	17.29	15.98	15.41	15.04	17.05
0.100	64.13	54.92	46.42	38.75	32.33	26.56	22.99	20.68	19.08	18.03	17.78	19.72
0.110	69.88	61.13	52.31	44.21	37.77	31.08	26.89	24.49	22.49	21.05	21.19	22.57
0.120	74.59	66.48	58.01	49.68	42.95	35.78	30.77	27.92	25.79	23.80	24.73	25.89
0.130	78.78	70.91	63.12	54.98	47.68	40.54	35.17	31.83	28.98	27.11	28.27	29.43
0.140	82.32	74.70	67.54	59.77	52.30	45.00	39.14	35.80	32.60	30.55	31.74	32.98
0.150	85.02	78.16	71.18	64.04	56.37	49.41	43.34	39.84	36.66	33.99	34.88	36.05
0.160	87.33	81.33	74.78	67.77	60.73	53.46	47.51	43.76	40.70	38.04	38.20	40.35
0.170	89.23	83.94	77.93	71.06	64.57	57.51	51.39	47.79	44.19	42.18	41.94	43.90
0.180	90.75	86.20	80.83	74.26	67.98	61.58	55.47	51.63	47.95	46.16	45.08	46.93
0.190	91.94	88.09	83.38	77.13	71.13	65.07	59.22	55.20	51.29	49.66	48.19	49.83
0.200	92.87	89.60	85.49	79.81	73.78	68.33	62.65	58.64	54.64	52.90	51.83	53.32
0.220	94.36	91.94	89.04	84.59	78.98	73.69	68.74	64.82	60.98	59.24	58.33	58.93
0.240	95.67	93.55	91.38	88.11	83.41	78.47	74.19	70.75	67.10	65.01	64.24	64.97
0.260	96.63	94.86	93.03	90.75	86.95	82.69	78.73	75.44	72.34	70.68	70.35	70.34
0.280	97.30	95.86	94.33	92.66	89.64	86.06	82.54	79.71	76.91	75.30	75.85	75.30
0.300	97.75	96.67	95.33	94.06	91.67	88.80	85.53	83.30	80.88	79.45	79.81	79.32
0.320	98.16	97.24	96.27	95.10	93.26	90.92	88.38	86.38	84.38	83.06	82.92	83.11
0.340	98.47	97.73	96.96	96.01	94.58	92.53	90.69	89.04	87.30	85.74	86.61	85.70
0.360	98.69	98.09	97.48	96.72	95.58	93.84	92.56	91.13	89.87	88.69	89.41	88.22
0.380	98.86	98.36	97.87	97.39	96.32	95.06	93.86	92.79	91.85	91.07	91.50	90.66
0.400	99.03	98.63	98.20	97.78	96.91	96.01	94.96	94.12	93.58	92.66	93.11	92.37
0.420	99.17	98.83	98.45	98.13	97.42	96.84	95.96	95.30	94.84	94.38	94.61	93.77
0.440	99.27	98.99	98.68	98.45	97.89	97.50	96.77	96.18	95.85	95.64	95.61	94.92
0.460	99.40	99.13	98.85	98.66	98.24	97.99	97.33	97.03	96.66	96.37	96.41	95.77
0.480	99.48	99.22	99.06	98.83	98.61	98.41	97.78	97.57	97.39	97.05	97.11	96.21
0.500	99.54	99.30	99.15	98.98	98.80	98.69	98.15	98.04	97.98	97.53	97.63	96.75
0.550	99.63	99.44	99.45	99.34	99.31	99.21	98.89	98.83	98.74	98.53	98.08	97.52
0.600	99.74	99.55	99.63	99.60	99.58	99.48	99.26	99.26	99.16	99.10	98.53	97.89
0.650	99.81	99.69	99.77	99.69	99.76	99.66	99.52	99.49	99.45	99.44	98.90	98.26
0.700	99.86	99.76	99.84	99.76	99.85	99.77	99.72	99.69	99.66	99.59	99.26	98.70
0.750	99.89	99.85	99.87	99.82	99.89	99.85	99.81	99.78	99.72	99.69	99.49	99.06
0.800	99.93	99.93	99.91	99.86	99.91	99.89	99.86	99.83	99.81	99.79	99.64	99.26
0.850	99.94	99.96	99.94	99.94	99.94	99.94	99.89	99.87	99.86	99.84	99.78	99.56
0.900	99.97	99.97	99.96	99.96	99.95	99.95	99.94	99.90	99.91	99.89	99.89	99.75
0.950	99.98	99.98	99.98	99.98	99.98	99.98	99.97	99.96	99.95	99.95	99.93	99.88
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 40 MeV

Scaled radius	Scaled depth interval 0.0 – 0.05	0.05 – 0.10	0.10 – 0.15	0.15 – 0.20	0.20 – 0.25	0.25 – 0.30	0.30 – 0.35	0.35 – 0.40	0.40 – 0.45	0.45 – 0.50	0.50 – 0.55	0.55 – 0.60
0.005	94.67	86.10	46.76	17.84	8.28	4.23	2.43	1.77	0.89	0.48	0.36	0.28
0.010	97.20	93.45	82.07	52.86	28.63	15.42	9.27	5.90	3.42	2.40	1.59	1.20
0.015	98.32	95.56	91.36	76.42	50.82	30.43	18.63	12.03	7.57	5.32	3.63	2.49
0.020	98.90	96.71	94.24	87.04	68.18	47.20	30.43	20.27	13.08	9.03	6.61	4.63
0.025	99.22	97.57	95.57	91.88	79.67	61.43	42.62	29.17	20.00	13.75	9.69	7.15
0.030	99.42	98.16	96.44	94.06	86.55	71.98	53.08	38.82	27.43	19.33	13.61	10.02
0.035	99.54	98.60	97.17	95.32	90.54	79.70	62.51	47.86	35.12	25.51	18.08	12.91
0.040	99.63	98.85	97.69	96.20	92.79	85.17	70.56	55.95	42.60	31.74	22.91	16.80
0.045	99.69	99.07	98.07	96.82	94.12	88.61	76.84	63.13	49.81	37.78	28.40	20.79
0.050	99.72	99.22	98.37	97.16	95.22	91.20	82.20	69.21	56.16	43.58	33.55	24.86
0.060	99.76	99.42	98.80	98.00	96.47	94.14	88.29	79.14	67.39	55.21	43.33	33.82
0.070	99.78	99.60	99.10	98.44	97.36	95.78	91.83	85.74	75.83	65.01	52.25	42.66
0.080	99.81	99.69	99.25	98.78	97.90	96.67	93.99	89.73	82.13	72.69	61.11	50.84
0.090	99.83	99.73	99.35	99.04	98.31	97.34	95.47	92.29	86.43	78.83	68.39	58.28
0.100	99.84	99.75	99.39	99.22	98.57	97.78	96.38	93.85	89.54	83.20	74.09	64.76
0.110	99.85	99.75	99.44	99.35	98.76	98.21	97.05	95.05	91.98	86.87	78.72	70.51
0.120	99.86	99.77	99.51	99.44	98.95	98.43	97.42	95.94	93.51	89.34	82.69	74.80
0.130	99.86	99.80	99.52	99.51	99.09	98.67	97.78	96.51	94.52	91.47	85.80	78.76
0.140	99.87	99.82	99.54	99.57	99.21	98.80	98.06	96.93	95.41	92.81	88.18	81.96
0.150	99.87	99.82	99.57	99.61	99.29	98.94	98.27	97.34	96.11	94.06	90.06	84.80
0.160	99.87	99.82	99.58	99.66	99.41	99.05	98.47	97.68	96.53	94.86	91.66	87.07
0.170	99.87	99.83	99.60	99.68	99.48	99.13	98.66	98.00	96.92	95.49	92.85	88.94
0.180	99.88	99.84	99.61	99.70	99.51	99.19	98.74	98.21	97.21	96.00	93.69	90.39
0.190	99.88	99.86	99.61	99.72	99.53	99.23	98.83	98.45	97.52	96.43	94.44	91.66
0.200	99.88	99.86	99.62	99.74	99.54	99.28	98.89	98.59	97.88	96.73	95.17	92.67
0.220	99.89	99.87	99.65	99.76	99.59	99.40	99.04	98.83	98.29	97.31	96.12	94.30
0.240	99.90	99.87	99.66	99.79	99.63	99.45	99.16	99.00	98.52	97.78	96.76	95.39
0.260	99.90	99.88	99.67	99.80	99.65	99.48	99.31	99.15	98.70	98.10	97.29	96.11
0.280	99.90	99.88	99.69	99.81	99.67	99.51	99.38	99.25	98.86	98.36	97.66	96.83
0.300	99.90	99.88	99.70	99.82	99.70	99.56	99.40	99.36	99.00	98.59	97.95	97.32
0.320	99.90	99.89	99.71	99.82	99.72	99.58	99.46	99.45	99.08	98.75	98.20	97.69
0.340	99.91	99.89	99.72	99.82	99.72	99.59	99.51	99.51	99.18	98.89	98.47	97.99
0.360	99.91	99.89	99.74	99.83	99.73	99.62	99.56	99.55	99.30	98.99	98.73	98.16
0.380	99.91	99.89	99.74	99.83	99.74	99.64	99.59	99.62	99.42	99.14	98.95	98.40
0.400	99.92	99.90	99.76	99.84	99.74	99.66	99.62	99.63	99.49	99.24	99.11	98.52
0.420	99.92	99.90	99.77	99.84	99.75	99.68	99.64	99.67	99.52	99.34	99.22	98.72
0.440	99.92	99.90	99.78	99.85	99.75	99.70	99.66	99.71	99.56	99.43	99.28	98.94
0.460	99.92	99.91	99.79	99.85	99.76	99.73	99.68	99.74	99.60	99.49	99.33	99.09
0.480	99.93	99.91	99.82	99.85	99.76	99.75	99.71	99.77	99.67	99.54	99.41	99.22
0.500	99.93	99.91	99.85	99.86	99.78	99.75	99.74	99.80	99.70	99.59	99.49	99.31
0.550	99.94	99.92	99.87	99.87	99.81	99.79	99.85	99.84	99.76	99.69	99.61	99.49
0.600	99.95	99.93	99.89	99.88	99.83	99.84	99.89	99.89	99.80	99.76	99.73	99.66
0.650	99.95	99.94	99.91	99.91	99.86	99.87	99.91	99.91	99.84	99.81	99.80	99.77
0.700	99.96	99.95	99.94	99.93	99.90	99.90	99.92	99.94	99.87	99.89	99.90	99.89
0.750	99.96	99.95	99.97	99.95	99.91	99.95	99.93	99.95	99.92	99.93	99.93	99.92
0.800	99.97	99.97	99.98	99.96	99.93	99.96	99.94	99.96	99.96	99.95	99.95	99.94
0.850	99.98	99.98	99.99	99.97	99.95	99.98	99.95	99.97	99.97	99.97	99.97	99.97
0.900	99.99	99.99	99.99	99.99	99.96	99.99	99.97	99.98	99.98	99.98	99.98	99.98
0.950	99.99	100.00	100.00	100.00	99.98	100.00	99.98	99.99	99.99	99.99	99.99	99.99
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 40 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.27	0.14	0.13	0.12	0.09	0.07	0.03	0.09	0.05	0.05	0.06	0.04
0.010	0.93	0.72	0.49	0.41	0.32	0.27	0.19	0.21	0.18	0.18	0.28	0.36
0.015	1.82	1.56	1.11	0.96	0.75	0.67	0.44	0.38	0.49	0.42	0.55	0.72
0.020	3.22	2.59	2.09	1.66	1.28	1.11	0.77	0.72	0.80	0.73	0.95	1.10
0.025	4.95	3.98	3.12	2.45	1.91	1.66	1.29	1.18	1.15	1.11	1.51	1.59
0.030	7.37	5.66	4.25	3.47	2.84	2.44	1.95	1.68	1.80	1.68	2.15	1.85
0.035	9.96	7.77	5.74	4.66	3.71	3.18	2.63	2.31	2.45	2.27	2.75	2.25
0.040	12.70	10.09	7.49	6.00	5.00	4.16	3.55	3.01	3.23	2.89	3.34	2.95
0.045	15.63	12.56	9.38	7.45	6.28	5.08	4.43	3.90	4.05	3.76	4.23	3.76
0.050	18.92	15.47	11.62	9.02	7.70	6.35	5.32	4.72	4.79	4.83	5.48	4.56
0.060	25.75	21.14	16.32	12.73	10.63	8.74	7.36	6.56	6.71	6.88	7.93	7.14
0.070	33.36	27.16	21.74	17.43	14.09	11.63	9.95	8.80	8.82	8.98	10.50	9.52
0.080	41.65	33.67	27.02	21.92	18.17	14.98	12.88	11.60	11.43	11.46	13.67	13.18
0.090	48.95	40.61	32.79	27.02	22.35	18.34	16.05	14.35	14.26	14.65	16.48	16.71
0.100	55.23	46.95	38.59	32.07	26.41	22.12	19.46	17.11	16.83	17.57	19.52	20.50
0.110	61.10	52.68	44.07	36.81	31.09	26.17	22.80	20.35	19.74	20.58	22.96	23.41
0.120	66.56	57.71	49.17	41.95	35.70	30.35	26.42	23.85	23.23	23.42	26.27	27.05
0.130	71.06	63.00	54.22	46.79	39.99	34.49	30.25	27.07	26.49	26.41	29.64	29.63
0.140	74.95	67.35	58.71	51.58	44.53	38.55	34.25	30.73	29.97	29.52	32.54	33.52
0.150	78.25	71.14	62.94	55.96	48.94	42.52	38.14	34.27	33.42	33.24	35.50	36.83
0.160	81.25	74.54	66.88	59.86	53.29	46.63	42.20	37.95	36.79	36.78	38.97	40.32
0.170	83.79	77.59	70.44	63.42	57.07	50.60	46.15	41.73	40.30	40.25	42.20	43.73
0.180	85.87	80.24	73.46	66.79	60.63	54.28	49.86	45.51	44.44	43.37	45.49	46.34
0.190	87.53	82.73	76.35	69.93	63.93	57.69	53.37	49.24	47.92	46.71	48.89	49.00
0.200	88.93	84.70	78.89	72.75	67.02	60.92	56.76	52.69	51.18	50.26	52.18	52.16
0.220	91.40	87.87	83.32	77.89	72.68	66.60	62.51	59.28	58.04	57.28	57.57	57.96
0.240	93.30	90.32	86.35	82.04	77.83	71.79	68.10	64.99	64.41	63.44	63.55	63.08
0.260	94.50	92.25	89.00	85.28	82.16	76.36	73.12	70.17	69.86	69.27	69.37	68.53
0.280	95.58	93.76	91.02	87.94	85.16	80.51	77.64	74.88	75.11	74.50	74.90	73.02
0.300	96.34	94.85	92.57	90.19	87.91	83.85	81.95	79.34	79.32	79.51	79.74	77.50
0.320	96.93	95.69	93.84	92.08	89.96	86.61	85.39	83.41	83.10	83.12	83.31	80.51
0.340	97.40	96.32	94.92	93.53	91.64	88.73	87.98	86.54	86.33	86.09	86.86	82.98
0.360	97.74	96.96	95.71	94.74	93.25	90.74	90.16	89.07	88.82	88.52	89.91	85.84
0.380	98.10	97.38	96.40	95.57	94.41	92.42	91.97	91.07	90.85	90.77	92.18	88.23
0.400	98.35	97.78	97.04	96.31	95.32	93.74	93.65	93.01	92.82	92.61	93.57	89.97
0.420	98.52	98.11	97.44	96.91	96.20	94.88	94.93	94.70	94.45	93.96	94.40	91.63
0.440	98.70	98.37	97.83	97.43	96.96	95.87	95.86	95.97	95.61	95.09	95.35	92.57
0.460	98.85	98.62	98.14	97.85	97.57	96.72	96.64	96.85	96.58	96.13	96.19	93.35
0.480	99.00	98.85	98.41	98.21	98.04	97.46	97.25	97.51	97.58	97.24	96.68	94.19
0.500	99.11	99.00	98.64	98.55	98.45	98.10	97.84	98.00	98.27	97.75	97.07	94.68
0.550	99.39	99.35	99.14	99.04	99.12	98.86	98.83	98.96	99.07	98.51	97.96	95.82
0.600	99.57	99.57	99.42	99.39	99.55	99.37	99.38	99.37	99.32	98.87	98.46	96.82
0.650	99.67	99.74	99.67	99.56	99.72	99.65	99.66	99.62	99.44	99.12	98.70	97.45
0.700	99.76	99.86	99.82	99.79	99.83	99.80	99.79	99.74	99.64	99.30	98.93	97.96
0.750	99.84	99.91	99.90	99.88	99.87	99.87	99.84	99.82	99.76	99.54	99.12	98.46
0.800	99.92	99.94	99.93	99.93	99.91	99.91	99.89	99.89	99.80	99.68	99.32	98.76
0.850	99.95	99.96	99.97	99.95	99.94	99.94	99.93	99.93	99.84	99.79	99.55	99.12
0.900	99.96	99.98	99.98	99.97	99.96	99.96	99.96	99.96	99.91	99.86	99.71	99.62
0.950	99.98	99.99	99.99	99.99	99.98	99.98	99.99	99.98	99.95	99.95	99.84	99.78
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 30 MeV

Scaled radius	Scaled depth interval 0.0–0.05	0.05–0.10	0.10–0.15	0.15–0.20	0.20–0.25	0.25–0.30	0.30–0.35	0.35–0.40	0.40–0.45	0.45–0.50	0.50–0.55	0.55–0.60
0.005	94.47	84.29	41.24	15.08	6.64	3.11	1.94	1.14	0.73	0.39	0.32	0.19
0.010	96.85	93.15	78.69	46.21	23.47	12.15	7.23	4.29	2.88	1.82	1.35	0.95
0.015	97.91	95.18	90.41	70.73	43.95	25.70	15.41	9.25	6.44	4.15	2.89	2.03
0.020	98.59	96.48	93.53	83.90	61.23	39.64	24.91	16.31	10.38	7.11	5.12	3.40
0.025	98.99	97.30	95.03	90.22	74.34	53.26	35.50	23.49	15.54	10.66	7.34	5.18
0.030	99.26	97.82	95.96	93.02	82.64	64.85	45.68	31.17	21.41	15.04	10.26	7.22
0.035	99.45	98.31	96.69	94.59	88.12	73.52	55.39	39.14	28.21	19.86	13.80	9.97
0.040	99.57	98.64	97.33	95.50	91.19	80.42	64.05	47.06	34.81	24.98	17.77	12.97
0.045	99.65	98.85	97.74	96.25	93.09	85.21	71.03	54.76	40.96	30.08	21.86	16.20
0.050	99.70	99.02	98.06	96.95	94.27	88.61	76.93	61.17	47.22	35.66	26.23	19.79
0.060	99.79	99.26	98.63	97.57	95.84	92.70	84.97	72.06	58.78	45.88	35.11	26.98
0.070	99.83	99.43	98.85	98.13	96.86	94.91	89.77	79.98	68.11	55.21	43.88	34.85
0.080	99.85	99.54	99.05	98.48	97.44	96.25	92.57	85.36	75.16	63.65	52.28	42.83
0.090	99.87	99.59	99.19	98.82	97.78	96.93	94.53	88.97	81.04	70.73	59.98	50.16
0.100	99.88	99.64	99.32	98.95	98.17	97.46	95.67	91.40	85.18	76.35	66.55	56.50
0.110	99.88	99.66	99.39	99.13	98.45	97.79	96.54	93.03	88.19	80.78	71.53	62.12
0.120	99.88	99.70	99.46	99.24	98.65	98.06	97.17	94.26	90.40	84.17	76.14	67.05
0.130	99.88	99.73	99.52	99.35	98.84	98.37	97.61	95.22	92.13	86.81	79.88	71.73
0.140	99.89	99.73	99.56	99.44	98.94	98.54	97.88	95.88	93.49	89.07	83.15	75.44
0.150	99.89	99.74	99.58	99.51	99.08	98.72	98.15	96.39	94.32	90.77	85.81	78.94
0.160	99.89	99.76	99.61	99.54	99.18	98.91	98.34	96.91	95.08	92.03	87.95	81.84
0.170	99.89	99.77	99.62	99.57	99.29	99.04	98.47	97.19	95.72	93.19	89.47	84.38
0.180	99.89	99.77	99.65	99.61	99.36	99.11	98.61	97.52	96.16	94.13	90.83	86.30
0.190	99.89	99.78	99.66	99.62	99.44	99.17	98.68	97.74	96.46	94.93	91.86	87.84
0.200	99.89	99.79	99.68	99.63	99.50	99.24	98.82	97.97	96.79	95.59	92.79	89.16
0.220	99.89	99.80	99.70	99.67	99.56	99.32	98.96	98.26	97.27	96.36	94.21	91.38
0.240	99.89	99.80	99.72	99.70	99.64	99.39	99.08	98.49	97.61	96.97	95.15	93.07
0.260	99.89	99.80	99.74	99.73	99.69	99.49	99.18	98.68	97.94	97.33	95.95	94.30
0.280	99.90	99.81	99.75	99.74	99.73	99.52	99.29	98.79	98.27	97.81	96.49	95.18
0.300	99.90	99.81	99.76	99.74	99.75	99.56	99.40	98.90	98.44	98.10	96.95	95.89
0.320	99.90	99.81	99.77	99.77	99.78	99.60	99.45	99.01	98.60	98.30	97.39	96.50
0.340	99.90	99.82	99.78	99.79	99.79	99.63	99.51	99.10	98.75	98.56	97.65	97.04
0.360	99.90	99.82	99.80	99.81	99.80	99.65	99.56	99.20	98.85	98.70	97.94	97.44
0.380	99.91	99.82	99.81	99.84	99.80	99.68	99.58	99.30	98.93	98.79	98.10	97.76
0.400	99.91	99.82	99.82	99.85	99.82	99.71	99.60	99.37	99.03	98.92	98.26	97.98
0.420	99.91	99.83	99.83	99.87	99.83	99.72	99.63	99.44	99.11	99.01	98.44	98.22
0.440	99.91	99.84	99.83	99.89	99.84	99.73	99.66	99.48	99.19	99.14	98.58	98.44
0.460	99.91	99.85	99.83	99.89	99.86	99.74	99.67	99.53	99.25	99.28	98.75	98.58
0.480	99.91	99.86	99.84	99.90	99.87	99.76	99.69	99.56	99.31	99.38	98.89	98.70
0.500	99.92	99.87	99.84	99.91	99.88	99.78	99.70	99.59	99.34	99.49	99.01	98.83
0.550	99.93	99.89	99.86	99.92	99.90	99.83	99.72	99.69	99.46	99.64	99.26	99.12
0.600	99.95	99.90	99.87	99.93	99.91	99.86	99.77	99.74	99.63	99.77	99.47	99.39
0.650	99.95	99.92	99.90	99.94	99.94	99.90	99.86	99.79	99.77	99.83	99.64	99.63
0.700	99.97	99.92	99.92	99.95	99.97	99.96	99.90	99.83	99.83	99.92	99.78	99.76
0.750	99.99	99.93	99.95	99.95	99.98	99.97	99.93	99.86	99.86	99.94	99.89	99.87
0.800	99.99	99.94	99.97	99.97	99.99	99.98	99.96	99.91	99.88	99.96	99.93	99.93
0.850	99.99	99.95	99.98	99.98	99.99	99.99	99.97	99.96	99.90	99.97	99.96	99.96
0.900	99.99	99.99	99.99	99.99	99.99	99.99	99.99	99.97	99.95	99.98	99.98	99.98
0.950	100.00	100.00	100.00	100.00	100.00	100.00	99.99	99.98	99.99	99.99	99.99	99.99
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 30 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.16	0.12	0.12	0.10	0.07	0.04	0.04	0.04	0.02	0.02	0.0	0.07
0.010	0.61	0.44	0.46	0.31	0.18	0.16	0.20	0.15	0.14	0.23	0.14	0.42
0.015	1.43	1.09	0.90	0.60	0.45	0.44	0.42	0.38	0.31	0.30	0.37	0.74
0.020	2.56	1.93	1.57	1.14	0.90	0.84	0.78	0.65	0.62	0.72	0.83	1.04
0.025	3.76	2.82	2.35	1.68	1.39	1.30	1.17	0.91	1.03	1.40	1.34	1.62
0.030	5.51	4.14	3.25	2.49	1.96	1.81	1.61	1.25	1.35	1.82	1.99	2.10
0.035	7.34	5.41	4.38	3.26	2.73	2.46	2.28	1.78	1.79	2.31	2.78	3.16
0.040	9.46	7.09	5.62	4.25	3.55	3.23	2.99	2.47	2.29	3.05	3.75	4.46
0.045	11.79	8.98	7.05	5.40	4.40	3.88	3.67	3.12	2.80	3.89	4.55	5.74
0.050	14.50	11.08	8.73	6.79	5.49	4.59	4.36	3.77	3.53	4.73	5.81	6.35
0.060	20.02	15.83	12.64	9.63	7.73	6.37	5.83	5.55	5.14	6.52	8.58	8.26
0.070	26.18	21.12	16.73	12.97	10.58	8.55	7.88	7.33	6.87	8.53	10.40	11.37
0.080	32.38	26.66	20.98	16.43	13.75	11.19	10.16	9.56	8.94	10.86	12.95	13.51
0.090	38.84	31.92	25.47	20.23	17.08	13.98	12.76	11.72	11.10	13.56	15.60	16.35
0.100	45.32	37.13	30.13	24.11	20.28	17.00	15.26	14.43	13.81	15.98	19.14	18.59
0.110	51.67	42.74	34.98	28.49	23.66	20.33	18.42	17.39	16.31	18.27	21.80	21.20
0.120	56.85	47.95	39.58	32.60	27.61	23.92	21.48	20.66	19.25	21.12	24.81	25.06
0.130	61.81	52.59	44.06	36.69	31.58	27.30	24.42	23.80	22.44	24.93	28.65	27.85
0.140	66.27	57.17	48.70	40.82	35.47	30.74	27.69	27.17	25.86	28.25	32.51	31.97
0.150	70.32	61.57	53.08	44.76	39.00	34.21	31.16	30.56	29.39	31.90	35.47	35.29
0.160	73.69	65.54	57.23	48.93	42.51	37.77	34.56	33.98	33.07	35.18	39.04	38.18
0.170	76.76	69.19	60.96	52.80	46.06	41.11	37.73	37.02	36.56	38.98	42.91	41.94
0.180	79.62	72.40	64.54	56.37	49.76	44.42	41.12	40.32	39.84	42.89	46.95	45.43
0.190	81.75	75.47	67.60	59.92	53.33	47.84	44.51	43.72	43.33	46.36	51.18	47.92
0.200	83.70	78.08	70.71	63.04	56.67	51.11	47.90	47.43	46.60	49.97	54.51	50.72
0.220	86.93	82.30	75.85	68.99	62.59	57.49	54.24	54.39	53.29	57.39	59.78	56.55
0.240	89.39	85.60	80.24	74.12	68.28	63.27	60.64	60.79	59.89	63.64	64.94	59.88
0.260	91.28	88.22	83.81	78.47	73.45	68.76	66.43	66.59	66.06	69.69	71.17	64.51
0.280	92.77	90.17	86.72	82.06	78.00	73.62	71.52	71.83	71.92	74.61	76.90	69.17
0.300	93.89	91.82	88.92	85.11	81.60	78.07	75.97	76.43	76.78	79.07	80.86	73.79
0.320	94.82	93.16	90.73	87.69	84.79	82.02	80.40	80.48	81.62	83.48	83.18	77.80
0.340	95.73	94.26	92.28	89.79	87.53	85.43	84.07	84.18	85.22	86.66	85.70	79.51
0.360	96.43	95.26	93.50	91.64	89.72	88.19	87.44	87.65	88.49	89.32	87.89	80.73
0.380	96.98	96.07	94.50	93.18	91.66	90.42	90.30	90.46	90.72	91.05	90.28	83.20
0.400	97.52	96.74	95.55	94.27	93.19	92.18	92.27	92.92	93.03	92.50	91.85	85.12
0.420	97.90	97.17	96.32	95.38	94.39	93.79	93.79	94.50	94.53	94.18	92.89	86.37
0.440	98.24	97.60	96.92	96.26	95.53	95.22	95.31	95.82	96.01	95.38	93.88	87.81
0.460	98.50	98.03	97.50	97.00	96.37	96.29	96.44	96.86	97.00	96.25	94.59	89.11
0.480	98.73	98.40	98.00	97.50	97.14	97.11	97.27	97.66	97.55	97.12	95.16	90.07
0.500	98.90	98.66	98.37	97.92	97.74	97.67	97.92	98.21	98.00	97.67	95.63	90.31
0.550	99.30	99.14	99.10	98.73	98.77	98.71	98.93	99.22	98.80	98.45	96.62	91.96
0.600	99.58	99.45	99.49	99.32	99.41	99.48	99.41	99.63	99.24	98.93	97.39	94.02
0.650	99.74	99.70	99.68	99.67	99.61	99.72	99.67	99.72	99.43	99.14	98.16	95.52
0.700	99.84	99.83	99.81	99.84	99.78	99.81	99.77	99.79	99.61	99.34	98.58	96.23
0.750	99.90	99.93	99.89	99.89	99.88	99.90	99.86	99.86	99.72	99.49	98.99	97.48
0.800	99.95	99.96	99.93	99.91	99.91	99.93	99.91	99.90	99.81	99.68	99.25	98.58
0.850	99.96	99.97	99.95	99.95	99.93	99.95	99.95	99.92	99.86	99.75	99.52	99.00
0.900	99.98	99.98	99.97	99.98	99.96	99.98	99.96	99.95	99.93	99.83	99.67	99.56
0.950	99.99	99.99	99.99	99.99	99.99	99.99	99.98	99.97	99.96	99.89	99.79	99.86
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 20 MeV

Scaled radius	Scaled depth interval 0.0–0.05	0.05–0.10	0.10–0.15	0.15–0.20	0.20–0.25	0.25–0.30	0.30–0.35	0.35–0.40	0.40–0.45	0.45–0.50	0.50–0.55	0.55–0.60
0.005	94.13	78.51	30.14	10.69	4.24	2.11	1.21	0.76	0.46	0.24	0.23	0.11
0.010	96.52	91.75	68.53	33.99	15.93	8.61	4.84	2.87	1.77	1.10	0.74	0.43
0.015	97.67	94.60	85.11	57.59	31.91	17.52	10.10	6.42	3.85	2.46	1.71	1.21
0.020	98.30	95.86	91.83	73.78	48.09	28.63	16.83	11.05	6.98	4.49	3.09	2.14
0.025	98.70	96.69	94.18	83.01	62.23	39.51	24.35	16.30	10.73	7.07	4.92	3.30
0.030	98.98	97.33	95.36	88.71	72.66	50.34	32.81	21.63	14.83	9.98	6.92	4.87
0.035	99.15	97.83	96.25	91.83	80.24	59.97	41.66	27.96	19.56	13.50	9.20	6.59
0.040	99.32	98.20	96.80	93.64	85.52	68.24	49.82	34.27	24.43	17.13	11.63	8.29
0.045	99.41	98.52	97.25	94.74	88.97	74.84	56.91	40.74	29.64	21.10	14.66	10.49
0.050	99.48	98.69	97.70	95.48	91.16	79.92	63.66	47.04	34.91	25.01	17.92	12.60
0.060	99.58	98.95	98.18	96.57	93.98	86.86	73.91	58.11	45.51	33.72	24.62	17.94
0.070	99.66	99.18	98.56	97.36	95.47	90.45	81.36	67.79	54.96	42.11	31.56	23.94
0.080	99.71	99.33	98.80	97.80	96.55	93.04	86.22	74.75	63.23	49.81	38.31	30.21
0.090	99.74	99.43	98.96	98.12	97.11	94.51	89.53	80.49	69.94	56.91	44.89	36.26
0.100	99.75	99.50	99.09	98.39	97.56	95.41	91.85	84.45	75.40	63.68	51.04	42.17
0.110	99.77	99.55	99.21	98.50	97.84	96.01	93.49	87.51	79.58	69.24	57.19	47.55
0.120	99.78	99.60	99.29	98.66	98.10	96.54	94.51	89.76	83.03	73.70	62.59	52.73
0.130	99.79	99.66	99.36	98.87	98.25	97.05	95.29	91.47	85.64	77.36	66.81	57.62
0.140	99.79	99.67	99.42	98.94	98.46	97.31	95.89	92.83	87.79	80.55	70.59	62.04
0.150	99.80	99.68	99.45	99.11	98.56	97.58	96.39	93.83	89.47	83.07	73.93	65.91
0.160	99.80	99.72	99.47	99.17	98.67	97.83	96.80	94.64	90.79	85.24	77.09	69.28
0.170	99.80	99.73	99.49	99.22	98.75	97.98	97.05	95.21	91.97	87.09	79.58	72.29
0.180	99.81	99.74	99.54	99.28	98.81	98.14	97.26	95.68	92.91	88.64	81.82	74.89
0.190	99.82	99.74	99.54	99.32	98.88	98.29	97.48	96.17	93.71	89.84	83.89	77.25
0.200	99.82	99.75	99.56	99.36	98.90	98.42	97.65	96.51	94.41	90.76	85.54	79.56
0.220	99.83	99.76	99.60	99.43	98.99	98.63	97.96	96.93	95.28	92.43	88.00	83.45
0.240	99.84	99.77	99.62	99.50	99.10	98.78	98.20	97.31	95.89	93.69	89.89	86.14
0.260	99.85	99.78	99.62	99.54	99.19	98.85	98.36	97.60	96.34	94.59	91.47	88.28
0.280	99.85	99.78	99.64	99.58	99.24	98.96	98.49	97.94	96.69	95.26	92.77	90.01
0.300	99.86	99.79	99.64	99.60	99.31	99.05	98.64	98.15	96.96	95.82	93.75	91.43
0.320	99.86	99.79	99.65	99.63	99.38	99.15	98.73	98.35	97.22	96.29	94.65	92.68
0.340	99.87	99.80	99.66	99.69	99.45	99.20	98.80	98.46	97.51	96.66	95.18	93.71
0.360	99.89	99.81	99.67	99.71	99.52	99.26	98.89	98.64	97.76	97.00	95.76	94.59
0.380	99.90	99.82	99.68	99.74	99.56	99.29	98.98	98.71	97.98	97.29	96.25	95.39
0.400	99.90	99.83	99.69	99.79	99.65	99.33	99.07	98.79	98.16	97.60	96.65	95.98
0.420	99.91	99.84	99.70	99.80	99.70	99.35	99.15	98.86	98.35	97.86	97.02	96.60
0.440	99.92	99.84	99.73	99.82	99.74	99.40	99.22	98.94	98.53	98.05	97.35	97.06
0.460	99.92	99.85	99.75	99.82	99.74	99.45	99.28	99.02	98.65	98.30	97.61	97.40
0.480	99.94	99.86	99.77	99.82	99.77	99.48	99.35	99.11	98.87	98.49	97.90	97.74
0.500	99.94	99.87	99.78	99.83	99.80	99.52	99.42	99.21	99.03	98.65	98.11	97.99
0.550	99.96	99.89	99.83	99.84	99.86	99.61	99.57	99.41	99.32	99.01	98.63	98.68
0.600	99.97	99.92	99.88	99.89	99.90	99.71	99.67	99.57	99.55	99.31	99.12	99.12
0.650	99.99	99.96	99.90	99.91	99.92	99.77	99.72	99.75	99.78	99.60	99.53	99.50
0.700	99.99	99.97	99.93	99.91	99.93	99.87	99.78	99.83	99.88	99.77	99.73	99.77
0.750	99.99	99.97	99.97	99.92	99.93	99.90	99.85	99.89	99.92	99.90	99.89	99.92
0.800	99.99	99.98	99.99	99.93	99.96	99.93	99.92	99.96	99.94	99.96	99.95	99.97
0.850	99.99	99.98	100.00	99.95	99.97	99.94	99.97	99.98	99.97	99.98	99.96	99.98
0.900	100.00	100.00	100.00	99.99	99.99	99.99	100.00	99.99	99.99	99.99	99.98	99.99
0.950	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.99	100.00	100.00
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 20 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.10	0.11	0.04	0.04	0.06	0.06	0.06	0.03	0.05	0.09	0.0	0.0
0.010	0.32	0.33	0.20	0.18	0.19	0.18	0.18	0.14	0.12	0.22	0.63	0.0
0.015	0.83	0.75	0.55	0.46	0.38	0.39	0.28	0.29	0.43	0.44	1.19	0.01
0.020	1.60	1.29	1.01	0.84	0.69	0.64	0.56	0.54	0.70	0.93	1.34	0.03
0.025	2.60	1.89	1.57	1.27	1.05	1.00	0.85	0.89	1.12	1.57	1.90	0.03
0.030	3.71	2.74	2.25	1.79	1.44	1.30	1.22	1.37	1.71	2.18	2.53	1.18
0.035	5.04	3.60	3.03	2.42	1.97	1.78	1.71	1.88	2.39	3.50	3.92	1.52
0.040	6.34	4.75	3.90	3.09	2.53	2.30	2.34	2.36	2.89	4.60	4.44	2.83
0.045	7.96	5.79	4.75	3.83	3.22	2.85	2.98	3.12	3.71	5.45	5.36	5.08
0.050	9.55	7.20	5.74	4.65	3.87	3.49	3.69	3.87	4.63	6.74	6.54	6.34
0.060	13.53	10.44	8.18	6.64	5.65	4.71	5.15	5.58	6.42	8.51	8.91	9.29
0.070	17.96	13.89	10.96	8.76	7.50	6.48	6.94	7.38	8.30	10.73	13.04	11.58
0.080	22.76	17.68	14.17	11.23	9.87	8.60	9.06	9.28	10.21	13.13	15.65	14.20
0.090	27.83	21.95	17.55	14.07	12.26	11.22	11.43	11.71	12.44	16.00	17.13	16.16
0.100	32.69	26.36	21.14	17.16	14.97	13.85	13.79	14.09	14.69	18.98	21.16	17.40
0.110	37.75	30.53	24.96	20.19	17.74	16.45	16.25	16.89	17.17	21.30	24.70	19.08
0.120	42.60	34.68	28.79	23.40	20.64	19.38	19.02	20.04	19.88	25.13	26.41	20.88
0.130	47.66	39.23	32.48	26.69	23.67	22.37	21.70	22.98	22.70	28.08	27.60	22.64
0.140	52.09	43.38	36.11	30.16	26.83	25.55	24.65	25.81	25.62	31.34	31.46	25.99
0.150	56.13	47.62	39.85	33.66	30.32	28.92	27.90	29.08	29.22	34.48	34.69	27.89
0.160	59.90	51.33	43.51	36.85	33.37	32.13	31.20	32.67	33.02	37.44	37.93	32.58
0.170	63.39	55.00	47.02	40.18	36.65	35.18	34.51	36.25	36.59	40.88	40.56	35.05
0.180	66.54	58.59	50.35	43.54	39.98	38.70	37.73	39.62	40.06	44.27	44.40	36.87
0.190	69.41	61.79	53.65	46.47	43.04	41.87	40.75	42.86	43.81	47.86	46.94	40.19
0.200	71.75	64.74	56.59	49.66	46.23	45.08	43.95	46.38	47.89	51.29	50.94	43.08
0.220	76.39	69.95	62.31	55.61	52.13	51.46	51.01	52.45	55.46	58.97	56.84	46.38
0.240	80.23	74.56	67.45	61.35	57.88	57.63	57.82	59.27	62.39	65.15	62.45	52.25
0.260	83.41	78.27	72.20	66.55	63.54	63.30	63.79	65.74	68.92	71.01	66.78	56.96
0.280	85.90	81.41	76.03	71.14	68.36	68.67	69.37	71.68	75.27	75.61	71.56	59.10
0.300	87.91	84.49	79.45	75.39	72.91	73.08	74.54	77.16	79.67	80.51	76.11	61.80
0.320	89.73	86.78	82.42	79.22	77.11	77.63	79.22	82.00	84.09	83.73	78.64	65.38
0.340	91.10	88.66	85.14	82.62	80.71	81.36	83.32	86.01	87.44	86.51	80.76	69.27
0.360	92.44	90.36	87.55	85.26	84.15	84.52	87.01	89.20	90.39	89.33	83.86	70.79
0.380	93.42	91.79	89.50	87.67	87.01	87.31	89.94	91.82	93.19	90.79	85.33	73.69
0.400	94.37	93.04	91.15	89.82	89.45	89.79	92.08	94.31	94.85	92.34	86.31	76.49
0.420	95.16	94.23	92.72	91.61	91.51	92.02	93.89	95.96	96.44	93.62	87.45	78.62
0.440	95.91	95.09	93.94	93.37	93.32	93.98	95.16	96.97	97.23	95.08	88.43	80.41
0.460	96.52	95.97	95.05	94.82	94.89	95.61	96.29	97.87	97.82	95.53	90.10	83.91
0.480	97.09	96.66	96.01	96.05	96.12	96.80	97.19	98.40	98.04	96.05	91.04	84.74
0.500	97.52	97.28	96.75	97.06	97.13	97.68	97.86	98.71	98.40	96.41	91.55	87.12
0.550	98.48	98.38	98.32	98.60	98.75	98.88	98.97	99.35	98.89	97.47	93.43	88.75
0.600	99.06	99.15	99.13	99.34	99.46	99.46	99.62	99.57	99.14	97.85	95.14	91.35
0.650	99.42	99.54	99.63	99.68	99.75	99.79	99.81	99.69	99.32	98.44	96.55	94.29
0.700	99.74	99.77	99.84	99.79	99.88	99.87	99.88	99.74	99.40	98.97	96.88	94.86
0.750	99.85	99.86	99.89	99.88	99.92	99.89	99.92	99.83	99.51	99.28	97.67	95.25
0.800	99.94	99.90	99.94	99.92	99.96	99.94	99.94	99.86	99.76	99.46	98.70	96.13
0.850	99.97	99.96	99.95	99.93	99.97	99.97	99.97	99.90	99.86	99.60	98.88	97.92
0.900	99.99	99.98	99.98	99.97	99.97	99.98	99.98	99.92	99.88	99.71	99.29	98.60
0.950	99.99	99.99	100.00	99.98	99.98	99.99	99.99	99.96	99.93	99.90	99.72	99.35
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 15 MeV

Scaled radius	Scaled depth interval 0.0–0.05	0.05–0.10	0.10–0.15	0.15–0.20	0.20–0.25	0.25–0.30	0.30–0.35	0.35–0.40	0.40–0.45	0.45–0.50	0.50–0.55	0.55–0.60
0.005	94.04	75.51	26.39	8.76	3.64	1.71	1.16	0.65	0.31	0.18	0.09	0.11
0.010	96.30	90.86	63.30	29.25	13.34	6.75	3.95	2.11	1.34	0.78	0.56	0.48
0.015	97.37	94.02	82.08	51.36	27.08	14.31	8.55	4.85	2.95	2.06	1.42	1.05
0.020	98.03	95.52	89.60	67.89	42.05	24.20	14.10	8.52	5.20	3.43	2.51	1.85
0.025	98.46	96.30	92.87	79.06	54.99	34.03	20.24	12.74	7.90	5.66	3.94	2.76
0.030	98.74	96.99	94.37	85.30	66.15	43.96	27.44	17.57	11.22	7.96	5.61	3.94
0.035	98.97	97.58	95.22	89.62	74.38	53.11	35.00	23.00	14.94	10.76	7.56	5.23
0.040	99.14	97.91	95.90	92.05	80.58	61.16	42.29	28.39	19.25	13.90	9.64	6.72
0.045	99.23	98.26	96.44	93.53	85.02	68.26	49.53	34.14	23.52	16.93	11.76	8.55
0.050	99.32	98.54	96.78	94.59	88.14	73.79	55.87	39.78	27.98	20.45	14.22	10.46
0.060	99.41	98.83	97.47	95.70	91.83	81.88	66.85	50.09	36.86	27.16	19.80	14.23
0.070	99.49	98.98	97.89	96.48	93.68	87.32	75.00	59.55	45.85	34.27	25.66	18.90
0.080	99.59	99.12	98.14	97.19	94.78	90.59	80.96	67.45	54.24	41.74	31.16	23.51
0.090	99.64	99.23	98.42	97.43	95.64	92.86	85.51	73.51	60.81	48.48	36.86	28.63
0.100	99.66	99.30	98.61	97.67	96.28	94.19	88.32	78.32	67.11	54.53	42.74	33.60
0.110	99.68	99.34	98.75	97.95	96.64	94.91	90.49	82.29	71.96	60.17	47.89	38.47
0.120	99.71	99.42	98.85	98.08	97.06	95.48	92.24	84.99	76.22	65.22	53.39	43.24
0.130	99.72	99.43	98.94	98.24	97.31	96.06	93.39	87.37	79.50	69.48	58.27	47.73
0.140	99.74	99.46	99.02	98.38	97.51	96.53	94.15	89.13	82.29	72.79	62.85	51.71
0.150	99.75	99.50	99.08	98.47	97.73	96.90	94.71	90.57	84.50	76.01	66.52	55.66
0.160	99.77	99.52	99.13	98.58	97.86	97.11	95.26	91.55	86.38	78.43	69.84	59.34
0.170	99.77	99.53	99.16	98.67	97.99	97.35	95.78	92.32	87.90	80.79	72.65	62.68
0.180	99.77	99.55	99.22	98.72	98.13	97.55	96.14	93.00	89.16	82.77	75.29	66.01
0.190	99.77	99.56	99.23	98.75	98.22	97.70	96.48	93.59	90.29	84.47	77.67	68.91
0.200	99.78	99.56	99.27	98.80	98.37	97.84	96.68	93.99	91.24	85.87	79.65	71.31
0.220	99.78	99.58	99.31	98.92	98.58	98.05	97.06	94.83	92.61	88.22	83.07	75.54
0.240	99.80	99.60	99.33	98.99	98.69	98.23	97.35	95.45	93.62	90.01	85.87	79.19
0.260	99.80	99.61	99.35	99.05	98.82	98.42	97.58	95.90	94.52	91.37	87.99	82.33
0.280	99.81	99.62	99.37	99.08	98.92	98.54	97.80	96.25	95.30	92.42	89.50	84.65
0.300	99.82	99.63	99.40	99.11	99.02	98.69	97.96	96.54	95.81	93.20	90.83	86.63
0.320	99.82	99.64	99.42	99.16	99.09	98.81	98.14	96.78	96.25	93.93	91.93	88.35
0.340	99.83	99.66	99.45	99.22	99.16	98.91	98.28	97.03	96.60	94.63	92.90	89.84
0.360	99.84	99.67	99.49	99.28	99.21	98.99	98.45	97.32	96.91	95.22	93.78	91.12
0.380	99.84	99.68	99.52	99.31	99.27	99.05	98.58	97.52	97.22	95.72	94.47	92.24
0.400	99.84	99.69	99.56	99.36	99.31	99.14	98.68	97.76	97.44	96.16	95.16	93.23
0.420	99.85	99.70	99.61	99.42	99.36	99.25	98.81	97.95	97.65	96.59	95.79	94.14
0.440	99.85	99.72	99.66	99.46	99.42	99.33	98.90	98.15	97.84	97.00	96.25	95.00
0.460	99.85	99.73	99.67	99.49	99.46	99.40	99.00	98.31	98.03	97.34	96.73	95.70
0.480	99.86	99.77	99.71	99.50	99.49	99.43	99.10	98.54	98.23	97.66	97.15	96.38
0.500	99.87	99.78	99.73	99.52	99.53	99.50	99.17	98.68	98.46	97.91	97.54	96.86
0.550	99.91	99.85	99.79	99.59	99.58	99.58	99.36	99.01	98.82	98.64	98.38	98.03
0.600	99.92	99.89	99.84	99.69	99.64	99.66	99.56	99.29	99.27	99.17	98.95	98.93
0.650	99.95	99.93	99.87	99.77	99.74	99.76	99.73	99.55	99.62	99.56	99.41	99.48
0.700	99.95	99.95	99.91	99.86	99.80	99.82	99.84	99.74	99.80	99.78	99.74	99.80
0.750	99.95	99.97	99.92	99.88	99.85	99.89	99.90	99.86	99.94	99.94	99.89	99.91
0.800	99.96	99.98	99.94	99.92	99.92	99.92	99.92	99.96	99.97	99.98	99.95	99.97
0.850	99.96	100.00	99.98	99.96	99.96	99.94	99.96	99.99	99.98	99.99	99.98	99.98
0.900	99.99	100.00	100.00	99.96	100.00	99.98	99.97	100.00	99.99	100.00	99.99	99.99
0.950	100.00	100.00	100.00	99.97	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 15 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.08	0.05	0.09	0.01	0.03	0.05	0.03	0.04	0.01	0.02	0.0	0.24
0.010	0.31	0.28	0.24	0.11	0.11	0.19	0.12	0.15	0.18	0.33	0.82	0.36
0.015	0.75	0.55	0.48	0.33	0.29	0.38	0.32	0.40	0.80	0.64	1.25	0.36
0.020	1.27	0.99	0.83	0.65	0.54	0.66	0.56	0.70	1.15	1.31	2.08	1.63
0.025	1.98	1.52	1.25	1.02	0.89	0.94	0.86	1.07	1.66	1.99	3.30	1.84
0.030	2.99	2.14	1.73	1.44	1.25	1.21	1.13	1.53	2.38	3.04	4.20	1.99
0.035	4.00	2.93	2.37	2.01	1.72	1.56	1.43	1.96	2.89	4.21	4.51	2.07
0.040	5.22	3.72	3.03	2.63	2.21	2.08	1.85	2.46	3.69	4.70	5.06	2.69
0.045	6.45	4.71	3.79	3.23	2.81	2.52	2.45	3.32	4.33	5.19	5.82	3.17
0.050	7.74	5.92	4.58	3.98	3.47	3.08	3.09	4.24	5.17	5.90	7.32	3.58
0.060	10.92	8.31	6.59	5.64	4.87	4.50	4.45	5.77	6.88	8.37	10.67	6.13
0.070	14.21	11.28	8.59	7.36	6.58	6.15	6.18	7.92	8.82	11.09	13.45	8.59
0.080	17.91	14.26	11.15	9.52	8.37	7.88	7.89	9.76	12.20	13.29	15.62	10.99
0.090	22.02	17.61	13.85	11.92	10.40	9.82	10.24	11.98	14.54	16.48	18.88	14.13
0.100	26.05	21.14	16.97	14.36	12.81	12.51	12.77	14.42	17.27	19.70	22.18	16.08
0.110	30.58	24.72	20.20	17.22	15.37	15.14	15.56	17.33	20.21	23.67	23.38	19.37
0.120	34.67	28.10	23.45	20.31	18.13	18.01	18.32	20.34	23.20	27.02	25.62	22.04
0.130	38.66	31.37	26.63	23.34	20.90	20.89	21.19	23.01	26.59	30.50	28.76	25.49
0.140	42.79	35.06	29.60	25.92	23.61	23.80	24.25	25.75	29.91	33.77	33.08	27.86
0.150	46.95	38.51	32.79	28.84	26.67	26.63	27.43	28.85	32.96	37.97	36.51	30.27
0.160	50.48	42.08	35.95	32.07	29.71	29.86	30.60	32.12	36.12	41.73	39.76	31.64
0.170	54.09	45.59	39.05	35.19	32.64	33.10	33.90	35.50	39.85	44.15	42.37	35.19
0.180	57.23	49.01	42.18	38.15	35.79	36.13	37.23	38.92	44.01	47.50	45.12	37.94
0.190	60.41	52.06	45.46	41.12	38.78	39.16	40.42	42.49	46.90	51.26	47.62	40.46
0.200	63.21	55.16	48.76	44.32	42.01	42.43	43.62	45.93	50.47	53.93	50.85	40.86
0.220	68.42	61.03	54.60	50.52	48.11	48.56	50.12	53.08	57.32	60.16	57.07	44.55
0.240	72.75	66.04	60.34	56.11	53.85	54.53	56.31	60.23	64.58	66.02	60.69	47.23
0.260	76.62	70.41	65.27	61.48	59.46	60.68	62.35	66.03	71.79	72.88	63.36	49.02
0.280	79.97	74.56	69.74	66.60	64.95	66.04	68.36	71.71	77.61	78.06	66.48	50.92
0.300	82.80	78.04	73.96	71.44	70.08	71.30	73.42	77.11	82.68	81.94	69.81	53.01
0.320	85.29	80.90	77.81	75.43	74.52	75.77	78.54	81.96	86.92	86.37	75.18	55.08
0.340	87.38	83.74	81.04	79.18	78.67	80.21	83.07	86.24	90.41	88.83	77.46	56.42
0.360	89.13	86.02	83.84	82.55	82.32	84.01	86.95	89.78	92.47	91.03	79.30	59.93
0.380	90.71	88.16	86.30	85.57	85.41	87.18	90.16	92.57	94.00	92.48	80.54	63.99
0.400	92.00	89.93	88.57	88.24	88.13	89.77	92.57	94.64	95.43	93.56	81.51	66.98
0.420	93.14	91.47	90.48	90.37	90.55	92.18	94.54	96.30	96.50	94.26	82.38	68.77
0.440	94.15	92.96	92.10	92.30	92.62	93.99	95.97	97.47	97.84	94.72	83.82	71.04
0.460	95.12	94.31	93.52	94.11	94.47	95.50	96.89	98.14	98.36	95.53	85.61	73.68
0.480	96.04	95.34	94.88	95.42	95.89	96.65	97.66	98.54	98.66	95.80	86.43	78.09
0.500	96.72	96.34	95.95	96.61	97.14	97.56	98.31	98.93	98.90	96.22	87.72	79.85
0.550	98.10	97.95	97.93	98.43	98.85	99.02	99.28	99.44	99.20	96.98	89.97	82.79
0.600	98.98	98.94	99.09	99.26	99.52	99.64	99.67	99.58	99.35	97.43	91.28	86.43
0.650	99.50	99.54	99.61	99.78	99.83	99.87	99.80	99.77	99.47	98.03	93.70	87.83
0.700	99.78	99.74	99.78	99.89	99.93	99.95	99.86	99.83	99.64	98.48	96.03	91.13
0.750	99.90	99.86	99.86	99.94	99.95	99.97	99.90	99.90	99.72	98.74	96.86	95.74
0.800	99.94	99.92	99.91	99.96	99.97	99.97	99.92	99.91	99.77	99.34	97.56	96.31
0.850	99.97	99.95	99.96	99.98	99.97	99.98	99.94	99.92	99.80	99.42	97.88	97.66
0.900	99.98	99.97	99.96	99.98	99.99	99.99	99.96	99.95	99.94	99.56	98.81	98.78
0.950	99.99	100.00	99.98	99.99	100.00	99.99	99.97	99.96	100.00	99.87	99.12	99.07
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 10 MeV

Scaled radius	Scaled depth interval 0.0–0.05	0.05–0.10	0.10–0.15	0.15–0.20	0.20–0.25	0.25–0.30	0.30–0.35	0.35–0.40	0.40–0.45	0.45–0.50	0.50–0.55	0.55–0.60
0.005	93.27	67.38	18.36	5.78	2.27	1.03	0.65	0.33	0.20	0.10	0.08	0.08
0.010	95.49	88.11	51.19	20.96	9.45	4.66	2.52	1.32	0.80	0.54	0.48	0.34
0.015	96.67	92.63	72.88	39.42	18.62	9.81	5.54	3.24	1.86	1.27	1.05	0.75
0.020	97.46	94.40	84.24	56.08	30.47	16.12	9.41	5.35	3.43	2.32	1.77	1.24
0.025	97.93	95.40	89.45	67.91	42.01	23.56	14.25	8.36	5.56	3.64	2.73	1.91
0.030	98.28	96.05	92.41	77.31	52.93	32.09	19.32	11.71	7.87	5.13	3.71	2.61
0.035	98.54	96.59	93.72	83.33	61.73	39.56	24.94	15.67	10.48	7.00	5.06	3.47
0.040	98.73	97.02	94.64	87.41	69.25	47.39	30.56	20.04	13.39	9.06	6.42	4.55
0.045	98.87	97.35	95.22	90.10	75.43	53.98	36.40	24.32	16.23	11.26	7.81	5.61
0.050	98.94	97.58	95.77	92.06	79.82	60.09	42.07	28.62	19.48	13.63	9.38	6.91
0.060	99.08	98.00	96.43	94.26	86.34	70.56	52.45	37.09	26.16	18.67	13.13	9.62
0.070	99.22	98.25	96.96	95.31	89.85	77.80	61.68	45.39	33.03	24.09	17.27	12.68
0.080	99.27	98.40	97.35	96.06	92.24	82.70	69.11	52.97	39.58	29.29	21.47	16.17
0.090	99.29	98.57	97.59	96.57	93.45	86.25	74.57	59.68	46.04	34.91	25.84	19.63
0.100	99.31	98.66	97.79	96.93	94.33	88.78	79.27	65.72	51.79	40.00	30.23	23.50
0.110	99.34	98.78	98.00	97.19	95.03	90.63	82.48	70.51	57.45	45.11	34.67	27.51
0.120	99.36	98.82	98.11	97.38	95.42	91.90	85.21	74.42	62.38	49.87	38.94	31.27
0.130	99.38	98.91	98.22	97.54	95.76	92.88	87.03	77.83	66.58	54.58	42.87	35.16
0.140	99.39	98.96	98.33	97.71	96.04	93.46	88.50	80.34	70.22	58.89	46.70	38.67
0.150	99.39	98.98	98.42	97.82	96.33	93.90	89.79	82.57	73.23	62.57	50.65	42.18
0.160	99.41	99.01	98.49	97.97	96.48	94.39	90.90	84.52	75.94	66.00	54.34	45.61
0.170	99.41	99.04	98.55	98.05	96.65	94.78	91.70	85.90	78.36	69.09	57.70	48.77
0.180	99.41	99.09	98.61	98.14	96.79	95.02	92.34	87.12	80.21	71.94	60.82	51.89
0.190	99.41	99.09	98.65	98.25	96.90	95.34	92.90	88.07	81.89	74.08	63.62	54.74
0.200	99.43	99.14	98.69	98.31	97.04	95.55	93.27	88.92	83.38	76.34	66.41	57.70
0.220	99.44	99.16	98.79	98.47	97.22	95.94	94.02	90.30	85.56	79.87	70.95	62.76
0.240	99.45	99.18	98.87	98.55	97.40	96.13	94.69	91.34	87.34	82.62	74.79	67.34
0.260	99.47	99.21	98.94	98.61	97.56	96.37	95.19	92.16	88.77	84.69	77.88	71.35
0.280	99.47	99.22	98.98	98.66	97.80	96.56	95.55	92.98	90.09	86.60	80.41	74.85
0.300	99.47	99.24	99.03	98.73	97.94	96.72	95.92	93.57	91.19	88.12	82.73	77.84
0.320	99.48	99.27	99.11	98.79	98.09	96.93	96.23	94.05	92.08	89.44	84.73	80.59
0.340	99.50	99.31	99.21	98.83	98.28	97.14	96.53	94.51	92.85	90.53	86.38	82.87
0.360	99.51	99.35	99.26	98.89	98.39	97.29	96.80	94.96	93.54	91.53	87.97	84.97
0.380	99.53	99.41	99.32	98.95	98.51	97.47	97.07	95.46	94.14	92.54	89.51	86.85
0.400	99.53	99.44	99.36	99.03	98.64	97.59	97.30	95.81	94.65	93.41	90.82	88.46
0.420	99.56	99.49	99.39	99.10	98.72	97.72	97.52	96.17	95.11	94.11	91.93	89.95
0.440	99.59	99.52	99.44	99.14	98.83	97.88	97.68	96.53	95.65	94.79	93.00	91.31
0.460	99.62	99.55	99.48	99.21	98.91	98.08	97.85	96.90	96.15	95.38	93.95	92.67
0.480	99.65	99.57	99.51	99.28	98.99	98.30	98.06	97.22	96.63	95.97	94.87	93.92
0.500	99.70	99.59	99.59	99.38	99.08	98.46	98.24	97.52	97.10	96.49	95.74	94.95
0.550	99.74	99.67	99.69	99.56	99.33	98.90	98.64	98.25	98.09	97.65	97.39	97.05
0.600	99.79	99.78	99.75	99.69	99.49	99.30	99.04	98.94	98.73	98.53	98.46	98.36
0.650	99.85	99.84	99.85	99.84	99.68	99.54	99.41	99.41	99.25	99.11	99.24	99.20
0.700	99.88	99.89	99.96	99.89	99.87	99.74	99.74	99.72	99.60	99.57	99.64	99.68
0.750	99.94	99.97	99.97	99.92	99.94	99.89	99.91	99.89	99.84	99.81	99.86	99.86
0.800	99.97	100.00	99.99	99.96	99.96	99.96	99.99	99.97	99.96	99.92	99.94	99.95
0.850	99.99	100.00	99.99	99.98	100.00	99.99	100.00	99.99	99.98	99.97	99.97	99.99
0.900	100.00	100.00	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.98	99.99
0.950	100.00	100.00	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.99	100.00
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 10 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.08	0.04	0.04	0.03	0.03	0.04	0.02	0.04	0.05	0.0	0.0	0.0
0.010	0.28	0.15	0.15	0.09	0.12	0.11	0.08	0.31	0.12	0.31	0.0	0.0
0.015	0.60	0.34	0.30	0.28	0.29	0.26	0.24	0.55	0.12	0.31	0.0	0.0
0.020	0.99	0.67	0.59	0.52	0.48	0.44	0.59	0.82	0.39	0.40	0.02	0.0
0.025	1.42	1.04	0.86	0.82	0.81	0.69	0.83	1.06	0.78	1.79	0.43	0.0
0.030	1.91	1.45	1.28	1.14	1.09	1.04	1.25	1.36	1.35	2.98	2.32	0.0
0.035	2.57	1.98	1.69	1.50	1.42	1.38	1.67	1.76	2.02	3.93	2.40	0.0
0.040	3.34	2.50	2.14	1.91	1.84	1.90	2.07	2.28	2.86	4.45	2.47	0.0
0.045	4.27	3.23	2.74	2.37	2.23	2.40	2.67	2.90	4.20	5.23	2.61	0.0
0.050	4.98	3.99	3.33	2.85	2.73	2.91	3.28	3.65	5.58	5.59	2.61	0.0
0.060	7.13	5.55	4.55	4.15	4.02	4.08	4.69	5.70	7.13	7.56	4.29	0.00
0.070	9.70	7.33	6.18	5.44	5.32	5.43	6.09	7.82	9.29	9.88	5.91	0.04
0.080	12.41	9.45	7.92	7.01	6.86	7.12	7.87	9.90	11.70	13.24	7.72	2.01
0.090	15.16	11.95	9.88	8.75	8.64	8.92	9.72	12.38	15.13	15.72	13.78	4.59
0.100	18.00	14.51	11.97	10.93	10.53	10.86	11.90	15.11	18.37	19.25	14.46	7.12
0.110	21.08	17.19	14.44	13.34	13.09	13.19	14.14	17.92	21.55	24.50	20.04	10.44
0.120	24.28	20.22	16.94	15.83	15.68	15.76	16.72	20.80	25.28	31.43	21.47	14.60
0.130	27.74	23.23	19.64	18.45	18.37	18.37	19.55	24.20	29.96	33.54	25.04	16.39
0.140	30.99	26.25	22.34	21.24	20.83	21.02	22.42	27.34	34.18	38.93	26.19	17.97
0.150	34.34	29.06	25.09	23.86	23.73	23.61	25.47	30.67	37.47	44.46	28.39	18.41
0.160	37.77	31.92	27.96	26.77	26.56	26.75	28.67	33.98	41.24	47.37	30.93	20.60
0.170	40.87	34.80	30.82	29.74	29.60	29.58	31.64	36.92	45.07	52.22	34.89	21.82
0.180	43.82	37.86	33.62	32.58	32.69	33.13	34.97	40.18	49.00	56.06	37.37	22.24
0.190	46.87	40.67	36.38	35.36	35.65	36.40	38.50	43.85	53.09	59.75	39.64	23.45
0.200	49.78	43.54	39.34	38.12	38.57	39.33	41.96	47.06	56.98	62.07	46.40	28.34
0.220	55.37	49.09	44.75	44.03	44.38	45.24	48.61	54.49	62.48	68.38	48.99	35.34
0.240	60.57	54.43	50.32	49.61	50.30	52.01	54.88	61.46	68.62	71.64	49.95	40.31
0.260	65.13	59.57	55.39	55.09	56.17	57.56	61.80	69.00	74.93	78.64	53.36	41.82
0.280	69.39	64.11	60.45	60.69	61.83	63.65	67.29	75.61	79.21	81.75	54.99	45.71
0.300	73.01	68.55	65.14	65.83	67.18	69.07	72.55	81.29	83.32	85.05	58.32	47.48
0.320	76.42	72.60	69.60	70.59	71.82	73.99	77.52	85.84	87.10	87.12	61.02	49.40
0.340	79.37	76.27	73.88	75.00	76.29	78.67	81.91	89.25	89.81	88.31	61.53	50.49
0.360	81.87	79.53	77.99	78.77	80.28	82.59	86.26	91.65	91.60	90.19	62.46	53.04
0.380	84.18	82.61	81.33	82.46	83.88	86.12	89.71	93.94	93.35	91.95	67.49	56.38
0.400	86.44	85.27	84.41	85.72	86.90	89.14	92.45	95.75	94.88	93.03	70.84	57.05
0.420	88.42	87.66	87.29	88.49	89.61	91.63	94.64	97.02	95.81	93.80	71.21	61.30
0.440	90.18	89.92	89.82	90.76	92.10	94.09	96.13	97.87	96.59	93.95	71.83	62.80
0.460	91.78	91.86	91.83	92.75	94.14	95.85	97.34	98.73	97.28	94.23	72.85	67.02
0.480	93.21	93.43	93.53	94.32	95.54	97.12	98.25	99.14	97.64	94.44	77.82	71.07
0.500	94.35	94.75	94.95	95.72	96.80	98.16	98.97	99.31	98.00	94.52	79.94	71.98
0.550	96.67	97.26	97.74	98.27	98.76	99.22	99.70	99.59	98.46	94.97	83.06	79.44
0.600	98.39	98.68	99.19	99.48	99.61	99.78	99.82	99.76	98.72	95.82	84.89	80.80
0.650	99.23	99.39	99.75	99.82	99.86	99.88	99.94	99.81	99.06	97.20	87.23	85.58
0.700	99.75	99.80	99.94	99.97	99.93	99.94	99.95	99.82	99.28	97.62	89.88	88.92
0.750	99.94	99.94	99.99	99.99	99.96	99.95	99.96	99.86	99.32	98.19	94.05	92.57
0.800	99.97	99.98	99.99	99.99	99.98	99.96	99.97	99.89	99.45	98.65	95.27	94.41
0.850	100.00	100.00	99.99	99.99	99.99	99.96	99.98	99.91	99.47	98.86	98.41	96.73
0.900	100.00	100.00	100.00	100.00	100.00	99.97	99.98	99.98	99.61	99.07	98.69	97.92
0.950	100.00	100.00	100.00	100.00	100.00	99.99	100.00	99.99	99.70	99.97	99.43	99.50
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 8 MeV

Scaled radius	Scaled depth interval 0.0–0.05	0.05–0.10	0.10–0.15	0.15–0.20	0.20–0.25	0.25–0.30	0.30–0.35	0.35–0.40	0.40–0.45	0.45–0.50	0.50–0.55	0.55–0.60
0.005	93.02	63.27	15.28	4.56	1.63	0.94	0.50	0.41	0.13	0.08	0.08	0.07
0.010	95.30	85.95	44.36	16.59	7.09	3.21	1.81	1.32	0.56	0.43	0.34	0.28
0.015	96.46	91.63	66.96	32.61	14.82	7.13	3.94	2.59	1.45	0.85	0.71	0.56
0.020	97.17	93.52	79.28	48.63	24.43	12.57	6.99	4.43	2.64	1.65	1.12	0.98
0.025	97.71	94.75	86.29	61.73	34.26	19.03	10.68	6.40	3.91	2.59	1.71	1.51
0.030	98.09	95.58	90.19	71.57	44.47	25.81	15.14	9.09	5.75	3.82	2.52	2.16
0.035	98.35	96.21	91.91	78.62	53.94	33.25	20.04	12.25	7.62	5.16	3.44	2.95
0.040	98.52	96.72	93.10	83.48	61.50	40.21	25.01	15.60	9.59	6.71	4.39	3.66
0.045	98.67	97.07	93.85	86.86	68.32	46.88	29.99	19.08	12.07	8.34	5.60	4.40
0.050	98.78	97.34	94.51	89.06	73.65	53.07	35.01	22.75	14.58	9.90	6.75	5.30
0.060	98.99	97.78	95.41	91.79	81.46	63.46	44.52	30.31	20.04	13.86	9.64	7.48
0.070	99.12	98.09	96.05	93.44	86.47	71.63	53.07	37.70	25.97	18.26	12.92	9.92
0.080	99.18	98.29	96.51	94.63	89.18	77.25	60.71	44.78	31.48	22.81	16.15	12.61
0.090	99.23	98.43	96.90	95.36	91.23	81.45	67.17	50.99	37.14	27.65	19.78	15.44
0.100	99.25	98.55	97.18	95.91	92.56	84.76	72.43	56.64	42.58	32.24	23.55	18.36
0.110	99.29	98.60	97.42	96.32	93.58	87.04	76.40	61.87	47.83	36.57	27.27	21.49
0.120	99.31	98.66	97.61	96.64	94.22	88.84	79.73	66.24	52.19	40.89	30.95	24.32
0.130	99.33	98.74	97.77	96.87	94.77	90.32	82.35	70.11	56.68	45.04	34.76	27.74
0.140	99.34	98.82	97.90	97.10	95.23	91.25	84.47	73.35	60.24	48.86	38.81	30.98
0.150	99.34	98.85	98.03	97.27	95.53	92.12	86.18	76.21	63.70	52.30	42.41	34.15
0.160	99.35	98.87	98.10	97.37	95.81	92.82	87.66	78.59	66.94	55.82	45.63	37.35
0.170	99.36	98.92	98.18	97.45	95.96	93.45	88.86	80.70	69.85	59.07	48.64	40.46
0.180	99.36	98.95	98.27	97.52	96.19	93.90	89.81	82.51	72.38	61.99	51.66	43.61
0.190	99.37	98.98	98.30	97.61	96.38	94.27	90.49	84.01	74.53	64.58	54.67	46.54
0.200	99.39	99.01	98.33	97.67	96.56	94.61	91.12	85.38	76.56	66.96	57.27	49.29
0.220	99.39	99.04	98.40	97.77	96.85	95.11	92.13	87.34	79.95	71.10	62.20	54.87
0.240	99.40	99.08	98.47	97.89	97.14	95.53	92.85	88.57	82.44	74.54	66.62	59.75
0.260	99.42	99.10	98.53	97.98	97.33	95.85	93.49	89.83	84.36	77.60	70.32	64.00
0.280	99.44	99.13	98.63	98.11	97.48	96.10	94.00	90.83	86.10	80.13	73.61	67.92
0.300	99.48	99.16	98.68	98.25	97.69	96.44	94.51	91.61	87.49	82.36	76.45	71.43
0.320	99.51	99.20	98.74	98.31	97.86	96.66	94.87	92.46	88.79	84.27	79.02	74.83
0.340	99.53	99.22	98.80	98.36	97.99	96.83	95.25	93.10	89.87	86.07	81.27	77.84
0.360	99.55	99.27	98.84	98.46	98.14	97.07	95.66	93.71	90.93	87.63	83.31	80.65
0.380	99.55	99.29	98.90	98.52	98.23	97.35	95.96	94.30	91.90	89.00	85.27	83.07
0.400	99.58	99.33	98.97	98.56	98.36	97.63	96.45	94.81	92.77	90.28	87.02	85.16
0.420	99.61	99.35	99.03	98.65	98.45	97.85	96.70	95.36	93.55	91.43	88.57	87.20
0.440	99.64	99.40	99.08	98.74	98.62	98.07	96.96	95.81	94.33	92.59	90.02	89.09
0.460	99.67	99.45	99.12	98.83	98.77	98.28	97.19	96.20	94.96	93.56	91.43	90.85
0.480	99.73	99.49	99.19	98.88	98.87	98.47	97.46	96.65	95.52	94.56	92.78	92.41
0.500	99.75	99.52	99.25	98.98	98.98	98.64	97.75	97.06	96.01	95.35	94.01	93.72
0.550	99.80	99.62	99.39	99.25	99.37	99.06	98.33	97.95	97.22	97.06	96.38	96.09
0.600	99.83	99.78	99.54	99.41	99.60	99.33	98.86	98.75	98.30	98.21	98.00	98.06
0.650	99.89	99.86	99.71	99.61	99.71	99.56	99.28	99.35	99.09	99.05	99.04	99.10
0.700	99.92	99.93	99.81	99.72	99.82	99.75	99.58	99.70	99.56	99.51	99.59	99.66
0.750	99.97	99.97	99.87	99.85	99.90	99.85	99.77	99.90	99.81	99.77	99.87	99.91
0.800	100.00	99.99	99.93	99.91	99.97	99.94	99.89	99.96	99.90	99.91	99.95	99.97
0.850	100.00	100.00	99.97	99.96	100.00	99.97	99.98	99.99	99.97	99.97	99.99	99.97
0.900	100.00	100.00	99.98	99.98	100.00	99.99	99.99	100.00	100.00	99.99	99.99	99.99
0.950	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 8 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.04	0.02	0.02	0.01	0.03	0.02	0.01	0.02	0.0	0.0	0.0	0.0
0.010	0.18	0.15	0.11	0.11	0.16	0.09	0.09	0.17	0.02	0.23	0.0	0.0
0.015	0.41	0.35	0.30	0.25	0.35	0.22	0.28	0.46	0.19	0.39	0.0	0.0
0.020	0.68	0.56	0.57	0.44	0.54	0.39	0.56	0.79	0.53	0.51	0.0	0.0
0.025	1.07	0.86	0.85	0.66	0.86	0.76	0.87	1.03	0.92	0.62	0.0	0.0
0.030	1.48	1.30	1.18	0.98	1.23	1.15	1.17	1.46	1.20	1.38	0.07	0.0
0.035	2.05	1.74	1.55	1.37	1.66	1.54	1.60	2.18	1.69	2.15	0.07	0.0
0.040	2.66	2.23	2.08	1.84	2.17	2.00	2.11	2.83	2.25	2.41	0.07	0.32
0.045	3.36	2.83	2.49	2.35	2.67	2.46	2.64	3.53	3.36	3.84	0.07	0.90
0.050	4.08	3.42	2.97	2.87	3.22	3.02	3.23	4.37	4.09	4.77	0.07	1.16
0.060	5.89	4.79	4.13	4.05	4.34	4.17	4.44	6.22	5.45	7.29	0.12	1.22
0.070	7.81	6.28	5.61	5.41	5.77	5.66	6.10	8.01	7.70	7.58	3.11	5.04
0.080	10.03	8.13	7.32	6.96	7.42	7.65	8.20	10.43	9.74	8.02	5.86	5.04
0.090	12.34	10.07	9.05	8.70	9.24	9.58	10.53	13.02	12.29	10.91	6.17	5.04
0.100	14.71	12.24	10.90	10.53	11.20	11.98	12.54	15.43	14.86	13.14	11.28	6.15
0.110	17.36	14.56	12.95	12.56	13.23	13.87	14.83	17.76	17.70	14.60	14.80	8.42
0.120	20.24	17.05	15.10	14.73	15.37	16.04	17.76	20.45	20.82	18.98	16.30	9.53
0.130	23.00	19.73	17.43	16.77	17.65	18.49	20.74	23.17	23.76	25.44	21.84	9.99
0.140	25.93	22.40	19.90	19.05	20.00	21.18	23.72	26.02	27.73	30.59	27.15	10.89
0.150	28.79	25.30	22.62	21.78	22.61	24.17	26.61	29.04	31.53	34.82	27.85	11.15
0.160	31.64	28.14	25.18	24.55	25.16	26.90	29.73	32.25	35.00	40.10	28.53	12.61
0.170	34.59	30.96	27.83	27.26	27.83	29.90	32.94	35.95	38.81	43.68	30.81	13.43
0.180	37.70	33.89	30.44	29.89	30.67	32.70	36.11	39.52	41.38	47.13	33.14	15.93
0.190	40.73	36.68	33.11	32.70	33.72	35.89	39.92	43.71	45.11	52.41	33.90	17.62
0.200	43.52	39.43	35.83	35.62	36.86	39.19	43.48	47.79	49.09	56.68	34.08	18.56
0.220	48.90	44.76	41.34	41.44	43.09	45.90	49.83	55.59	59.26	64.92	37.94	22.59
0.240	54.14	49.79	46.65	47.00	49.08	51.83	56.47	62.94	66.38	68.60	40.45	28.79
0.260	59.03	54.95	51.98	52.71	55.21	58.19	62.56	69.00	71.91	73.48	42.93	33.78
0.280	63.63	59.72	57.16	58.06	61.09	64.69	68.39	73.89	77.08	75.88	45.43	37.21
0.300	67.76	64.25	62.04	63.52	66.48	70.36	74.77	79.06	83.09	77.49	49.71	37.54
0.320	71.41	68.58	66.43	68.60	71.52	75.51	79.92	83.77	86.70	80.31	52.53	39.94
0.340	74.83	72.69	70.81	73.12	75.73	79.79	84.26	87.98	88.62	80.72	55.34	40.93
0.360	77.97	76.01	75.01	77.46	79.44	83.58	87.82	91.33	91.25	81.98	57.36	45.44
0.380	81.00	79.17	78.74	81.28	83.09	87.00	90.77	93.62	92.88	84.26	59.27	47.00
0.400	83.63	82.24	82.01	84.67	86.40	89.99	93.41	95.33	94.70	86.09	63.68	48.29
0.420	86.04	84.96	84.91	87.85	89.17	92.37	95.51	96.89	96.40	87.47	64.70	50.94
0.440	88.12	87.36	87.68	90.26	91.52	94.05	97.05	97.55	96.69	88.80	67.03	53.51
0.460	90.21	89.57	90.09	92.36	93.46	95.43	97.74	98.03	96.79	90.94	68.99	54.92
0.480	92.01	91.71	92.21	94.30	95.13	96.72	98.44	98.33	97.16	90.99	71.21	57.86
0.500	93.43	93.53	93.93	95.79	96.51	97.85	99.23	98.60	97.23	91.52	72.89	58.71
0.550	96.33	96.80	97.18	98.20	98.94	99.22	99.72	98.99	97.58	92.06	76.29	66.41
0.600	98.13	98.60	98.85	99.39	99.66	99.66	99.76	99.12	98.20	92.80	81.21	69.26
0.650	99.27	99.44	99.58	99.79	99.85	99.79	99.79	99.31	98.45	95.93	87.72	71.62
0.700	99.73	99.85	99.93	99.95	99.95	99.88	99.85	99.46	98.58	96.67	90.83	78.67
0.750	99.94	99.95	99.98	99.98	99.98	99.92	99.88	99.67	98.96	97.23	92.67	85.42
0.800	100.00	99.98	99.99	99.99	99.98	99.98	99.90	99.72	99.11	97.81	93.66	86.86
0.850	100.00	99.98	100.00	99.99	99.98	99.98	99.93	99.77	99.35	98.15	96.21	89.77
0.900	100.00	99.99	100.00	99.99	99.99	100.00	99.97	99.83	99.36	98.19	96.86	96.59
0.950	100.00	100.00	100.00	100.00	99.99	100.00	99.99	99.98	99.73	98.74	97.45	97.18
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 6 MeV

Scaled radius	Scaled depth interval 0.0–0.05	0.05–0.10	0.10–0.15	0.15–0.20	0.20–0.25	0.25–0.30	0.30–0.35	0.35–0.40	0.40–0.45	0.45–0.50	0.50–0.55	0.55–0.60
0.005	92.31	60.37	13.30	3.82	1.40	0.79	0.34	0.34	0.04	0.10	0.08	0.08
0.010	94.48	84.18	40.04	14.18	5.66	2.86	1.40	1.07	0.49	0.36	0.28	0.23
0.015	95.74	90.37	62.44	28.32	12.85	5.81	3.26	2.13	1.23	0.74	0.55	0.52
0.020	96.48	92.74	75.95	42.48	20.87	10.34	5.72	3.59	2.18	1.28	0.89	0.86
0.025	96.99	93.86	83.31	55.18	29.80	15.74	9.04	5.41	3.24	1.91	1.42	1.22
0.030	97.33	94.65	87.74	65.42	38.80	21.53	12.71	7.37	4.52	2.85	2.10	1.67
0.035	97.62	95.39	90.28	72.73	47.57	27.78	16.71	9.83	5.92	3.96	2.83	2.16
0.040	97.82	95.85	91.58	78.31	55.44	34.01	20.92	12.54	7.63	5.34	3.63	2.88
0.045	97.97	96.17	92.60	82.32	61.87	40.01	25.20	15.35	9.68	6.61	4.45	3.60
0.050	98.08	96.47	93.31	84.86	67.33	45.86	29.17	18.48	11.69	7.97	5.45	4.35
0.060	98.23	96.93	94.36	88.48	75.98	56.18	37.60	24.89	16.17	11.18	7.72	5.93
0.070	98.31	97.25	95.01	90.59	81.90	64.50	45.43	31.12	21.30	14.72	10.32	7.81
0.080	98.37	97.53	95.63	91.95	85.91	71.18	52.82	36.97	26.10	18.77	13.22	10.18
0.090	98.43	97.71	96.14	92.90	88.15	75.97	59.24	43.19	30.98	22.58	15.93	12.59
0.100	98.49	97.83	96.49	93.63	89.86	79.55	64.50	48.63	35.61	26.55	18.91	15.11
0.110	98.55	97.92	96.74	94.16	91.12	82.44	69.07	53.62	40.15	30.32	22.12	17.86
0.120	98.56	97.97	96.89	94.57	91.97	84.78	72.69	58.03	44.77	34.21	25.42	20.46
0.130	98.58	98.02	97.04	94.92	92.67	86.40	75.80	62.07	48.97	37.93	28.84	23.47
0.140	98.60	98.11	97.16	95.22	93.09	87.89	78.24	65.44	52.70	41.69	32.20	26.13
0.150	98.62	98.19	97.26	95.44	93.61	89.02	80.30	68.59	56.12	45.24	35.61	28.98
0.160	98.65	98.24	97.35	95.63	93.97	89.84	82.01	71.32	59.20	48.69	38.99	31.95
0.170	98.68	98.30	97.42	95.79	94.27	90.59	83.42	73.70	62.25	51.72	41.80	34.98
0.180	98.72	98.34	97.48	95.95	94.49	91.23	84.75	75.68	65.00	54.83	44.51	37.91
0.190	98.74	98.36	97.54	96.04	94.75	91.74	85.80	77.41	67.57	57.65	47.07	40.96
0.200	98.77	98.38	97.61	96.16	94.96	92.14	86.74	79.01	69.76	60.13	49.73	43.86
0.220	98.79	98.41	97.72	96.35	95.40	92.86	88.23	81.40	73.50	64.72	54.90	49.14
0.240	98.83	98.45	97.84	96.46	95.75	93.42	89.31	83.52	76.55	68.69	59.45	54.26
0.260	98.87	98.46	97.92	96.56	95.97	93.99	90.18	84.95	79.16	72.11	63.59	58.75
0.280	98.94	98.54	98.00	96.69	96.19	94.36	90.97	86.30	81.31	75.13	67.59	62.99
0.300	98.99	98.59	98.08	96.87	96.45	94.77	91.64	87.55	83.08	77.76	71.04	67.08
0.320	99.01	98.68	98.20	97.01	96.69	95.08	92.41	88.52	84.61	80.15	73.95	70.63
0.340	99.05	98.74	98.29	97.14	96.86	95.53	93.05	89.39	86.08	82.40	77.02	73.91
0.360	99.11	98.81	98.35	97.29	97.07	95.90	93.70	90.27	87.32	84.42	79.68	77.03
0.380	99.19	98.87	98.44	97.45	97.28	96.29	94.15	91.12	88.50	86.26	82.18	79.89
0.400	99.23	98.95	98.53	97.60	97.44	96.62	94.60	91.94	89.64	87.81	84.57	82.52
0.420	99.27	98.97	98.62	97.74	97.57	96.96	95.00	92.75	90.75	89.36	86.52	84.88
0.440	99.34	99.01	98.70	97.89	97.76	97.20	95.48	93.52	91.85	90.87	88.40	86.95
0.460	99.38	99.06	98.78	98.03	97.93	97.47	95.83	94.30	92.78	92.20	89.94	89.02
0.480	99.42	99.12	98.85	98.13	98.16	97.75	96.21	94.98	93.75	93.44	91.39	90.91
0.500	99.45	99.19	98.96	98.29	98.42	97.95	96.61	95.63	94.66	94.50	92.63	92.42
0.550	99.62	99.36	99.12	98.72	98.86	98.54	97.57	97.07	96.55	96.71	95.33	95.49
0.600	99.74	99.56	99.31	99.02	99.18	99.00	98.44	98.35	98.02	98.25	97.37	97.46
0.650	99.81	99.68	99.57	99.33	99.59	99.45	99.11	98.99	98.98	99.14	98.75	98.79
0.700	99.89	99.75	99.69	99.52	99.77	99.78	99.52	99.48	99.54	99.64	99.42	99.58
0.750	99.93	99.85	99.84	99.74	99.90	99.90	99.74	99.75	99.85	99.85	99.82	99.86
0.800	99.98	99.92	99.93	99.92	99.96	100.00	99.91	99.96	99.95	99.96	99.97	99.96
0.850	99.98	99.95	99.96	99.99	99.98	100.00	99.97	99.97	99.99	99.98	99.99	99.99
0.900	100.00	99.96	99.99	100.00	100.00	100.00	99.99	100.00	100.00	100.00	100.00	100.00
0.950	100.00	99.98	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 6 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.04	0.02	0.02	0.02	0.03	0.05	0.02	0.0	0.07	0.0	0.0	0.0
0.010	0.15	0.13	0.12	0.09	0.08	0.13	0.11	0.03	0.07	0.0	0.0	0.0
0.015	0.28	0.27	0.26	0.24	0.22	0.33	0.21	0.12	0.27	0.0	0.0	0.0
0.020	0.53	0.45	0.48	0.45	0.42	0.55	0.34	0.17	0.91	0.64	0.0	0.0
0.025	0.84	0.74	0.73	0.74	0.73	0.81	0.67	0.35	1.42	1.76	1.81	0.0
0.030	1.27	1.06	1.04	1.05	1.07	1.11	1.10	0.88	1.74	2.21	1.81	0.0
0.035	1.73	1.46	1.33	1.37	1.49	1.51	1.67	1.48	2.03	2.46	2.17	0.01
0.040	2.25	1.80	1.71	1.68	1.92	2.03	2.16	2.16	2.93	2.88	6.71	0.01
0.045	2.89	2.25	2.14	2.12	2.37	2.42	2.72	2.94	3.65	3.42	10.05	0.01
0.050	3.53	2.79	2.63	2.57	2.79	2.87	3.37	3.72	4.39	5.13	10.39	0.01
0.060	4.83	4.10	3.71	3.65	3.94	4.23	4.99	5.60	6.56	8.22	11.70	0.45
0.070	6.48	5.40	4.84	4.84	5.28	5.70	6.71	7.88	10.39	12.02	14.41	0.45
0.080	8.37	6.87	6.42	6.29	6.72	7.62	8.55	10.07	13.62	13.80	14.87	1.15
0.090	10.45	8.52	7.98	7.87	8.15	9.49	10.47	12.48	17.52	15.60	14.87	1.15
0.100	12.82	10.59	9.81	9.69	9.85	11.33	12.79	14.98	20.42	18.15	14.89	1.15
0.110	15.14	12.85	11.87	11.61	11.58	13.37	15.11	17.20	23.41	22.61	14.89	1.38
0.120	17.47	14.89	14.13	13.86	13.82	15.65	17.63	19.37	27.75	27.14	17.12	1.65
0.130	20.04	17.34	16.29	16.10	16.32	18.04	20.23	22.74	33.30	29.43	22.47	2.28
0.140	22.67	19.98	18.58	18.35	18.98	20.82	23.40	26.16	37.84	30.39	23.03	2.28
0.150	25.40	22.30	21.09	20.76	21.54	23.55	26.75	30.07	40.37	34.47	24.16	3.01
0.160	27.98	24.78	23.38	23.18	24.31	26.71	30.09	33.99	44.45	39.55	25.13	3.30
0.170	30.80	27.39	25.99	25.74	26.92	29.75	33.56	37.50	48.74	44.21	27.51	3.30
0.180	33.57	29.99	28.32	28.33	29.62	32.82	37.16	41.46	52.36	47.28	29.40	3.30
0.190	36.39	32.78	31.13	31.21	32.45	35.73	41.01	46.31	54.94	49.27	33.55	4.65
0.200	39.14	35.49	33.90	34.07	35.67	38.71	44.88	49.73	57.15	54.04	36.66	5.43
0.220	44.62	40.75	39.49	39.95	42.33	45.10	51.65	57.03	63.66	61.81	41.32	8.07
0.240	49.86	46.04	44.61	45.67	48.25	51.38	58.14	64.18	69.83	64.56	45.51	8.54
0.260	54.52	51.15	50.02	51.24	53.88	57.93	64.85	71.04	75.44	67.11	45.78	9.98
0.280	59.18	56.10	55.11	56.97	59.89	63.76	70.54	77.40	80.51	71.40	47.81	13.14
0.300	63.61	60.91	60.18	61.88	65.53	69.37	75.67	81.37	83.56	74.57	49.66	23.84
0.320	67.65	65.47	64.94	66.50	70.63	74.64	80.48	85.53	87.93	78.78	50.80	27.42
0.340	71.46	70.01	69.55	71.31	75.37	79.63	84.62	89.23	91.18	81.38	50.84	28.26
0.360	75.13	74.14	73.79	75.59	79.58	83.75	87.78	91.49	93.16	85.55	51.09	28.59
0.380	78.43	77.77	77.69	79.50	83.25	87.31	90.42	94.05	95.15	87.12	51.81	29.77
0.400	81.58	81.05	81.46	83.01	86.66	90.39	93.10	95.47	96.13	88.08	53.10	30.82
0.420	84.42	84.19	84.89	86.37	89.81	92.92	95.25	97.26	97.29	89.24	56.45	30.82
0.440	86.90	86.92	87.59	89.44	92.50	95.02	96.88	98.30	97.35	90.78	61.10	32.80
0.460	88.98	89.38	90.16	91.99	94.35	96.53	97.77	99.07	97.49	91.28	62.28	41.34
0.480	90.79	91.56	92.63	94.07	95.79	97.62	98.54	99.14	97.93	92.84	66.21	47.31
0.500	92.54	93.16	94.42	95.58	97.14	98.41	99.14	99.27	97.96	94.63	78.34	52.82
0.550	96.18	96.42	97.45	98.03	98.92	99.47	99.72	99.64	98.32	96.24	84.97	58.11
0.600	98.25	98.49	99.00	99.25	99.66	99.81	99.80	99.65	98.42	96.31	86.81	62.36
0.650	99.32	99.53	99.69	99.62	99.80	99.91	99.82	99.68	98.95	96.81	87.81	71.38
0.700	99.78	99.86	99.91	99.84	99.85	99.94	99.85	99.70	99.06	97.83	88.88	78.70
0.750	99.91	99.97	99.94	99.89	99.93	99.96	99.90	99.86	99.34	99.21	93.79	82.99
0.800	99.96	99.99	99.96	99.94	99.93	99.96	99.91	99.88	99.43	99.40	94.67	90.14
0.850	99.99	99.99	99.97	99.97	99.96	99.96	99.92	99.89	99.53	99.56	95.69	93.48
0.900	99.99	100.00	99.98	99.97	99.98	99.98	99.98	99.89	99.62	99.73	98.14	95.64
0.950	99.99	100.00	99.99	99.97	99.99	99.99	100.00	99.97	99.86	99.84	99.45	95.78
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 5 MeV

Scaled radius	Scaled depth interval 0.0 – 0.05	0.05 – 0.10	0.10 – 0.15	0.15 – 0.20	0.20 – 0.25	0.25 – 0.30	0.30 – 0.35	0.35 – 0.40	0.40 – 0.45	0.45 – 0.50	0.50 – 0.55	0.55 – 0.60
0.005	91.95	56.81	11.19	3.05	1.18	0.73	0.36	0.17	0.09	0.08	0.07	0.03
0.010	93.94	81.74	35.80	12.29	4.98	2.49	1.28	0.70	0.37	0.30	0.26	0.22
0.015	95.18	89.43	57.78	25.04	11.27	5.24	2.82	1.59	0.92	0.73	0.56	0.44
0.020	95.97	91.82	72.49	37.94	18.08	8.79	5.15	2.87	1.81	1.25	0.98	0.72
0.025	96.38	92.98	80.65	50.81	25.84	13.58	7.63	4.48	2.84	1.92	1.51	1.03
0.030	96.79	93.82	85.56	60.87	34.27	18.29	10.70	6.32	4.12	2.77	1.98	1.49
0.035	97.01	94.40	88.47	68.84	42.22	23.72	13.98	8.33	5.60	3.66	2.62	1.97
0.040	97.21	94.91	90.30	75.08	50.17	29.38	17.52	10.74	7.19	4.73	3.40	2.53
0.045	97.39	95.24	91.34	79.56	56.76	35.30	21.46	13.10	8.98	6.01	4.31	3.19
0.050	97.46	95.54	92.16	82.65	62.68	40.31	25.58	16.02	10.92	7.20	5.38	3.97
0.060	97.65	95.93	93.06	86.80	71.78	50.49	33.29	21.60	14.67	10.02	7.84	5.61
0.070	97.79	96.24	93.80	89.40	77.77	58.69	40.57	27.24	18.91	13.38	10.12	7.44
0.080	97.89	96.45	94.35	90.64	81.74	64.94	47.34	33.10	23.14	16.83	12.76	9.74
0.090	98.00	96.60	94.78	91.53	84.94	70.08	53.29	38.64	27.84	20.51	15.65	12.06
0.100	98.11	96.74	95.18	92.15	86.91	74.38	58.90	43.82	32.40	23.91	18.77	14.27
0.110	98.18	96.87	95.49	92.63	88.54	77.55	63.37	48.42	36.97	27.83	21.83	16.83
0.120	98.18	96.95	95.69	93.17	89.37	80.02	67.35	52.93	41.19	31.57	24.88	19.36
0.130	98.21	97.02	95.88	93.56	90.04	82.14	70.33	56.86	45.20	35.04	27.87	22.15
0.140	98.23	97.09	96.02	93.87	90.67	83.72	72.99	60.26	48.67	38.45	30.99	25.22
0.150	98.24	97.16	96.13	94.07	91.25	84.94	75.12	63.21	51.96	41.95	34.02	27.91
0.160	98.25	97.21	96.24	94.26	91.63	85.99	76.99	66.04	55.27	45.38	36.95	30.81
0.170	98.29	97.28	96.37	94.42	92.02	86.86	78.46	68.50	58.09	48.20	39.90	33.58
0.180	98.30	97.31	96.45	94.54	92.34	87.63	79.99	70.57	60.92	51.17	42.45	36.27
0.190	98.30	97.35	96.53	94.73	92.63	88.18	81.10	72.43	63.26	53.88	45.21	38.76
0.200	98.33	97.41	96.59	94.88	92.91	88.60	82.15	74.25	65.58	56.55	47.81	41.06
0.220	98.35	97.48	96.69	95.08	93.34	89.39	83.85	77.06	69.29	61.21	52.85	45.87
0.240	98.40	97.56	96.83	95.31	93.65	89.99	85.10	79.37	72.58	65.48	57.52	50.98
0.260	98.45	97.67	96.97	95.48	93.92	90.76	86.16	81.33	75.44	69.02	61.38	55.64
0.280	98.50	97.74	97.05	95.68	94.23	91.33	87.17	82.92	77.80	72.18	65.31	60.20
0.300	98.55	97.84	97.18	95.78	94.50	91.80	88.02	84.32	79.81	75.03	68.84	64.45
0.320	98.59	97.91	97.35	96.02	94.74	92.23	88.87	85.75	81.76	77.74	72.14	68.48
0.340	98.61	97.98	97.52	96.21	95.03	92.78	89.64	86.89	83.39	80.03	75.17	72.00
0.360	98.66	98.07	97.68	96.43	95.33	93.22	90.29	87.93	84.97	82.02	77.82	75.21
0.380	98.73	98.15	97.80	96.60	95.57	93.64	90.97	88.96	86.57	84.02	80.21	78.16
0.400	98.78	98.24	97.92	96.76	95.76	94.10	91.69	90.02	87.98	85.79	82.72	81.00
0.420	98.82	98.36	98.02	96.97	96.04	94.50	92.30	91.01	89.35	87.33	84.93	83.59
0.440	98.91	98.51	98.18	97.18	96.34	94.93	93.00	91.87	90.57	88.82	87.00	86.02
0.460	98.97	98.67	98.34	97.42	96.64	95.34	93.66	92.83	91.66	90.32	88.86	88.23
0.480	99.00	98.80	98.46	97.61	96.97	95.76	94.29	93.73	92.68	91.75	90.60	90.19
0.500	99.09	98.90	98.60	97.82	97.38	96.23	94.96	94.54	93.71	93.05	92.15	91.93
0.550	99.24	99.13	98.89	98.43	98.14	97.33	96.33	96.24	96.07	95.79	95.18	95.40
0.600	99.42	99.42	99.20	98.97	98.82	98.34	97.66	97.52	97.77	97.61	97.29	97.75
0.650	99.59	99.61	99.57	99.41	99.29	98.96	98.56	98.72	98.77	98.73	98.84	99.08
0.700	99.77	99.80	99.83	99.73	99.57	99.43	99.25	99.36	99.36	99.45	99.53	99.66
0.750	99.84	99.88	99.91	99.85	99.83	99.74	99.69	99.75	99.68	99.78	99.85	99.90
0.800	99.90	99.94	99.97	99.90	99.95	99.92	99.90	99.89	99.88	99.93	99.95	99.95
0.850	99.98	99.96	99.98	99.93	99.98	99.99	99.99	99.96	99.95	99.98	99.98	99.98
0.900	99.99	100.00	99.99	99.99	100.00	100.00	100.00	99.99	99.99	100.00	100.00	100.00
0.950	99.99	100.00	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 5 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.04	0.03	0.04	0.02	0.02	0.05	0.07	0.12	0.26	0.21	0.0	0.0
0.010	0.15	0.13	0.14	0.10	0.11	0.16	0.30	0.59	0.31	0.65	0.0	0.0
0.015	0.35	0.29	0.28	0.22	0.26	0.33	0.57	0.80	0.81	1.33	0.0	0.0
0.020	0.60	0.48	0.47	0.44	0.40	0.60	0.84	1.09	0.95	2.18	0.53	0.0
0.025	0.88	0.73	0.67	0.67	0.64	0.97	1.34	1.44	1.20	2.86	0.90	0.0
0.030	1.15	1.05	0.95	0.92	0.92	1.35	1.72	2.11	2.24	4.04	4.71	0.0
0.035	1.59	1.47	1.20	1.26	1.23	1.70	2.11	2.71	2.85	4.28	5.14	0.0
0.040	2.14	1.85	1.64	1.69	1.56	2.11	2.46	3.09	3.44	4.28	9.08	0.0
0.045	2.58	2.22	2.11	2.10	1.93	2.48	2.98	3.82	4.09	4.28	12.66	0.0
0.050	3.09	2.80	2.60	2.56	2.32	2.83	3.54	4.67	5.24	4.28	13.06	0.0
0.060	4.56	4.06	3.59	3.70	3.49	3.99	5.14	6.43	8.20	4.28	14.68	1.20
0.070	6.15	5.45	4.98	4.86	4.71	5.52	6.91	8.03	10.09	4.84	15.91	4.11
0.080	8.02	7.04	6.44	6.47	6.47	7.16	8.97	10.41	11.87	9.00	16.02	8.22
0.090	10.08	8.87	7.99	8.11	8.10	8.76	10.99	12.51	16.27	17.58	16.27	17.38
0.100	12.04	10.61	9.59	9.85	9.95	10.89	12.70	15.07	21.41	22.77	16.27	17.38
0.110	14.25	12.69	11.39	11.89	11.98	13.07	14.88	17.58	24.94	25.05	17.43	17.60
0.120	16.72	14.83	13.42	13.98	13.91	15.11	17.35	21.21	28.25	29.81	18.63	17.60
0.130	19.30	17.05	15.50	16.08	16.34	17.48	19.79	24.20	32.73	33.93	19.45	18.33
0.140	21.76	19.39	18.05	18.34	18.90	20.21	22.82	28.59	37.17	40.08	23.45	18.38
0.150	24.30	21.97	20.51	20.73	21.59	23.26	25.66	32.35	40.49	46.62	36.11	23.51
0.160	26.76	24.47	23.02	23.28	24.21	26.32	29.03	37.53	45.31	47.19	40.97	34.32
0.170	29.41	27.07	25.50	26.05	27.02	29.37	32.98	42.58	47.95	49.97	45.22	34.83
0.180	31.99	29.51	28.02	28.97	30.13	32.51	37.15	46.99	51.37	59.20	45.48	34.83
0.190	34.46	32.23	30.51	31.56	33.33	35.57	41.39	51.32	57.55	62.31	45.48	34.89
0.200	37.16	34.76	33.05	34.05	36.25	38.93	44.86	55.97	60.96	65.98	46.67	36.19
0.220	42.41	39.68	38.77	40.24	42.74	45.54	51.50	63.39	69.35	69.45	47.21	36.19
0.240	47.51	44.74	44.28	45.89	48.43	52.03	58.12	71.27	76.89	73.47	47.88	38.87
0.260	52.30	49.62	49.36	51.57	54.19	57.79	64.33	76.33	81.44	73.67	50.47	42.90
0.280	56.99	54.83	54.61	57.28	60.15	63.33	69.95	80.29	87.06	75.86	51.18	43.81
0.300	61.54	59.80	60.13	62.49	65.60	68.29	74.40	84.11	90.10	82.23	51.56	45.22
0.320	65.70	64.53	65.14	67.59	70.79	73.21	79.69	87.83	91.70	83.17	59.50	45.22
0.340	69.43	69.07	69.83	72.02	75.35	77.86	84.23	91.22	95.46	83.33	61.67	47.83
0.360	73.16	73.12	74.45	76.22	79.91	83.13	88.01	93.76	96.32	83.43	64.28	54.54
0.380	76.59	76.84	78.46	80.28	83.60	87.48	91.17	95.42	97.12	83.79	68.12	58.13
0.400	79.65	79.97	82.15	83.72	86.68	90.69	93.73	96.83	97.35	85.67	68.84	58.13
0.420	82.47	83.21	85.35	86.52	89.71	93.29	95.58	97.94	97.41	85.90	69.66	66.07
0.440	85.07	86.00	88.03	89.31	92.20	95.18	96.69	98.75	97.52	86.54	70.32	72.28
0.460	87.27	88.49	90.44	91.87	94.42	96.84	97.88	99.10	97.54	86.56	71.43	74.51
0.480	89.44	90.78	92.48	93.72	95.99	97.92	98.85	99.33	97.63	86.91	72.88	76.46
0.500	91.37	92.82	94.22	95.23	97.18	98.57	99.42	99.55	97.64	86.91	74.17	77.11
0.550	95.40	96.21	97.59	97.67	98.91	99.23	99.79	99.55	97.71	87.38	74.58	83.97
0.600	98.04	98.52	98.95	99.13	99.70	99.76	99.80	99.56	97.88	90.13	75.14	88.96
0.650	99.28	99.51	99.64	99.74	99.91	99.94	99.86	99.57	98.09	90.16	82.79	90.13
0.700	99.79	99.90	99.95	99.97	99.97	99.95	99.89	99.61	98.26	91.97	89.81	90.58
0.750	99.92	99.97	99.97	99.98	99.98	99.96	99.90	99.71	98.80	94.67	91.25	93.04
0.800	99.96	99.98	99.99	99.99	99.98	99.99	99.92	99.85	98.80	94.98	91.25	93.96
0.850	99.98	99.99	100.00	100.00	99.99	99.99	99.99	99.91	98.92	97.02	94.33	98.13
0.900	99.99	99.99	100.00	100.00	99.99	100.00	99.99	99.94	98.93	97.30	95.80	99.93
0.950	100.00	100.00	100.00	100.00	99.99	100.00	99.99	99.98	99.07	98.65	96.34	100.00
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 4 MeV

Scaled radius	Scaled depth interval 0.0 – 0.05	0.05 – 0.10	0.10 – 0.15	0.15 – 0.20	0.20 – 0.25	0.25 – 0.30	0.30 – 0.35	0.35 – 0.40	0.40 – 0.45	0.45 – 0.50	0.50 – 0.55	0.55 – 0.60
0.005	91.50	52.74	9.39	2.73	1.09	0.47	0.26	0.20	0.07	0.06	0.08	0.03
0.010	93.66	78.86	31.38	10.10	3.68	1.94	1.03	0.60	0.41	0.27	0.19	0.13
0.015	94.82	87.65	51.65	20.57	8.91	4.15	2.35	1.35	0.84	0.57	0.45	0.37
0.020	95.66	90.77	66.38	32.91	14.98	6.87	3.92	2.22	1.43	1.00	0.76	0.61
0.025	96.05	92.11	75.92	44.06	21.87	10.56	6.05	3.49	2.23	1.48	1.19	0.91
0.030	96.40	93.00	81.46	54.20	29.03	14.90	8.51	5.00	3.27	2.17	1.57	1.28
0.035	96.75	93.65	85.18	62.83	35.93	19.49	11.54	6.68	4.39	2.82	1.96	1.64
0.040	96.98	94.16	87.59	69.54	43.01	24.33	14.68	8.61	5.50	3.75	2.63	2.15
0.045	97.07	94.47	88.96	74.83	49.50	29.18	17.77	10.56	6.92	4.63	3.39	2.65
0.050	97.15	94.78	90.03	78.60	54.97	34.22	20.95	12.86	8.41	5.71	4.25	3.35
0.060	97.32	95.33	91.35	83.66	64.02	43.01	27.45	17.61	11.67	8.24	6.01	4.59
0.070	97.44	95.80	92.32	86.95	71.43	50.99	34.20	22.60	14.87	10.70	7.95	6.08
0.080	97.55	96.07	93.05	88.79	76.23	57.53	40.31	27.51	18.54	13.49	10.10	7.86
0.090	97.63	96.28	93.67	89.97	79.99	63.60	46.04	32.37	22.48	16.49	12.35	9.78
0.100	97.70	96.47	94.13	91.02	82.55	68.06	51.07	36.94	26.61	19.60	14.95	11.64
0.110	97.76	96.64	94.49	91.69	84.29	71.57	55.90	41.44	30.29	22.92	17.61	13.98
0.120	97.76	96.79	94.70	92.25	85.78	74.46	60.06	45.71	34.22	26.10	20.33	16.43
0.130	97.82	96.85	94.93	92.66	86.88	76.86	63.78	49.60	37.83	29.19	23.04	18.94
0.140	97.84	96.94	95.16	92.96	87.72	78.88	66.93	52.90	41.66	32.32	25.86	21.35
0.150	97.88	96.99	95.34	93.22	88.32	80.55	69.41	56.21	44.77	35.32	28.75	23.90
0.160	97.88	97.03	95.52	93.45	88.95	82.08	71.67	59.21	47.85	38.24	31.68	26.56
0.170	97.93	97.10	95.60	93.68	89.46	83.11	73.42	61.89	50.77	41.15	34.51	28.84
0.180	97.99	97.16	95.75	93.91	89.89	84.07	75.04	64.24	53.44	44.11	37.32	31.26
0.190	98.01	97.22	95.88	94.10	90.33	85.03	76.73	66.43	55.94	46.85	40.18	33.94
0.200	98.02	97.26	95.92	94.24	90.69	85.66	78.22	68.44	58.35	49.41	42.92	36.60
0.220	98.07	97.42	96.12	94.58	91.32	86.73	80.50	71.77	62.74	54.60	48.07	41.70
0.240	98.11	97.53	96.28	94.85	91.77	87.62	82.38	74.65	66.51	58.78	52.80	46.58
0.260	98.22	97.62	96.42	95.13	92.30	88.35	83.71	77.01	69.85	62.72	57.21	51.10
0.280	98.33	97.68	96.56	95.38	92.74	89.05	84.84	79.20	72.71	66.41	61.34	55.49
0.300	98.38	97.72	96.71	95.58	93.19	89.79	85.93	81.06	75.18	69.57	65.31	59.85
0.320	98.41	97.78	96.87	95.82	93.57	90.48	86.97	82.81	77.55	72.65	68.74	63.93
0.340	98.52	97.89	96.99	96.01	94.00	91.15	87.85	84.35	79.84	75.54	72.03	67.73
0.360	98.59	98.02	97.12	96.29	94.38	91.77	88.77	85.81	81.79	78.14	75.11	71.22
0.380	98.64	98.09	97.26	96.54	94.79	92.29	89.62	87.13	83.58	80.70	77.91	74.69
0.400	98.68	98.20	97.37	96.78	95.21	92.89	90.40	88.45	85.34	82.82	80.57	77.87
0.420	98.73	98.28	97.54	96.99	95.58	93.43	91.24	89.60	87.03	84.96	83.09	80.98
0.440	98.81	98.39	97.73	97.27	95.96	94.06	92.05	90.66	88.44	86.80	85.40	83.90
0.460	98.88	98.52	97.93	97.50	96.26	94.58	92.79	91.66	89.77	88.55	87.35	86.49
0.480	99.00	98.67	98.12	97.71	96.60	95.23	93.57	92.65	91.16	90.19	89.15	88.85
0.500	99.07	98.83	98.29	97.87	96.99	95.79	94.38	93.55	92.39	91.70	90.93	90.93
0.550	99.34	99.17	98.78	98.49	97.87	97.07	96.21	95.48	95.11	94.91	94.55	94.76
0.600	99.51	99.48	99.18	99.03	98.57	98.08	97.56	97.35	97.20	97.32	97.03	97.38
0.650	99.66	99.60	99.40	99.38	99.13	98.90	98.52	98.63	98.65	98.67	98.65	98.81
0.700	99.76	99.75	99.64	99.71	99.55	99.47	99.19	99.29	99.45	99.40	99.45	99.65
0.750	99.86	99.82	99.87	99.85	99.82	99.80	99.67	99.72	99.83	99.77	99.79	99.92
0.800	99.90	99.91	99.96	99.96	99.93	99.94	99.88	99.91	99.95	99.89	99.96	99.98
0.850	99.94	99.92	99.98	99.98	99.97	99.99	99.97	99.95	99.99	99.94	99.98	99.98
0.900	99.98	99.96	99.98	99.99	99.98	100.00	99.99	99.99	100.00	99.97	100.00	100.00
0.950	100.00	99.99	100.00	100.00	99.99	100.00	99.99	99.99	100.00	99.98	100.00	100.00
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 4 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.05	0.02	0.02	0.06	0.02	0.02	0.01	0.0	0.0	0.0	0.0	0.0
0.010	0.13	0.09	0.09	0.10	0.11	0.08	0.07	0.06	0.0	0.0	0.0	0.0
0.015	0.28	0.20	0.18	0.20	0.31	0.18	0.27	0.20	0.0	1.32	0.0	0.0
0.020	0.51	0.37	0.41	0.34	0.51	0.42	0.38	0.27	0.0	3.86	0.0	0.0
0.025	0.79	0.60	0.68	0.52	0.74	0.75	0.48	0.36	0.06	5.37	0.0	0.0
0.030	1.05	0.89	0.96	0.80	1.04	1.06	0.75	0.76	0.18	7.22	0.0	0.0
0.035	1.48	1.20	1.29	1.20	1.48	1.33	1.04	1.13	0.23	7.97	1.24	0.0
0.040	1.87	1.57	1.58	1.54	1.94	1.86	1.44	2.10	0.71	9.43	1.24	0.0
0.045	2.33	2.00	1.96	1.98	2.37	2.34	2.02	2.95	1.91	9.43	1.24	0.0
0.050	2.82	2.41	2.35	2.42	2.83	2.80	2.59	3.65	3.91	9.43	1.24	0.0
0.060	4.07	3.36	3.27	3.43	3.88	4.11	3.70	4.99	4.60	9.43	1.24	0.0
0.070	5.31	4.34	4.35	4.71	5.20	5.73	5.24	6.23	5.28	9.43	1.24	0.0
0.080	6.84	5.81	5.82	6.09	6.65	7.17	6.77	7.87	6.70	18.02	1.24	0.0
0.090	8.48	7.45	7.48	7.61	8.41	8.96	8.32	10.16	9.97	23.23	1.24	0.0
0.100	10.37	9.06	9.15	9.27	10.33	11.09	10.27	12.37	14.73	25.51	1.76	0.0
0.110	12.33	10.98	11.05	11.05	11.98	13.22	12.35	14.50	20.00	28.23	1.76	0.0
0.120	14.43	13.03	13.00	13.16	14.33	15.53	15.60	18.14	22.80	31.19	2.96	0.0
0.130	16.64	15.06	15.09	15.45	16.45	17.55	18.20	21.13	26.56	35.51	5.07	0.0
0.140	18.85	17.22	17.44	17.64	18.81	19.80	21.33	25.60	30.96	41.14	5.55	2.22
0.150	21.13	19.59	20.01	19.88	21.50	22.39	24.77	29.73	35.42	45.01	5.55	8.04
0.160	23.58	21.86	22.35	22.31	24.15	24.93	27.90	33.57	39.94	49.99	5.55	8.04
0.170	26.00	24.24	24.81	24.93	26.89	28.04	31.62	37.01	42.59	51.50	10.61	8.34
0.180	28.44	26.78	27.38	27.33	29.41	31.01	35.29	40.72	46.77	55.17	13.64	15.94
0.190	30.76	29.31	29.89	29.94	31.99	34.05	39.34	45.73	49.68	62.82	17.41	15.94
0.200	33.26	31.87	32.51	32.35	34.70	37.21	43.51	49.57	54.76	65.65	17.41	15.94
0.220	38.14	37.18	37.80	38.15	40.24	43.68	50.63	56.61	62.38	71.63	18.18	15.94
0.240	43.24	42.10	42.87	43.76	46.51	50.09	57.31	64.12	74.43	78.71	18.18	18.91
0.260	48.30	47.23	48.13	49.50	52.24	56.67	64.38	73.17	80.64	81.22	18.18	23.62
0.280	52.93	52.15	53.66	55.00	58.01	62.88	71.06	79.34	84.80	82.09	22.01	35.66
0.300	57.38	57.17	58.66	60.91	63.92	68.39	76.67	84.27	86.83	82.33	28.92	40.35
0.320	61.67	61.94	63.63	66.24	69.20	73.84	81.48	88.86	89.53	84.35	33.23	46.02
0.340	65.84	66.45	68.60	71.43	73.93	78.41	85.53	91.72	92.02	85.30	35.78	47.91
0.360	69.73	70.57	72.82	75.78	78.61	83.03	89.02	94.19	93.06	86.04	43.17	47.91
0.380	73.41	74.50	76.65	80.12	82.79	86.76	91.59	96.19	93.85	89.46	48.35	48.23
0.400	76.87	78.15	80.32	83.72	86.19	89.92	93.21	97.64	94.68	90.83	54.15	48.23
0.420	80.29	81.72	83.50	87.15	89.19	92.60	95.10	98.11	94.68	91.29	59.16	49.64
0.440	83.21	85.01	86.53	89.79	91.91	94.52	96.42	98.76	94.68	91.29	70.45	49.64
0.460	85.90	87.75	89.21	92.10	93.89	96.43	97.40	98.97	94.82	91.29	73.78	49.70
0.480	88.30	90.08	91.72	94.09	95.71	97.79	98.47	99.12	95.52	91.80	80.19	51.56
0.500	90.67	92.04	93.43	95.78	97.14	98.42	99.01	99.21	96.03	91.80	80.47	60.05
0.550	94.80	96.01	96.83	98.11	99.08	99.46	99.69	99.53	97.19	92.89	82.89	63.86
0.600	97.58	98.40	98.90	99.40	99.72	99.82	99.91	99.53	97.88	92.89	84.73	78.00
0.650	99.15	99.52	99.75	99.87	99.93	99.87	99.98	99.65	98.90	94.60	86.64	78.99
0.700	99.80	99.87	99.95	99.98	99.96	99.87	99.98	99.71	99.04	94.72	89.11	80.68
0.750	99.96	99.97	99.96	99.99	99.99	99.93	99.99	99.90	99.31	95.72	90.56	82.73
0.800	99.99	99.99	99.97	99.99	100.00	99.98	100.00	99.91	99.63	97.43	90.66	83.80
0.850	99.99	99.99	99.97	99.99	100.00	99.98	100.00	99.96	99.63	97.62	91.91	85.07
0.900	100.00	99.99	99.99	99.99	100.00	99.99	100.00	99.98	99.68	98.06	91.91	95.34
0.950	100.00	99.99	100.00	100.00	100.00	99.99	100.00	100.00	99.85	98.57	94.12	100.00
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 3 MeV

Scaled radius	Scaled depth interval 0.0 – 0.05	0.05 – 0.10	0.10 – 0.15	0.15 – 0.20	0.20 – 0.25	0.25 – 0.30	0.30 – 0.35	0.35 – 0.40	0.40 – 0.45	0.45 – 0.50	0.50 – 0.55	0.55 – 0.60
0.005	90.17	51.37	8.92	2.33	0.81	0.39	0.19	0.15	0.11	0.06	0.04	0.05
0.010	92.18	77.52	28.99	8.86	3.17	1.53	0.88	0.55	0.29	0.21	0.11	0.13
0.015	93.42	86.44	48.82	18.20	7.11	3.52	1.91	1.05	0.69	0.48	0.34	0.26
0.020	94.17	89.49	63.83	28.82	12.51	6.11	3.29	1.92	1.21	0.87	0.56	0.46
0.025	94.66	90.95	73.42	39.90	18.46	9.27	4.97	2.93	1.86	1.35	0.83	0.73
0.030	95.06	91.68	79.61	49.61	25.33	12.94	6.91	4.11	2.78	1.92	1.29	1.01
0.035	95.37	92.26	83.71	57.96	31.74	16.75	9.17	5.34	3.63	2.59	1.74	1.40
0.040	95.61	92.81	86.22	64.90	37.97	20.69	11.68	6.98	4.60	3.29	2.33	1.86
0.045	95.77	93.22	87.96	70.09	43.94	24.97	14.40	8.61	5.84	4.12	3.01	2.33
0.050	95.91	93.56	89.16	73.76	49.82	29.25	17.08	10.40	6.96	5.04	3.68	2.80
0.060	96.16	94.17	90.61	79.55	58.81	37.79	22.86	14.42	9.69	7.02	5.40	3.93
0.070	96.28	94.59	91.58	83.11	65.73	45.45	28.76	18.81	12.85	9.22	7.11	5.28
0.080	96.37	94.83	92.36	85.21	71.21	52.23	34.75	23.01	16.17	11.70	8.99	6.90
0.090	96.45	95.07	92.92	86.90	74.78	57.77	40.34	27.78	19.29	14.28	10.86	8.71
0.100	96.53	95.22	93.41	88.06	77.81	62.38	45.49	31.97	23.09	17.13	13.21	10.70
0.110	96.64	95.39	93.78	88.95	79.99	66.33	50.28	36.21	26.73	20.13	15.53	12.89
0.120	96.66	95.59	94.02	89.58	81.39	69.48	54.40	40.10	30.12	23.14	18.16	14.93
0.130	96.70	95.71	94.26	90.14	82.52	72.22	57.96	43.69	33.68	26.15	20.86	17.19
0.140	96.79	95.81	94.34	90.54	83.47	74.31	61.04	46.92	37.08	28.94	23.60	19.44
0.150	96.86	95.91	94.50	90.88	84.42	76.03	63.78	50.04	40.19	31.73	26.51	21.76
0.160	96.91	95.97	94.62	91.20	85.01	77.65	66.11	52.89	43.16	34.58	29.24	24.30
0.170	96.95	96.04	94.67	91.46	85.56	79.09	67.99	55.83	46.00	37.65	31.96	26.70
0.180	96.98	96.12	94.76	91.69	86.03	80.34	69.76	58.27	48.80	40.23	34.61	29.22
0.190	97.02	96.21	94.88	91.90	86.59	81.24	71.25	60.48	51.48	42.93	37.16	31.74
0.200	97.07	96.28	95.03	92.05	86.93	82.10	72.64	62.62	53.71	45.43	39.68	34.27
0.220	97.14	96.44	95.15	92.35	87.72	83.55	75.24	66.28	58.03	50.41	44.68	39.45
0.240	97.26	96.55	95.32	92.64	88.36	84.70	77.44	69.38	62.05	55.07	49.49	44.27
0.260	97.34	96.63	95.43	93.06	88.89	85.75	79.23	72.11	65.69	59.18	54.21	49.02
0.280	97.40	96.69	95.59	93.43	89.37	86.47	80.73	74.51	68.88	62.90	58.47	53.67
0.300	97.46	96.82	95.83	93.73	89.82	87.45	82.17	76.59	71.75	66.43	62.47	58.11
0.320	97.53	96.97	95.98	94.06	90.32	88.29	83.49	78.59	74.16	69.64	66.41	62.36
0.340	97.67	97.14	96.21	94.32	90.83	89.04	84.73	80.39	76.38	72.66	70.13	66.21
0.360	97.81	97.34	96.43	94.61	91.38	89.74	85.92	82.14	78.54	75.52	73.53	69.90
0.380	97.93	97.58	96.67	94.93	91.83	90.45	86.95	83.68	80.70	77.98	76.56	73.50
0.400	98.08	97.77	96.94	95.17	92.33	91.24	88.11	85.44	82.66	80.35	79.36	76.82
0.420	98.23	97.90	97.08	95.47	92.97	91.88	89.16	86.95	84.63	82.56	81.93	79.85
0.440	98.40	98.00	97.26	95.82	93.61	92.62	90.17	88.48	86.60	84.71	84.32	82.53
0.460	98.52	98.15	97.42	96.19	94.19	93.30	91.12	89.77	88.36	86.89	86.50	85.20
0.480	98.68	98.30	97.62	96.64	94.79	94.02	92.16	91.02	89.96	88.90	88.62	87.52
0.500	98.86	98.48	97.93	97.05	95.36	94.68	93.17	92.27	91.42	90.59	90.48	89.72
0.550	99.25	98.96	98.41	97.99	96.47	96.37	95.23	95.15	94.44	94.28	94.48	94.25
0.600	99.47	99.29	98.77	98.65	97.47	97.84	96.96	97.16	96.88	96.81	97.18	97.13
0.650	99.65	99.64	99.24	99.16	98.53	98.77	98.45	98.61	98.44	98.41	98.65	98.72
0.700	99.82	99.82	99.59	99.54	99.27	99.31	99.33	99.40	99.25	99.44	99.52	99.59
0.750	99.93	99.90	99.81	99.79	99.66	99.75	99.75	99.78	99.73	99.81	99.81	99.90
0.800	99.97	99.96	99.98	99.95	99.82	99.92	99.94	99.93	99.86	99.97	99.94	99.96
0.850	99.98	99.96	100.00	99.99	99.91	99.98	99.99	99.99	99.92	100.00	99.98	99.98
0.900	99.99	99.99	100.00	100.00	99.95	100.00	99.99	100.00	99.98	100.00	100.00	99.99
0.950	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 3 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.03	0.04	0.03	0.02	0.03	0.04	0.08	0.0	0.34	0.0	0.0	0.0
0.010	0.11	0.09	0.16	0.13	0.08	0.14	0.32	0.0	0.45	3.51	0.0	0.0
0.015	0.26	0.22	0.32	0.27	0.25	0.25	0.53	0.0	0.58	3.51	0.0	0.0
0.020	0.45	0.41	0.53	0.54	0.45	0.40	0.82	0.15	0.89	3.51	0.0	0.0
0.025	0.69	0.61	0.78	0.77	0.69	0.64	1.23	0.50	1.86	9.02	0.0	0.0
0.030	1.04	0.85	1.01	1.00	1.01	0.91	1.70	1.07	3.56	15.41	0.0	0.39
0.035	1.41	1.19	1.36	1.31	1.34	1.26	2.20	2.00	4.44	18.10	0.0	0.39
0.040	1.84	1.65	1.69	1.75	1.69	1.66	2.61	3.37	4.85	20.58	0.0	0.39
0.045	2.22	2.00	2.04	2.18	2.14	1.94	3.04	4.61	5.91	22.46	0.0	0.39
0.050	2.66	2.44	2.51	2.73	2.65	2.36	3.50	5.32	6.44	22.46	0.0	0.39
0.060	3.64	3.44	3.41	3.89	3.66	3.28	4.91	6.71	8.14	22.46	0.0	0.39
0.070	4.80	4.60	4.45	5.16	5.09	4.57	6.38	8.32	9.02	22.46	0.0	0.39
0.080	6.12	5.82	5.81	6.55	6.52	6.40	8.42	10.91	10.76	22.46	0.0	8.77
0.090	7.58	7.15	7.09	8.10	8.21	8.21	10.77	13.44	12.10	26.43	0.03	18.81
0.100	9.30	8.55	8.58	9.83	10.04	9.95	12.76	16.04	14.91	27.27	0.03	18.81
0.110	11.02	10.09	10.08	11.76	12.10	12.65	15.04	18.57	17.28	27.27	0.03	18.81
0.120	12.92	11.89	12.06	13.71	14.35	15.04	17.38	22.06	19.44	30.96	0.03	18.81
0.130	15.02	13.70	14.08	15.81	16.58	17.76	20.33	25.33	24.76	33.89	0.03	18.81
0.140	17.16	15.81	16.15	17.87	18.94	20.37	23.33	28.15	28.54	48.20	0.03	18.81
0.150	19.61	17.97	18.13	19.81	21.09	23.29	26.98	32.17	33.86	59.45	0.03	18.81
0.160	21.86	20.15	20.37	22.13	23.47	26.41	30.28	35.93	39.88	59.45	0.03	18.81
0.170	24.13	22.51	22.65	24.55	26.22	29.10	33.19	39.81	42.96	59.45	0.74	23.69
0.180	26.60	24.90	24.90	27.05	29.16	32.16	36.30	42.46	47.69	59.45	0.74	24.29
0.190	29.10	27.43	27.49	29.40	31.93	34.80	38.81	45.63	51.56	59.45	0.74	24.29
0.200	31.70	30.03	30.31	32.04	35.03	37.73	41.89	48.56	53.00	59.45	0.74	36.37
0.220	36.62	35.46	35.77	37.44	40.23	44.27	49.58	54.59	64.59	71.27	0.74	36.37
0.240	41.55	40.61	41.22	43.06	45.90	50.49	56.55	63.29	68.97	88.06	3.06	41.89
0.260	46.60	45.59	46.80	48.50	51.90	56.96	63.29	70.48	76.14	88.44	3.06	45.40
0.280	51.52	50.36	51.95	54.34	58.14	63.18	68.83	74.71	80.44	88.61	3.25	45.78
0.300	56.21	55.64	57.15	60.41	63.90	68.26	75.37	80.21	83.89	88.61	9.89	51.94
0.320	60.82	60.70	62.59	65.88	69.67	73.76	79.61	84.57	89.54	93.62	10.34	51.94
0.340	65.24	65.66	67.31	70.74	74.22	79.30	84.10	89.45	92.75	93.62	10.64	57.05
0.360	69.14	70.12	72.01	75.49	78.45	84.18	87.88	91.42	93.28	93.62	10.64	57.05
0.380	72.90	74.30	76.37	79.76	82.48	87.84	90.37	94.10	93.90	93.62	13.96	63.99
0.400	76.76	78.12	80.16	83.58	85.94	90.57	93.00	95.58	95.82	93.62	33.65	65.36
0.420	79.97	81.95	83.50	87.04	89.09	93.13	95.39	97.21	95.82	93.71	33.65	66.43
0.440	83.07	85.01	86.52	89.87	91.95	95.14	97.11	98.36	95.95	94.69	42.37	66.43
0.460	85.81	88.08	89.29	92.45	94.12	96.54	98.38	98.82	96.02	94.73	42.67	66.86
0.480	88.31	90.28	91.66	94.54	95.91	97.26	99.07	98.97	96.03	94.73	42.67	68.39
0.500	90.62	92.27	93.57	96.23	97.33	97.84	99.36	99.64	96.22	97.24	48.04	68.39
0.550	95.22	96.29	96.91	98.53	99.16	99.16	99.72	99.91	99.05	97.24	69.86	82.45
0.600	97.81	98.41	98.84	99.45	99.66	99.71	99.92	99.91	99.15	97.24	76.55	83.80
0.650	99.29	99.50	99.76	99.77	99.91	99.87	99.93	99.91	99.15	98.63	78.85	83.85
0.700	99.80	99.84	99.97	99.90	99.92	99.89	99.94	99.96	99.23	98.63	94.18	83.85
0.750	99.97	99.98	100.00	99.97	99.93	99.89	99.94	99.96	99.23	98.65	97.13	85.85
0.800	99.99	100.00	100.00	99.97	99.94	99.89	99.94	99.96	99.34	98.65	97.13	85.85
0.850	100.00	100.00	100.00	99.99	99.96	99.98	99.94	99.98	99.49	98.65	97.13	95.31
0.900	100.00	100.00	100.00	100.00	100.00	99.99	99.99	99.98	100.00	98.70	97.13	95.31
0.950	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.98	100.00	98.88	97.13	99.34
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 2 MeV

Scaled radius	Scaled depth interval 0.0 – 0.05	0.05 – 0.10	0.10 – 0.15	0.15 – 0.20	0.20 – 0.25	0.25 – 0.30	0.30 – 0.35	0.35 – 0.40	0.40 – 0.45	0.45 – 0.50	0.50 – 0.55	0.55 – 0.60
0.005	89.32	45.96	6.40	1.63	0.55	0.25	0.15	0.11	0.06	0.03	0.05	0.02
0.010	91.32	72.02	22.92	6.39	2.24	1.05	0.57	0.44	0.30	0.10	0.13	0.13
0.015	92.58	82.49	40.86	13.41	5.09	2.45	1.27	1.04	0.65	0.30	0.29	0.24
0.020	93.34	86.43	55.02	21.80	9.00	4.43	2.27	1.59	1.04	0.56	0.50	0.40
0.025	93.85	87.97	64.90	30.75	13.61	6.84	3.53	2.39	1.51	1.02	0.77	0.59
0.030	94.25	89.06	72.01	39.59	18.47	9.50	5.15	3.30	2.02	1.42	1.05	0.86
0.035	94.48	89.71	76.51	47.36	24.04	12.52	6.84	4.35	2.83	1.88	1.39	1.09
0.040	94.68	90.31	79.95	53.96	29.32	15.47	8.78	5.44	3.70	2.49	1.84	1.48
0.045	94.88	90.83	82.23	59.87	34.39	18.59	10.80	6.87	4.46	3.15	2.33	1.86
0.050	95.02	91.20	83.64	64.30	39.63	22.16	12.98	8.37	5.41	3.87	2.86	2.28
0.060	95.17	91.89	85.59	70.77	48.74	28.94	17.30	11.53	7.42	5.56	4.13	3.31
0.070	95.29	92.39	86.73	75.01	55.95	35.83	22.04	14.96	9.94	7.37	5.64	4.60
0.080	95.41	92.77	87.52	78.05	61.82	42.00	26.91	18.47	12.85	9.27	7.25	6.02
0.090	95.49	93.03	88.13	80.09	66.13	47.66	31.42	22.12	15.44	11.56	8.98	7.62
0.100	95.58	93.23	88.64	81.56	69.38	52.40	36.04	25.84	18.17	14.12	10.84	9.33
0.110	95.64	93.40	89.03	82.54	72.12	56.31	40.23	29.55	21.26	16.46	12.83	11.21
0.120	95.65	93.52	89.31	83.52	74.27	59.74	44.17	32.91	24.45	19.08	14.90	13.44
0.130	95.70	93.62	89.55	84.20	75.97	62.82	47.54	36.18	27.39	21.72	17.32	15.42
0.140	95.78	93.74	89.73	84.80	77.19	65.27	50.69	39.14	30.34	24.52	19.69	17.46
0.150	95.83	93.80	89.90	85.30	78.45	67.56	53.58	42.05	33.46	27.39	22.00	19.51
0.160	95.87	93.88	90.05	85.70	79.29	69.36	56.45	44.88	36.09	29.93	24.48	21.55
0.170	95.92	93.96	90.21	86.13	80.19	70.94	58.68	47.41	38.87	32.51	27.11	23.86
0.180	95.97	94.04	90.37	86.49	81.06	72.39	60.68	49.99	41.42	35.04	29.62	26.23
0.190	96.03	94.16	90.53	86.78	81.73	73.57	62.55	52.34	43.93	37.45	31.93	28.88
0.200	96.09	94.22	90.71	87.10	82.40	74.84	64.14	54.55	46.19	39.76	34.25	31.38
0.220	96.18	94.35	91.02	87.62	83.41	76.88	67.34	58.44	50.61	44.68	39.16	36.17
0.240	96.30	94.43	91.36	88.14	84.13	78.46	69.93	61.87	54.53	49.40	43.92	41.11
0.260	96.40	94.56	91.70	88.59	84.96	79.85	72.42	65.17	58.03	53.56	48.26	46.23
0.280	96.50	94.85	92.00	88.95	85.64	81.25	74.42	68.00	61.50	57.45	52.34	50.78
0.300	96.57	95.06	92.28	89.36	86.31	82.45	76.27	70.57	64.83	61.19	56.76	55.44
0.320	96.66	95.23	92.57	89.81	86.87	83.57	78.00	73.21	67.96	64.64	60.81	59.67
0.340	96.85	95.46	92.85	90.27	87.60	84.59	79.64	75.50	70.93	67.94	64.55	63.64
0.360	97.06	95.70	93.12	90.79	88.37	85.66	81.19	77.79	73.64	71.14	68.15	67.81
0.380	97.22	95.96	93.42	91.24	89.14	86.62	82.70	79.88	76.26	74.18	71.46	71.64
0.400	97.42	96.21	93.79	91.75	89.87	87.65	84.22	82.03	78.64	77.01	74.63	75.35
0.420	97.53	96.46	94.22	92.36	90.61	88.78	85.69	83.97	81.22	79.75	77.76	78.60
0.440	97.70	96.70	94.52	93.00	91.45	89.89	87.02	85.80	83.59	82.36	80.56	81.49
0.460	97.92	96.95	95.15	93.59	92.29	90.89	88.42	87.47	85.75	84.64	83.28	84.34
0.480	98.11	97.26	95.64	94.17	93.00	91.82	89.82	89.07	87.82	86.70	85.89	86.75
0.500	98.30	97.51	95.99	94.68	93.77	92.77	91.24	90.54	89.73	88.62	88.28	88.99
0.550	98.64	98.10	97.02	96.12	95.53	94.88	94.32	93.59	93.45	92.93	92.89	93.74
0.600	99.01	98.74	98.04	97.41	97.09	96.84	96.42	96.07	96.28	96.13	96.10	96.85
0.650	99.40	99.24	98.77	98.53	98.40	98.26	97.97	97.70	98.13	98.00	98.03	98.59
0.700	99.64	99.63	99.36	99.34	99.15	99.11	99.01	98.90	99.15	99.12	99.12	99.30
0.750	99.88	99.86	99.73	99.72	99.62	99.63	99.64	99.64	99.68	99.71	99.67	99.78
0.800	99.98	99.97	99.91	99.91	99.93	99.87	99.84	99.89	99.90	99.92	99.96	99.97
0.850	100.00	99.99	99.99	99.97	99.98	99.99	99.97	99.98	99.98	99.99	100.00	100.00
0.900	100.00	99.99	100.00	99.98	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
0.950	100.00	99.99	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 2 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.02	0.01	0.01	0.06	0.09	0.00	0.01	0.06	0.0	0.0	0.0	0.0
0.010	0.09	0.09	0.12	0.17	0.25	0.06	0.16	0.12	0.0	0.0	0.0	0.0
0.015	0.20	0.20	0.21	0.32	0.36	0.29	0.31	0.33	0.0	0.0	0.0	0.0
0.020	0.37	0.36	0.37	0.52	0.57	0.48	0.49	0.95	0.0	0.0	0.0	0.0
0.025	0.58	0.51	0.60	0.80	0.79	0.85	0.73	1.43	0.0	0.0	0.0	0.0
0.030	0.86	0.69	0.90	1.07	1.07	1.15	1.03	2.43	0.0	0.0	0.0	0.0
0.035	1.17	0.93	1.17	1.44	1.52	1.76	1.63	3.76	0.0	0.0	0.0	0.0
0.040	1.50	1.20	1.54	1.76	1.96	2.13	2.13	4.64	0.0	0.0	0.0	0.0
0.045	1.92	1.48	1.87	2.19	2.38	2.54	2.70	5.18	0.0	0.0	0.0	0.0
0.050	2.25	1.90	2.29	2.63	2.84	3.08	3.12	5.52	0.56	0.0	0.0	0.0
0.060	2.99	2.74	3.08	3.66	3.86	4.29	4.24	6.78	7.01	0.0	0.0	0.0
0.070	4.10	3.63	4.03	4.71	4.88	5.32	5.89	8.97	10.15	0.0	0.0	0.0
0.080	5.29	4.68	5.30	5.99	6.45	6.60	7.57	11.29	11.83	0.0	0.0	0.0
0.090	6.54	5.87	6.68	7.44	8.21	8.19	9.05	13.50	13.64	0.0	0.0	0.0
0.100	7.94	7.24	8.22	9.17	10.24	10.50	11.18	16.06	16.45	0.0	0.0	0.0
0.110	9.62	8.95	10.07	11.10	12.19	12.45	13.50	19.88	22.34	0.0	0.0	0.0
0.120	11.27	10.66	11.70	13.15	14.38	14.44	15.62	22.29	26.20	2.73	0.0	0.0
0.130	13.10	12.54	13.66	15.23	16.64	16.90	17.74	26.75	31.46	2.73	0.0	0.0
0.140	15.19	14.38	15.78	17.22	19.08	19.37	21.13	31.31	37.81	2.73	0.0	0.0
0.150	17.18	16.53	17.81	19.38	21.73	22.23	25.04	34.48	40.67	8.41	0.0	0.56
0.160	19.50	18.78	20.16	21.88	24.47	25.36	28.87	38.23	46.22	11.15	0.0	0.56
0.170	21.75	20.90	22.47	24.29	27.33	29.08	32.25	43.16	49.12	26.22	0.0	0.56
0.180	23.88	23.36	24.95	27.05	30.49	32.61	36.62	48.17	50.39	26.22	4.90	0.56
0.190	26.13	25.87	27.57	29.75	33.61	35.83	40.25	52.72	52.36	26.22	4.90	0.56
0.200	28.72	28.24	29.96	32.04	36.35	39.06	44.35	54.41	55.60	41.77	4.96	0.56
0.220	33.67	33.22	34.59	36.95	41.91	45.35	51.65	60.65	62.93	54.39	4.96	0.56
0.240	38.53	38.70	39.74	42.45	46.78	51.43	58.39	67.13	74.21	54.39	14.95	0.56
0.260	43.80	44.20	45.08	48.11	52.60	57.19	65.55	73.90	84.26	54.39	15.68	0.56
0.280	48.91	49.68	50.52	53.58	58.04	63.71	71.98	79.19	86.13	54.39	15.68	0.56
0.300	53.59	54.86	56.11	59.15	63.97	69.31	76.94	83.18	90.59	54.39	15.68	0.56
0.320	58.39	60.14	61.58	65.44	69.91	74.74	82.11	85.67	94.89	54.39	17.00	0.56
0.340	62.88	65.15	66.50	70.81	75.11	79.16	85.63	89.29	94.89	67.70	25.57	8.26
0.360	67.46	69.57	71.21	75.35	79.51	82.79	89.29	92.99	96.01	70.51	25.57	19.73
0.380	71.82	73.93	75.98	79.78	83.78	86.70	92.16	96.05	97.02	70.51	35.48	19.73
0.400	75.59	78.19	79.75	83.81	87.71	90.09	94.33	97.47	97.02	70.51	35.48	19.73
0.420	78.84	82.16	83.17	87.24	90.59	92.74	96.61	98.13	97.02	70.64	35.51	19.73
0.440	82.11	85.56	86.24	90.60	93.15	95.18	97.39	98.40	97.02	70.64	35.51	23.25
0.460	85.05	88.44	89.30	93.09	95.21	96.57	97.92	98.92	97.77	70.64	35.51	23.25
0.480	87.59	90.84	91.64	95.03	96.88	97.75	98.57	99.60	97.77	70.64	35.51	23.25
0.500	89.94	92.80	93.75	96.53	97.85	98.39	99.07	99.79	97.77	70.64	35.51	45.59
0.550	94.72	96.42	97.27	98.78	99.12	99.64	99.37	99.82	97.82	72.29	46.82	45.59
0.600	97.72	98.56	99.08	99.59	99.72	99.80	99.64	99.82	97.88	73.69	51.48	45.59
0.650	99.22	99.44	99.77	99.89	99.88	99.98	99.79	99.82	98.40	73.73	51.48	60.63
0.700	99.68	99.81	99.94	99.97	100.00	99.98	99.95	99.90	98.79	75.34	58.55	60.63
0.750	99.92	99.95	99.98	99.97	100.00	99.98	99.95	99.92	99.06	92.66	100.00	60.63
0.800	99.99	100.00	100.00	99.99	100.00	99.98	99.95	99.92	99.46	96.06	100.00	86.12
0.850	100.00	100.00	100.00	99.99	100.00	99.99	99.97	99.92	99.48	96.06	100.00	91.81
0.900	100.00	100.00	100.00	100.00	100.00	100.00	99.98	99.93	99.48	96.06	100.00	91.81
0.950	100.00	100.00	100.00	100.00	100.00	100.00	99.98	100.00	100.00	98.75	100.00	91.96
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 1 MeV

Scaled radius	Scaled depth interval 0.0 – 0.05	0.05 – 0.10	0.10 – 0.15	0.15 – 0.20	0.20 – 0.25	0.25 – 0.30	0.30 – 0.35	0.35 – 0.40	0.40 – 0.45	0.45 – 0.50	0.50 – 0.55	0.55 – 0.60
0.005	84.72	42.10	5.10	1.23	0.55	0.18	0.15	0.06	0.03	0.03	0.02	0.02
0.010	86.48	65.04	18.09	4.71	1.77	0.86	0.52	0.27	0.17	0.14	0.09	0.10
0.015	87.51	75.54	32.39	9.86	3.88	1.98	1.11	0.65	0.42	0.34	0.20	0.21
0.020	88.16	79.91	45.59	16.70	6.94	3.13	1.82	1.14	0.75	0.62	0.41	0.36
0.025	88.62	82.09	55.38	23.91	10.30	4.90	2.75	1.70	1.06	0.96	0.63	0.60
0.030	89.01	83.40	62.89	30.76	14.20	6.86	3.93	2.39	1.54	1.31	0.90	0.86
0.035	89.32	83.90	68.44	37.29	18.32	9.15	5.21	3.15	2.10	1.80	1.29	1.19
0.040	89.60	84.45	71.96	43.26	22.20	11.55	6.56	4.02	2.72	2.30	1.70	1.62
0.045	89.73	84.92	74.40	48.58	26.43	13.93	8.13	5.14	3.51	2.89	2.17	2.08
0.050	89.90	85.29	76.48	53.10	30.52	16.66	9.86	6.18	4.31	3.50	2.70	2.49
0.060	90.13	85.83	78.91	59.81	38.30	22.16	13.59	8.55	6.02	4.95	3.88	3.37
0.070	90.36	86.24	80.20	64.95	44.94	27.90	17.20	11.07	8.03	6.46	5.13	4.39
0.080	90.46	86.58	81.15	68.76	50.52	32.89	21.32	13.89	10.23	8.07	6.57	5.65
0.090	90.58	86.95	81.84	71.09	55.04	38.06	25.62	17.07	12.57	9.84	8.20	7.11
0.100	90.72	87.24	82.42	72.81	58.77	42.70	29.56	20.10	14.89	11.80	9.73	8.71
0.110	90.83	87.44	82.85	74.39	61.82	46.51	33.40	23.22	17.32	13.96	11.57	10.72
0.120	90.91	87.62	83.18	75.55	64.29	49.80	37.13	26.14	19.86	16.30	13.52	12.44
0.130	90.97	87.78	83.52	76.40	66.42	52.87	40.33	29.13	22.44	18.63	15.49	14.17
0.140	91.04	88.01	83.87	77.25	68.21	55.26	43.37	32.04	25.18	20.71	17.60	16.04
0.150	91.17	88.17	84.09	77.88	69.69	57.48	46.12	34.71	27.78	22.98	19.68	18.12
0.160	91.26	88.22	84.41	78.40	71.00	59.52	48.99	37.36	30.38	25.45	21.85	20.34
0.170	91.36	88.36	84.64	78.79	71.85	61.60	51.34	39.90	32.91	27.75	23.97	22.56
0.180	91.48	88.45	84.92	79.31	72.92	63.42	53.65	42.53	35.34	30.07	26.21	24.70
0.190	91.61	88.57	85.08	79.78	73.76	64.91	55.57	44.76	37.63	32.53	28.56	26.74
0.200	91.71	88.68	85.33	80.26	74.63	66.25	57.52	47.18	40.14	34.90	30.90	29.17
0.220	91.86	88.99	85.75	80.95	76.09	68.62	60.99	51.23	44.64	39.81	35.67	33.94
0.240	92.06	89.29	86.13	81.86	77.25	70.90	63.96	55.18	48.94	44.33	40.24	39.01
0.260	92.30	89.67	86.60	82.64	78.54	72.74	66.62	58.55	52.89	48.40	44.70	43.69
0.280	92.59	90.05	87.11	83.42	79.68	74.34	69.17	62.14	56.76	52.55	49.13	48.54
0.300	92.84	90.40	87.71	84.31	80.90	75.91	71.51	65.04	60.36	56.17	53.34	53.08
0.320	93.21	90.74	88.27	85.15	81.92	77.44	73.70	68.06	64.01	60.07	57.44	57.38
0.340	93.53	91.11	89.01	85.99	83.24	79.19	75.99	70.69	67.13	63.92	61.35	61.39
0.360	93.85	91.67	89.70	86.86	84.42	80.67	78.07	73.16	70.23	67.38	64.93	65.37
0.380	94.22	92.25	90.38	87.92	85.69	82.26	80.10	75.59	73.04	70.62	68.49	69.11
0.400	94.70	92.85	91.14	88.80	86.72	83.75	81.91	78.05	75.79	73.64	72.00	72.91
0.420	94.97	93.32	91.93	89.71	87.83	85.22	83.49	80.29	78.48	76.61	75.10	76.34
0.440	95.34	93.99	92.61	90.59	88.85	86.62	85.11	82.34	80.92	79.49	78.14	79.51
0.460	95.75	94.64	93.28	91.36	89.77	87.96	86.84	84.27	83.24	82.25	80.99	82.74
0.480	96.22	95.22	93.91	92.14	90.77	89.35	88.49	86.21	85.55	84.75	83.79	85.59
0.500	96.58	95.74	94.43	92.94	91.76	90.62	89.90	88.04	87.72	87.08	86.23	88.11
0.550	97.66	96.79	95.83	94.93	94.07	93.58	93.22	92.12	91.98	91.69	91.74	93.54
0.600	98.32	97.82	97.43	96.52	96.17	95.94	95.92	95.31	95.27	95.09	95.21	96.75
0.650	98.92	98.69	98.47	97.74	97.72	97.64	97.69	97.46	97.70	97.40	97.59	98.45
0.700	99.40	99.26	99.08	98.94	98.70	98.78	98.76	98.79	98.92	98.79	98.94	99.46
0.750	99.75	99.65	99.57	99.52	99.23	99.40	99.54	99.55	99.53	99.62	99.70	99.83
0.800	99.85	99.79	99.78	99.85	99.69	99.78	99.90	99.85	99.88	99.88	99.92	99.98
0.850	99.94	99.96	99.89	99.93	99.85	99.92	99.99	99.93	99.97	99.96	99.98	100.00
0.900	99.99	100.00	99.99	99.96	99.96	99.98	100.00	99.98	99.99	100.00	100.00	100.00
0.950	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE A2 (Continued)

Cumulative Radial Energy-Deposition Distribution in Water, Beam Energy = 1 MeV

Scaled radius	Scaled depth interval 0.60–0.65	0.65–0.70	0.70–0.75	0.75–0.80	0.80–0.85	0.85–0.90	0.90–0.95	0.95–1.00	1.00–1.05	1.05–1.10	1.10–1.15	1.15–1.20
0.005	0.04	0.01	0.02	0.0	0.05	0.03	0.22	0.0	0.0	0.0	0.0	0.0
0.010	0.11	0.10	0.09	0.14	0.13	0.17	0.58	0.0	0.0	0.0	0.0	0.0
0.015	0.25	0.19	0.20	0.25	0.21	0.33	0.60	0.0	0.0	0.0	0.0	0.0
0.020	0.44	0.34	0.30	0.45	0.35	0.45	0.78	0.28	0.0	4.93	0.0	0.0
0.025	0.65	0.48	0.44	0.74	0.63	0.88	1.27	1.04	0.0	6.43	0.0	0.0
0.030	0.89	0.74	0.71	0.97	0.84	1.15	1.56	1.31	0.0	8.07	0.0	0.0
0.035	1.13	1.03	1.01	1.36	1.24	1.59	2.03	2.34	0.0	9.91	0.0	0.0
0.040	1.38	1.37	1.35	1.70	1.77	2.39	2.42	3.35	1.05	10.86	0.0	0.0
0.045	1.80	1.75	1.77	2.07	2.14	3.07	3.25	4.09	1.84	11.75	0.0	0.0
0.050	2.17	2.21	2.10	2.64	2.73	3.84	3.95	4.91	4.24	12.44	0.0	0.0
0.060	2.98	3.12	3.22	3.80	3.96	5.21	5.62	5.90	12.71	15.42	0.0	0.0
0.070	3.86	4.11	4.32	4.87	5.11	6.35	7.66	8.23	15.48	18.76	0.0	0.0
0.080	5.00	5.34	5.66	5.98	6.67	8.02	9.95	10.52	20.79	26.35	0.0	0.0
0.090	6.21	6.60	7.01	7.31	8.31	9.81	12.51	12.64	22.29	31.10	0.0	0.0
0.100	7.69	8.06	8.44	8.88	10.03	11.53	14.91	16.77	22.98	34.37	0.0	0.0
0.110	9.20	9.57	10.19	10.77	12.17	13.80	16.92	19.53	23.55	37.41	0.0	0.0
0.120	10.94	11.43	11.78	12.45	14.58	16.07	19.37	22.90	24.57	50.08	0.0	0.0
0.130	12.79	13.24	13.55	14.21	16.85	18.67	22.13	26.90	25.57	51.43	0.0	0.0
0.140	14.72	15.25	15.63	16.19	19.12	21.62	25.94	31.68	27.45	53.09	0.0	17.90
0.150	16.65	17.10	17.71	18.31	21.59	24.60	29.88	35.02	29.46	59.23	0.0	17.90
0.160	18.57	19.00	19.77	20.51	23.65	27.58	32.31	37.72	33.36	59.23	0.0	17.90
0.170	20.84	21.04	21.89	23.12	26.37	30.96	35.94	40.02	40.25	59.23	0.0	17.90
0.180	23.23	23.36	24.37	25.63	29.17	34.26	39.21	42.35	44.33	59.23	0.0	17.90
0.190	25.35	25.91	26.84	28.15	31.86	36.81	42.07	47.05	49.21	59.23	0.0	17.90
0.200	27.55	28.45	29.20	30.64	34.41	39.90	45.87	51.23	53.93	59.23	0.0	17.90
0.220	32.22	32.94	34.18	36.41	40.17	45.61	52.79	58.36	58.82	60.96	0.0	17.90
0.240	37.11	37.78	39.61	42.26	45.80	51.10	59.52	65.73	67.71	82.95	0.0	45.04
0.260	41.77	42.97	45.38	48.22	52.19	58.57	66.13	74.88	84.15	94.87	0.0	45.04
0.280	46.36	47.81	50.81	54.38	58.51	65.50	71.50	84.55	92.93	94.87	0.0	45.04
0.300	51.29	52.67	56.00	60.09	63.72	70.98	77.22	89.19	98.00	94.87	0.0	45.04
0.320	55.87	57.81	61.26	64.44	69.25	76.05	81.38	93.47	98.42	96.04	0.0	45.04
0.340	60.19	62.32	66.45	69.25	73.90	80.09	85.03	95.14	99.95	96.04	0.0	45.04
0.360	64.54	66.86	71.08	73.92	78.61	83.77	89.56	96.79	99.95	96.04	0.0	45.04
0.380	68.77	71.12	75.60	77.65	83.00	88.56	91.92	97.60	99.95	96.04	1.69	45.04
0.400	72.73	74.77	79.57	81.30	86.66	92.16	93.40	98.65	99.95	96.04	1.69	45.04
0.420	76.55	78.61	83.20	85.11	89.45	94.34	95.16	99.00	99.95	96.04	1.69	45.04
0.440	79.97	81.98	85.65	88.16	91.81	95.90	96.76	99.00	99.95	96.04	1.69	45.04
0.460	83.21	85.09	88.62	90.90	93.58	96.57	98.01	99.81	99.95	96.04	1.69	45.04
0.480	86.39	87.53	91.06	92.89	95.44	97.45	98.40	99.81	99.95	96.04	50.77	45.04
0.500	89.28	90.06	92.82	94.79	96.84	98.32	99.46	99.81	99.95	96.04	50.77	45.04
0.550	94.77	94.99	96.63	97.79	98.64	99.45	100.00	99.81	100.00	96.04	50.77	45.04
0.600	97.52	97.82	98.89	99.37	99.66	100.00	100.00	99.81	100.00	96.04	50.77	58.41
0.650	99.06	99.24	99.76	99.93	99.87	100.00	100.00	99.81	100.00	96.04	50.77	71.46
0.700	99.77	99.83	99.92	99.99	100.00	100.00	100.00	99.81	100.00	96.04	100.00	71.46
0.750	99.97	99.98	99.97	99.99	100.00	100.00	100.00	99.81	100.00	97.44	100.00	71.46
0.800	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.81	100.00	99.56	100.00	71.46
0.850	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.81	100.00	99.56	100.00	86.21
0.900	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.81	100.00	99.56	100.00	86.21
0.950	100.00	100.00	100.00	100.00	100.00	100.00	100.00	99.81	100.00	99.62	100.00	100.00
1.000	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

NBS-114A (REV. 2-80)

U.S. DEPT. OF COMM. **BIBLIOGRAPHIC DATA SHEET** *(See instructions)*	1. PUBLICATION OR REPORT NO. 82-2451	2. Performing Organ. Report No.	3. Publication Date January 1982

4. TITLE AND SUBTITLE

TABLES OF ENERGY-DEPOSITION DISTRIBUTIONS IN WATER PHANTOMS IRRADIATED BY POINT-MONODIRECTIONAL ELECTRON BEAMS WITH ENERGIES FROM 1 TO 60 MeV, AND APPLICATIONS TO BROAD BEAMS

5. AUTHOR(S)

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6. PERFORMING ORGANIZATION *(If joint or other than NBS, see instructions)*

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20234

7. Contract/Grant No.

8. Type of Report & Period Covered

9. SPONSORING ORGANIZATION NAME AND COMPLETE ADDRESS *(Street, City, State, ZIP)*

10. SUPPLEMENTARY NOTES

[ ] Document describes a computer program; SF-185, FIPS Software Summary, is attached.

11. ABSTRACT *(A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here)*

This report presents tables of elementary three-dimensional absorbed-dose distributions in a water phantom irradiated by monoenergetic, point-monodirectional electron beams. Such distributions have been obtained by the Monte Carlo method for 14 beam energies from 1 MeV to 60 MeV. The tabulated results can be applied to the determination of absorbed-dose distributions from parallel beams of arbitrary finite cross section. The beam of interest is treated as a superposition of point-monodirectional beams, and the absorbed-dose distribution is obtained as a corresponding superposition of elementary absorbed-dose distributions. By way of example, the tabulated data are used to obtain (1) depth-dose curves and practical ranges in broad-beam geometry, and (2) central-axis depth-dose curves, radial distributions of absorbed dose, and isodose patterns for beams with finite circular cross section.

12. KEY WORDS *(Six to twelve entries; alphabetical order; capitalize only proper names; and separate key words by semicolons)*

Dosimetry; electrons; Monte Carlo; point-monodirectional beams; superposition; treatment planning.

13. AVAILABILITY

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[ ] Order From Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

[X] Order From National Technical Information Service (NTIS), Springfield, VA. 22161

14. NO. OF PRINTED PAGES

54 55

15. Price

$ 9.00

USCOMM-DC 6043-P80