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MASS STOPPING POWER AND PATHLENGTH  
OF NEUTRON PRODUCED RECOILS IN TISSUE  
AND TISSUE EQUIVALENT MATERIALS

I. NEUTRON ENERGY  $\leq 6$  MEV

by

U. OLDENBURG and J. BOOZ

1972



Joint Nuclear Research Centre  
Ispra Establishment - Italy

Biology Division

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The maximum energy of the ions that is dealt with corresponds to a neutron energy of 6 MeV. The results are presented in 120 tables. The 8 recoil ions are protons, deuterons, alpha-particles,  $^{12}\text{C}$ ,  $^{14}\text{N}$ ,  $^{16}\text{O}$ ,  $^{19}\text{F}$ , and  $^{32}\text{S}$ . Their mass stopping powers and ranges are given in wet tissue (ICRU), tissue equivalent

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## ABSTRACT

Nuclear and electronic mass stopping powers and ranges of 8 neutron produced recoil ions in 5 different tissue like absorbers are calculated using the theories of Bethe, Bloch and Lindhard, Scharff and Schiott. In between the two theories an interpolation within available experimental values has been made.

The maximum energy of the ions that is dealt with corresponds to a neutron energy of 6 MeV. The results are presented in 120 tables. The 8 recoil ions are protons, deuterons, alpha-particles,  $^{12}\text{C}$ ,  $^{14}\text{N}$ ,  $^{16}\text{O}$ ,  $^{19}\text{F}$ , and  $^{32}\text{S}$ . Their mass stopping powers and ranges are given in wet tissue (ICRU), tissue equivalent gas 1 (ROSSI, FAILLA), tissue equivalent conducting plastic (SHONKA), tissue equivalent gas 2 (SRDOC), water, and in the single elements which are contained in the different absorbers (H, C, N, O, F, Si, P, S, K, Ca).

## KEYWORDS

SLOWDOWN	FLUORINE 19
DISTANCE	SULFUR 32
NEUTRON BEAMS	WATER
MEV RANGE 01-10	GASES
RECOILS	POLYMERS
TISSUES	ABSORPTION
PHANTOMS	HYDROGEN
NUCLEI	CARBON
ELECTRONS	NITROGEN
IONS	OXYGEN
BETHE-BLOCH RELATION	FLUORINE
TABLES	SILICON
PROTONS	PHOSPHORUS
DEUTERONS	SULFUR
ALPHA PARTICLES	POTASSIUM
CARBON 12	CALCIUM
NITROGEN 14	ELECTRIC CONDUCTIVITY
OXYGEN 16	

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## 1. INTRODUCTION

The primary interaction of radiation with matter can be described in terms of the spectral distribution of energy, which is transferred by the radiation to small volumes in the irradiated material ("single event spectrum").

Such distributions have been calculated for irradiation of tissue and tissue equivalent (in the following abbreviated by : t.e.) materials by monoenergetic neutrons of an energy up to 6 MeV and are published elsewhere [1, 2, 3].

These calculations, which were done by means of the Monte Carlo method, need extensive data concerning neutron reactions (reaction cross sections, angular distributions, energy levels of excited nuclei) and the slowing down of the neutron produced ionizing particles (mass stopping power, pathlength).

If one assumes the chemical composition of soft tissue as given by the ICRU [4] and if one takes into account the seven most frequent elements, there are already 21 types of ions, which can be produced by a neutron reaction. 9 additional types of ionizing secondary particles have to be considered, if the calculation is extended to t.e. plastic materials as developed by SHONKA [5].

For the above mentioned calculations, pathlength-energy-tables for in total 30 types of ions in a variety of absorbing materials had to be computed. This report gives an extract of these tables for 8 ionizing particles (protons, deuterons, alpha-particles,  $^{12}\text{C}$ -,  $^{14}\text{N}$ -,  $^{16}\text{O}$ -,  $^{19}\text{F}$ -, and  $^{32}\text{S}$ -recoils) in 5 absorbers: wet tissue (ICRU), t.e. plastic (SHONKA), two t.e. gas mixtures and water. For comparison there are added corresponding tables for the slowing down of all ions in the single elements, which are contained in the different absorbers.

## 2. EVALUATION

The upper limit of the energy range of the tables in part 3 is given by the maximum neutron energy of 6 MeV, which was used. Table I shows a listing of the corresponding maximum ion energies  $E_m$  and of the related nuclear reactions. The calculation of  $E_m$  has been accomplished with the atomic mass values of MATTAUCH et al. [6].

Table I : Maximum Ion Energy  $E_m$  after Nuclear Reaction with Neutrons of 6 MeV Energy

Ion	$E_m$ (MeV)	Nuclear Reaction
$^1_1\text{H}, p$	6.625	$^{14}_7\text{N} (n,p) ^{14}_6\text{C}$
$^2_1\text{H}, d$	3.308	$^1_1\text{H} (n,\gamma) ^2_1\text{H}$
$^4_2\text{He}, \alpha$	7.503 1)	$^{40}_{20}\text{Ca} (n,\alpha) ^{37}_{18}\text{Ar}$
	7.233 2)	$^{32}_{16}\text{S} (n,\alpha) ^{29}_{14}\text{Si}$
$^{12}_6\text{C}$	1.717	$^{12}_6\text{C} (n,n') ^{12}_6\text{C}$
$^{14}_7\text{N}$	1.504	$^{14}_7\text{N} (n,n') ^{14}_7\text{N}$
$^{16}_8\text{O}$	1.339	$^{16}_8\text{O} (n,n') ^{16}_8\text{O}$
$^{19}_9\text{F}$	1.149	$^{19}_9\text{F} (n,n') ^{19}_9\text{F}$
$^{32}_{16}\text{S}$	0.712	$^{32}_{16}\text{S} (n,n') ^{32}_{16}\text{S}$

1) only in SHONKA-material

2) only in ICRU-tissue

### 2.1 Calculations of Mass Stopping Power

The mass stopping power  $S(E)$  of an absorber (density  $\rho$ ), which contains  $n$  types of elements, for an ion of energy  $E$  is given by formula (1):

$$S(E) = (dE/\rho \cdot dx) = \sum_{k=1}^n N_k s_k(E) \quad (1)$$

with:  $N_k$  = number of atoms of  $k$ -th element per gram of absorber



$s_k(E)$  = stopping cross section per atom of k-th element for the ion of energy E.

In order to calculate  $S(E)$  for a given absorber, one therefore has to determine both  $N_k$  and  $s_k(E)$ .

#### Determination of $N_k$

The chemical composition of an absorber is usually given either by the compound formula, by percentages of weight, or by percentages of volumes i.e. partial pressures (the last mentioned especially in case of gas mixtures). In the following,  $N_L$  is Avogadro's number, and  $A_k$  denotes the atomic mass number of the k-th element.

a) Determination of compounds:

$$N_k = n_k \cdot \frac{N_L}{M}$$

with:  $n_k$  = number of atoms of the k-th element in the molecule

$$M = \sum_k n_k \cdot A_k = \text{molecular weight.}$$

b) Determination for percentages of weight:

$$N_k = w_k \cdot \frac{N_L}{A_k}$$

with:  $w_k$  = percentage of weight of the k-th element in the absorber.

c) Determination for percentages of volume

Usually the partial pressures do not refer to single elements but to components of a gas mixture. Therefore one has to calculate first the number of molecules  $K$  per gram of absorber for each component. Then one is able to determine  $N_k$ , taking into account the different number of atoms of the k-th element,

which are contained in the molecules of the various components.

$$N_k = \sum_j n_{jk} \cdot K_j$$

with:  $n_{jk}$  = number of atoms of the k-th element in the molecules of the j-th component

$K_j$  = number of molecules of the j-th component per gram of absorber.

and

$$K_j = (v_j \cdot N_L) / \sum_j v_j M_j$$

with:  $v_j$  = percentage of volume (partial pressure) of the j-th component

$$M_j = \sum_k n_{jk} \cdot A_k = \text{molecular weight of the j-th component.}$$

The values  $N_k$  and  $w_k$  are summarized for the considered absorbers in Table II.

#### Determination of $s_k(E)$

The calculation of the stopping cross section  $s_k(E)$  per atom of the k-th element for an ion of energy E, mass M and effective charge  $Z_{\text{eff}}$  depends on the velocity  $v$  of the ionizing particle.

a)  $v \gtrsim 9 \cdot 10^8$  cm/sec (resp.  $E/M \gtrsim 400$  KeV/amu)

In this velocity range the slowing down of ions is mainly caused by interactions with the electrons of the absorbing material.

$s_k(E)$  is calculated using the formula of BETHE (a survey on this theory is given f.e. by FANO (1964) [9]):

$$s_k(E) = \frac{2 \pi e^4 Z_{\text{eff}}^2 Z_k}{m \cdot (E/M)} \ln \left( \frac{4m}{I_k} \cdot \frac{E}{M} \right) \quad (2)$$

Table II : Chemical composition of the different absorbers, given by  $N_k$  (number of atoms per molecule) and by  $w_k$  (percentage of weight).

Absorber Elements	ICRU-tissue <sup>1)</sup>		SHONKA-plastic <sup>2)</sup>		t.e. gas 1 <sup>3)</sup>		t.e. gas 2 <sup>4)</sup>		water	
	$w_k$ (%)	$N_k(10^{22}/g)$	$w_k$ (%)	$N_k(10^{22}/g)$	$w_k$ (%)	$N_k(10^{22}/g)$	$w_k$ (%)	$N_k(10^{22}/g)$	$w_k$ (%)	$N_k(10^{22}/g)$
H	10.2	6.094	10.26	6.1285	10.19	6.087	10.27	6.135	11.19	6.6857
C	12.3	0.6167	76.10	3.816	45.62	2.287	56.89	2.853		
N	3.5	0.1505	3.50	0.1505	3.51	0.1512	3.50	0.1505		
O	72.9	2.744	5.12	0.1929	40.68	1.531	29.34	1.104	88.81	3.3429
F			1.96	0.06201						
Si			1.00	0.02133						
P	0.2	0.00389								
S	0.5	0.00939								
K	0.3	0.00462								
Ca			2.06	0.0310						

1) The missing 0.1% of weight is composed essentially of Na(0.08%) and Mg(0.02%).

2) The values in this column are received from SHONKA's publication [5] after correction of the erroneous equation 4, but without correction of his number of hydrogen atoms per "tissue molecule" adopted for ICRU-tissue (10.2 instead of 10.119).

3) Composition by partial pressures(ROSSI and FAILLA [7]):  $CH_4$ :64,4%;  $CO_2$ :32,4%;  $N_2$ :3,2%.

4) Composition by partial pressures (SRDOC [8]):  $C_3H_8$ :55,0% ;  $CO_2$ :39,6% ;  $N_2$ :5,4% .

with:  $e$  = charge of the electron  
 $m$  = rest mass of the electron  
 $Z_k$  = nuclear charge of the  $k$ -th element  
 $I_k$  = mean excitation potential of the  $k$ -th element.

Abbreviating the ratio  $E/M$  by  $X$  and introducing the numerical values of the constants in equation (2), one obtains:

$$s_k(X) = 23.7487 \cdot 10^6 \frac{Z_{\text{eff}}^2 \cdot Z_k}{X} \ln\left(2.19444 \frac{X}{I_k}\right) \quad (3)$$

where  $s_k$  is given in KeV•barn,  $X$  in KeV/a.m.u., and  $I_k$  in eV.

For the calculation of  $Z_{\text{eff}}$ , a formula given by WILLIAMSON et al. [10] is used:

$$Z_{\text{eff}}(Z, X) = Z \cdot \text{tgh}(0.25162 \cdot \sqrt{X/Z}) \quad (4)$$

b)  $v \lesssim 3 \cdot 10^8$  cm/s (resp  $E/M \lesssim 40$  KeV/amu)

For ion velocities below about  $3 \cdot 10^8$  cm/s the stopping cross section per atom is calculated with the formulae of LINDHARD, SCHARFF and SCHIOTT [21]. These authors are representing the total stopping cross section  $s^t$  as a sum of two stopping cross sections  $s^e$  and  $s^n$ , where  $s^e$  gives the stopping by interactions with the electrons of the absorber ("electronic stopping") and  $s^n$  gives the stopping by nuclear collisions ("nuclear stopping"):

$$s_k(X) = s_k^t(X) = s_k^e(X) + s_k^n(X) \quad (5)$$

with the following approximation for the individual stopping cross sections:

$$s_k^e(X) = 384.46 \cdot D \cdot F(Z, Z_k) \cdot \sqrt{X} \quad (6)$$

$$s_k^n(X) = 847.73 \cdot 10^4 \frac{M}{M + M_k} \cdot G(Z, Z_k) \cdot f(w) \quad (7)$$

In these formulae  $s_k^e$  and  $s_k^n$  are given in KeV·barn, X is given in KeV/amu, and the other symbols have the following significance:

- Z, M : nuclear charge and mass of the ion  
 $Z_k, M_k$  : nuclear charge and mass of the absorber atom (k-th element)  
 D : constant of order of  $Z^{1/6}$   
 $F(Z, Z_k) = Z \cdot Z_k / (Z^{2/3} + Z_k^{2/3})^{3/2}$   
 $G(Z, Z_k) = Z \cdot Z_k / (Z^{2/3} + Z_k^{2/3})^{1/2}$   
 $f(w)$  : universal dimensionless function of the dimensionless variable

$$w = 32.533 \cdot \frac{M \cdot M_k}{M + M_k} \cdot \frac{X}{Z \cdot Z_k (Z^{2/3} + Z_k^{2/3})^{1/2}}$$

which is shown in fig.1 (after SCHIOTT [22]).

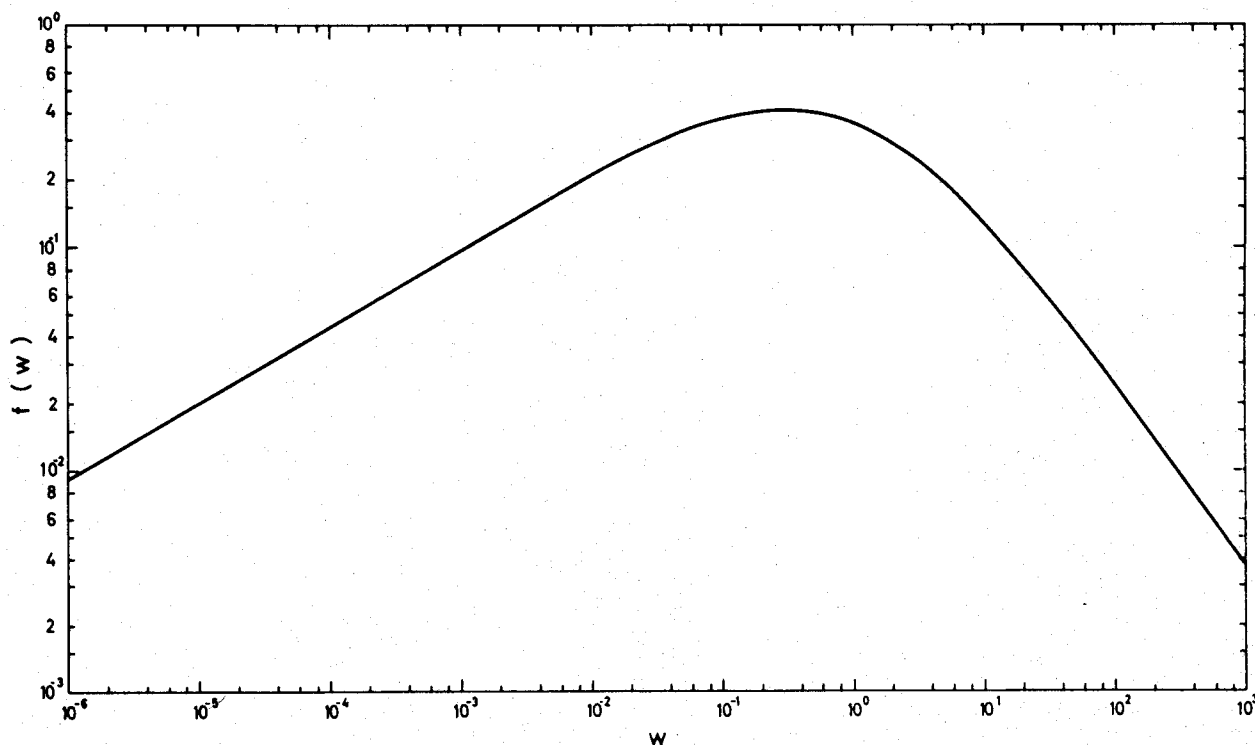


Fig.1 : The dimensionless function  $f(w)$  of formula (7) which characterizes the slowing down by nuclear collisions (after SCHIOTT [22]).

The stopping cross sections have been evaluated using  $D \equiv Z^{1/6}$ , because for protons and alpha-particles the cross section curves thus evaluated joined smoothly the curves of the interpolation region c .

For the heavy recoil particles there exist practically no experimental stopping cross section values for a more exact determination of D, except in the case of the slowing down in carbon [23, 24, 25, 18, 19, 12]. It should be mentioned however, that DUCKWORTH et al. found in this case oscillations of the value of D around the assumed value of  $Z^{1/6}$  [23, 24, 18].

c)  $3 \cdot 10^8$  cm/s  $\leq v \leq 9 \cdot 10^8$  cm/s (40 KeV/amu  $\leq E/M \leq 400$  KeV/amu)

The stopping cross sections per atom calculated with formula (3) no longer approximate sufficiently (within 2-3%) the experimental results [11 - 16] in this velocity range. One therefore has to interpolate directly within experimental values, as far as they exist.

This interpolation had to be done only for protons and alpha-particles, because the velocities of the carbon recoils and the heavier ions remain completely in the region of validity of the formulas of LINDHARD, SCHARFF and SCHIOTT (see section b). The determination for the elements heavier than oxygen is partially based on calculated values of JANNI [17] for protons and on values of WILLIAMSON et al. [10] for alpha-particles. This holds also for the determination of the stopping cross section for alpha-particles in hydrogen.

Table III summarizes the data for the different elements including the individual lower and upper limits of the above mentioned interpolation region.

Table III: Mean excitation potentials and upper ( $X_u$ ) and lower ( $X_e$ ) limits of interpolation region for protons and alpha-particles

Element	$I_k$ <sup>1)</sup> (eV)	Protons			alpha-particles		Liter- ature
		$X_e$ (KeV/amu)	$X_u$ (KeV/amu)	Liter- ature	$X_e$	$X_u$ (KeV/amu)	
H	18.2	5	150	11,15	60	500	10
C	78.5	12	300	15,18	10	150	18, 19
N	90.5	30	300	11,15 <sup>2)</sup>	70	300	16
O	96	10	250	11,15	25	500	16
F	120	10	400	17	80	300	10
Si	170	20	300	17,14	90	500	10
P	182	40	400	17	80	500	10
S	191	40	400	17	90	500	10
K	219	40	500	17	90	500	10
Ca	228	60	700	17,13	90	500	10

1) These values are taken from TURNER et al. [20]

2) Values of WHALING [11] reduced (~ 3%) in order to obtain correspondance with values of BICHSEL [15]

## 2.2 Calculation of pathlength

The pathlength  $L(E)$  of an ionizing particle of energy  $E$  is defined by:

$$L(E) = \int_0^E dE / (dE/\rho dx) \quad (8)$$

where  $dE/\rho dx$  represents the mass stopping power  $s(E)$  of the absorber for the ionizing particle and can be calculated according to section 2.1 .

The integration was done by a numerical method and could not be accomplished for the first value of energy because  $s(0)$  equals 0. Therefore the pathlength at 0.1 KeV has been determined by calculation of the sequence:

$$I_n = \int_{a_n}^{0.1} dE/s(E) \quad (9)$$

with:

$$a_1 = 0.01 ; \quad a_n = a_{n-1} \cdot 0.1$$

This sequence is converging against a fixed value, which is supposed to be  $L(0.1)$ . The calculation of the sequence was interrupted, when two successive values differed by less than 0.01%.



3. TABLES.

Each of the following tables shows the magnitude of ion energy  $E$ , effective charge  $Z_{\text{eff}}$  (as far as it is important), mass stopping power due to nuclear collisions  $SN(E)$ , mass stopping power due to electronic stopping  $SE(E)$ , total mass stopping power  $ST(E)$  (denoted by  $s(E)$  in section 2.1), and the corresponding pathlength (identical with  $L(E)$ ).

The mass stopping power is given in  $(\text{KeV}/\mu\text{m})/(\text{gram}/\text{cm}^3)$  and the pathlength in  $\mu\text{m}(\text{gram}/\text{cm}^3)$ .

The calculated values for protons and alpha-particles generally show correspondance within 2-3% with present experimental values.<sup>1)</sup> As already mentioned, there exists a greater deviation between the calculated and the sparsely existing experimental data for the slowing down of heavy recoils in carbon. Table IV shows the percent deviation of experimental values of PORAT et al. [19, 25] from those calculated in this paper.

Table IV : Percent deviation of experimental mass stopping power values of PORAT for heavy recoils in carbon from the calculated values of this paper

Energy Ion	400 KeV	600 KeV	800 KeV	1000 KeV
$^{12}\text{C}$	+ 12	+ 8	+ 4	+ 1
$^{14}\text{N}$	+ 13	+12	+ 11	+ 11
$^{16}\text{O}$	+ 10	+10	+ 10	+ 10

<sup>1)</sup> Recent measurements of HOYER and WAFFLER [26] on the mass stopping power for alpha-particles shows a greater deviation in hydrogen. At the Bragg-peak the results of HOYER and WAFFLER are about 20 % lower than the values in this work, which are based on the mass stopping power of hydrogen as calculated by Williamson [10].

ABSORBER.....WET TISSUE (ICRU)

ION.....PROTONS

ENERGY E	Z <sub>EFF</sub>	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/C
0.10	0.079	9.19	5.63	14.82	7.98E-03
0.15	0.097	8.61	6.90	15.51	1.13E-02
0.20	0.112	8.00	7.97	15.97	1.45E-02
0.30	0.136	7.14	9.76	16.89	2.05E-02
0.50	0.175	5.96	12.60	18.56	3.18E-02
0.70	0.207	5.21	14.91	20.12	4.22E-02
1.00	0.246	4.42	17.82	22.23	5.63E-02
1.50	0.298	3.66	21.82	25.48	7.73E-02
2.00	0.340	3.06	25.19	28.25	9.59E-02
3.00	0.409	2.48	30.86	33.33	1.28E-01
5.00	0.508	1.78	39.84	41.61	1.82E-01
7.00	0.580	1.43	45.51	46.94	2.27E-01
10.00	0.660	1.10	53.65	54.75	2.86E-01
15.00	0.749	0.82	62.98	63.80	3.71E-01
20.00	0.808	0.66	71.21	71.87	4.45E-01
30.00	0.879	0.49	83.43	83.92	5.72E-01
50.00	0.944	0.33	94.68	95.01	7.94E-01
70.00	0.970	0.24	98.31	98.56	9.99E-01
100.00	0.987	0.13	95.66	95.79	1.31E+00
150.00	0.996	0.09	84.29	84.37	1.86E+00
200.00	0.998	0.07	73.39	73.46	2.50E+00
300.00	1.000	0.05	59.13	59.19	4.03E+00
400.00	1.000	0.04	50.05	50.09	5.87E+00
500.00	1.000	0.03	43.58	43.61	8.02E+00
600.00	1.000	0.01	38.74	38.75	1.05E+01
700.00	1.000	0.01	34.95	34.96	1.32E+01
800.00	1.000	0.01	31.90	31.91	1.62E+01
900.00	1.000	0.01	29.39	29.40	1.94E+01
1000.00	1.000	0.00	27.29	27.29	2.30E+01
1200.00	1.000	0.00	23.94	23.95	3.08E+01
1500.00	1.000	0.00	20.34	20.34	4.45E+01
1700.00	1.000	0.00	18.53	18.53	5.48E+01
2000.00	1.000	0.00	16.39	16.39	7.20E+01
2500.00	1.000	0.00	13.82	13.82	1.05E+02
3000.00	1.000	0.00	12.00	12.00	1.44E+02
3500.00	1.000	0.00	10.63	10.63	1.89E+02
4000.00	1.000	0.00	9.57	9.57	2.38E+02
4500.00	1.000	0.00	8.71	8.71	2.93E+02
5000.00	1.000	0.00	8.01	8.01	3.53E+02
5500.00	1.000	0.00	7.42	7.42	4.18E+02
6000.00	1.000	0.00	6.91	6.91	4.88E+02
6500.00	1.000	0.00	6.48	6.48	5.63E+02

ABSORBER.....WET TISSUE (ICRU)

ION.....DEUTERONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GPAM/CCM)			MICRON*GRAM/CCM
0.10	0.056	14.35	3.99	18.33	6.37E-03
0.15	0.069	13.76	4.88	18.65	9.07E-03
0.20	0.079	13.13	5.64	18.76	1.17E-02
0.30	0.097	11.98	6.90	18.88	1.71E-02
0.50	0.125	10.23	8.91	19.14	2.76E-02
0.70	0.147	9.07	10.54	19.61	3.79E-02
1.00	0.175	7.84	12.60	20.44	5.29E-02
1.50	0.214	6.41	15.43	21.84	7.66E-02
2.00	0.246	5.63	17.82	23.46	9.87E-02
3.00	0.298	4.33	21.83	26.15	1.39E-01
5.00	0.377	3.23	28.18	31.41	2.09E-01
7.00	0.437	2.58	33.34	35.92	2.68E-01
10.00	0.508	2.01	39.85	41.87	3.45E-01
15.00	0.596	1.46	46.98	48.43	4.57E-01
20.00	0.660	1.25	53.61	54.86	5.54E-01
30.00	0.749	0.86	62.93	63.80	7.23E-01
50.00	0.849	0.60	78.08	78.69	1.00E+00
70.00	0.902	0.45	87.59	88.04	1.24E+00
100.00	0.944	0.34	94.68	95.02	1.57E+00
150.00	0.974	0.26	98.47	98.63	2.08E+00
200.00	0.987	0.13	95.65	95.78	2.59E+00
300.00	0.996	0.09	84.26	84.35	3.71E+00
400.00	0.998	0.07	73.36	73.43	4.99E+00
500.00	0.999	0.05	65.33	65.38	6.43E+00
600.00	1.000	0.04	59.12	59.16	8.04E+00
700.00	1.000	0.01	54.19	54.19	9.81E+00
800.00	1.000	0.01	50.06	50.06	1.17E+01
900.00	1.000	0.01	46.57	46.57	1.38E+01
1000.00	1.000	0.01	43.58	43.58	1.60E+01
1200.00	1.000	0.01	38.72	38.73	2.09E+01
1500.00	1.000	0.00	33.34	33.34	2.93E+01
1700.00	1.000	0.00	30.58	30.58	3.56E+01
2000.00	1.000	0.00	27.28	27.28	4.60E+01
2500.00	1.000	0.00	23.24	23.24	6.59E+01

ABSORBER.....WET TISSUE (ICRU)

ION.....ALPHA-PARTICLES

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	35.37	4.93	40.31	3.31E-03
0.15	0.049	36.51	6.04	42.55	4.51E-03
0.20	0.056	37.07	6.98	44.05	5.66E-03
0.30	0.069	36.93	8.55	45.47	7.89E-03
0.50	0.089	35.11	11.03	46.14	1.22E-02
0.70	0.105	33.30	13.06	46.35	1.66E-02
1.00	0.126	30.72	15.60	46.33	2.30E-02
1.50	0.154	27.21	19.11	46.32	3.39E-02
2.00	0.177	24.38	22.07	46.45	4.46E-02
3.00	0.217	20.63	27.03	47.66	6.59E-02
5.00	0.279	15.99	34.89	50.88	1.07E-01
7.00	0.330	12.99	41.28	54.28	1.45E-01
10.00	0.393	10.71	49.34	60.05	1.97E-01
15.00	0.478	8.33	60.43	68.76	2.75E-01
20.00	0.548	6.71	69.78	76.49	3.44E-01
30.00	0.663	5.05	85.47	90.52	4.63E-01
50.00	0.835	3.54	110.34	113.87	6.59E-01
70.00	0.965	2.58	130.35	132.93	8.21E-01
100.00	1.115	2.03	155.54	157.57	1.03E+00
150.00	1.294	1.48	191.43	192.91	1.31E+00
200.00	1.422	1.12	218.65	219.77	1.55E+00
300.00	1.593	0.83	253.95	254.78	1.97E+00
400.00	1.701	0.61	272.49	273.10	2.35E+00
500.00	1.773	0.37	278.12	278.49	2.71E+00
600.00	1.824	0.31	275.67	275.99	3.07E+00
700.00	1.861	0.27	269.51	269.78	3.44E+00
800.00	1.889	0.25	260.21	260.45	3.82E+00
900.00	1.910	0.22	251.32	251.54	4.21E+00
1000.00	1.926	0.20	241.25	241.45	4.61E+00
1200.00	1.949	0.15	221.90	222.05	5.48E+00
1500.00	1.970	0.01	199.18	199.19	6.91E+00
1700.00	1.978	0.01	187.41	187.42	7.94E+00
2000.00	1.986	0.01	172.20	172.20	9.61E+00
2500.00	1.993	0.01	149.03	149.03	1.28E+01
3000.00	1.996	0.00	132.22	132.23	1.63E+01
3500.00	1.998	0.00	119.06	119.06	2.03E+01
4000.00	1.999	0.00	108.47	108.47	2.47E+01
5000.00	1.999	0.00	99.76	99.76	2.95E+01
6000.00	1.999	0.00	92.47	92.47	3.47E+01
7000.00	2.000	0.00	86.26	86.26	4.03E+01
8000.00	2.000	0.00	80.90	80.90	4.63E+01
9000.00	2.000	0.00	76.23	76.23	5.27E+01
10000.00	2.000	0.00	72.12	72.12	5.94E+01
15000.00	2.000	0.00	68.48	68.48	6.66E+01

ABSORBER.....WET TISSUE (ICRU)

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	89.83	5.91	95.74	1.59E-03
0.15	100.59	7.23	107.82	2.08E-03
0.20	108.70	8.35	117.05	2.53E-03
0.30	118.70	10.23	128.93	3.34E-03
0.50	130.94	13.21	144.15	4.80E-03
0.70	138.12	15.63	153.75	6.14E-03
1.00	143.97	18.68	162.64	8.03E-03
1.50	147.46	22.87	170.33	1.10E-02
2.00	148.43	26.41	174.84	1.39E-02
3.00	144.35	32.35	176.69	1.96E-02
5.00	133.91	41.76	175.68	3.09E-02
7.00	124.10	49.41	173.51	4.24E-02
10.00	112.04	59.06	171.10	5.98E-02
15.00	96.56	72.33	168.90	8.93E-02
20.00	84.37	83.52	167.90	1.19E-01
30.00	69.01	102.29	171.30	1.78E-01
50.00	52.14	132.06	184.20	2.91E-01
70.00	41.69	156.26	197.94	3.95E-01
100.00	32.92	186.76	219.68	5.39E-01
150.00	25.19	228.73	253.92	7.50E-01
200.00	19.64	264.12	283.76	9.36E-01
300.00	15.10	323.48	338.58	1.26E+00
400.00	12.30	373.52	385.82	1.53E+00
500.00	10.11	417.61	427.72	1.78E+00
600.00	8.83	457.47	466.30	2.00E+00
700.00	7.56	494.12	501.69	2.21E+00
800.00	6.96	528.24	535.20	2.40E+00
900.00	6.24	560.28	566.53	2.58E+00
1000.00	5.59	590.59	596.18	2.76E+00
1200.00	5.06	646.96	652.02	3.08E+00
1500.00	4.17	723.32	727.50	3.51E+00

ABSORBER.....WET TISSUE (ICRU)

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	98.59	5.99	104.58	1.47E-03
0.15	111.22	7.34	118.56	1.92E-03
0.20	121.54	8.48	130.02	2.32E-03
0.30	132.99	10.38	143.37	3.05E-03
0.50	148.89	13.40	162.29	4.35E-03
0.70	158.27	15.86	174.13	5.54E-03
1.00	167.25	18.95	186.20	7.20E-03
1.50	173.86	23.21	197.07	9.81E-03
2.00	178.30	26.80	205.10	1.23E-02
3.00	176.06	32.83	208.88	1.71E-02
5.00	168.61	42.38	210.99	2.66E-02
7.00	159.06	50.14	209.20	3.61E-02
10.00	146.13	59.93	206.06	5.06E-02
15.00	129.38	73.40	202.78	7.50E-02
20.00	115.09	84.76	199.85	9.99E-02
30.00	95.92	103.81	199.72	1.50E-01
50.00	73.69	134.01	207.71	2.49E-01
70.00	60.58	158.57	219.14	3.42E-01
100.00	47.40	189.52	236.93	4.74E-01
150.00	37.36	232.12	269.48	6.71E-01
200.00	28.71	268.02	296.73	8.48E-01
300.00	22.77	328.26	351.04	1.16E+00
400.00	18.01	379.04	397.05	1.42E+00
500.00	15.22	423.78	439.00	1.66E+00
600.00	13.29	464.23	477.53	1.88E+00
700.00	11.56	501.43	512.99	2.08E+00
800.00	10.57	536.05	546.62	2.27E+00
900.00	9.37	568.57	577.94	2.45E+00
1000.00	8.37	599.32	607.70	2.62E+00
1200.00	7.42	656.52	663.95	2.93E+00

ABSORBER.....WET TISSUE (ICRU)

ION.....0-16 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	106.46	6.06	112.52	1.38E-03
0.15	120.54	7.42	127.96	1.79E-03
0.20	131.50	8.57	140.07	2.17E-03
0.30	147.10	10.49	157.59	2.83E-03
0.50	165.32	13.54	178.87	4.02E-03
0.70	177.07	16.03	193.10	5.09E-03
1.00	188.30	19.15	207.45	6.59E-03
1.50	198.66	23.46	222.12	8.91E-03
2.00	204.10	27.09	231.19	1.11E-02
3.00	208.17	33.18	241.34	1.53E-02
5.00	203.14	42.83	245.97	2.35E-02
7.00	194.86	50.68	245.54	3.17E-02
10.00	181.93	60.57	242.50	4.39E-02
15.00	164.01	74.18	238.19	6.48E-02
20.00	149.34	85.66	235.00	8.59E-02
30.00	126.23	104.91	231.14	1.29E-01
50.00	97.98	135.44	233.42	2.15E-01
70.00	82.05	160.25	242.30	2.99E-01
100.00	66.16	191.54	257.70	4.20E-01
150.00	50.94	234.59	285.53	6.04E-01
200.00	42.35	270.88	313.23	7.71E-01
300.00	30.68	331.76	362.44	1.07E+00
400.00	25.76	383.08	408.84	1.33E+00
500.00	21.51	428.30	449.81	1.56E+00
600.00	18.89	469.18	488.06	1.77E+00
700.00	16.47	506.77	523.23	1.97E+00
800.00	15.00	541.76	556.76	2.16E+00
900.00	14.00	574.62	588.62	2.33E+00
1000.00	12.70	605.70	618.41	2.50E+00

ABSORBER.....WET TISSUE (ICRU)

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	113.74	5.94	119.68	1.30E-03
0.15	129.33	7.27	136.60	1.69E-03
0.20	141.22	8.40	149.61	2.04E-03
0.30	159.89	10.28	170.18	2.67E-03
0.50	180.55	13.28	193.83	3.76E-03
0.70	194.92	15.71	210.63	4.75E-03
1.00	209.35	18.78	228.13	6.11E-03
1.50	223.62	23.00	246.61	8.21E-03
2.00	231.55	26.55	258.11	1.02E-02
3.00	240.46	32.52	272.98	1.40E-02
5.00	239.26	41.98	281.24	2.11E-02
7.00	233.96	49.68	283.64	2.82E-02
10.00	222.57	59.37	281.94	3.88E-02
15.00	204.09	72.72	276.81	5.67E-02
20.00	188.87	83.97	272.83	7.49E-02
30.00	163.62	102.84	266.46	1.12E-01
50.00	130.18	132.76	262.94	1.88E-01
70.00	109.95	157.09	267.04	2.64E-01
100.00	90.18	187.76	277.94	3.74E-01
150.00	69.48	229.95	299.44	5.47E-01
200.00	57.88	265.53	323.40	7.08E-01
300.00	42.96	325.20	368.17	9.97E-01
400.00	34.70	375.51	410.21	1.25E+00
500.00	30.84	419.83	450.68	1.49E+00
600.00	26.26	459.91	486.17	1.70E+00
700.00	23.93	496.76	520.69	1.90E+00
800.00	21.38	531.05	552.43	2.08E+00
900.00	19.21	563.27	582.48	2.26E+00



ABSORBER.....WET TISSUE (ICRU)

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	142.00	6.16	148.16	1.06E-03
0.15	162.28	7.55	169.82	1.37E-03
0.20	179.89	8.71	188.61	1.65E-03
0.30	207.68	10.67	218.35	2.14E-03
0.50	244.18	13.78	257.96	2.98E-03
0.70	269.47	16.30	285.77	3.71E-03
1.00	301.02	19.48	320.51	4.70E-03
1.50	328.98	23.86	352.84	6.18E-03
2.00	351.38	27.55	378.93	7.55E-03
3.00	380.84	33.75	414.59	1.01E-02
5.00	412.69	43.57	456.25	1.46E-02
7.00	425.35	51.55	476.90	1.89E-02
10.00	439.27	61.61	500.88	2.50E-02
15.00	432.74	75.46	508.20	3.50E-02
20.00	424.69	87.14	511.82	4.47E-02
30.00	401.12	106.72	507.84	6.43E-02
50.00	356.75	137.77	494.52	1.04E-01
70.00	323.16	163.02	486.18	1.45E-01
100.00	279.61	194.84	474.45	2.08E-01
150.00	232.35	238.63	470.98	3.13E-01
200.00	200.67	275.55	476.22	4.19E-01
300.00	160.46	337.47	497.93	6.25E-01
400.00	134.23	389.68	523.91	8.21E-01
500.00	114.01	435.68	549.69	1.01E+00
600.00	104.86	477.26	582.12	1.18E+00

ABSORBER.....TISSUE EQUIVALENT PLASTIC (SHONKA)

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	10.19	6.13	16.32	7.32E-03
0.15	0.097	9.53	7.51	17.04	1.03E-02
0.20	0.112	8.93	8.67	17.61	1.32E-02
0.30	0.136	7.99	10.62	18.61	1.87E-02
0.50	0.175	6.73	13.71	20.44	2.90E-02
0.70	0.207	5.91	16.22	22.13	3.84E-02
1.00	0.246	5.01	19.39	24.40	5.13E-02
1.50	0.298	4.18	23.75	27.93	7.04E-02
2.00	0.340	3.49	27.42	30.91	8.74E-02
3.00	0.409	2.86	33.59	36.45	1.17E-01
5.00	0.508	2.06	43.36	45.42	1.66E-01
7.00	0.580	1.69	49.67	51.36	2.08E-01
10.00	0.660	1.27	58.62	59.89	2.62E-01
15.00	0.749	1.00	69.25	70.25	3.38E-01
20.00	0.808	0.77	77.55	78.32	4.05E-01
30.00	0.879	0.59	90.52	91.11	5.23E-01
50.00	0.944	0.38	103.04	103.42	7.27E-01
70.00	0.970	0.30	107.51	107.81	9.15E-01
100.00	0.987	0.16	106.55	106.71	1.19E+00
150.00	0.996	0.12	91.60	91.72	1.70E+00
200.00	0.998	0.09	78.72	78.81	2.29E+00
300.00	1.000	0.07	61.96	62.02	3.73E+00
400.00	1.000	0.05	52.06	52.11	5.50E+00
500.00	1.000	0.02	45.19	45.21	7.56E+00
600.00	1.000	0.02	40.06	40.07	9.92E+00
700.00	1.000	0.01	36.07	36.09	1.26E+01
800.00	1.000	0.01	32.89	32.90	1.55E+01
900.00	1.000	0.01	30.27	30.28	1.86E+01
1000.00	1.000	0.01	28.08	28.09	2.21E+01
1200.00	1.000	0.01	24.60	24.61	2.97E+01
1500.00	1.000	0.01	20.86	20.87	4.30E+01
1700.00	1.000	0.01	18.99	18.99	5.30E+01
2000.00	1.000	0.00	16.79	16.79	6.99E+01
2500.00	1.000	0.00	14.14	14.14	1.02E+02
3000.00	1.000	0.00	12.26	12.26	1.41E+02
3500.00	1.000	0.00	10.86	10.86	1.84E+02
4000.00	1.000	0.00	9.77	9.77	2.33E+02
4500.00	1.000	0.00	8.89	8.89	2.86E+02
5000.00	1.000	0.00	8.17	8.17	3.45E+02
5500.00	1.000	0.00	7.56	7.56	4.09E+02
6000.00	1.000	0.00	7.05	7.05	4.77E+02
6500.00	1.000	0.00	6.60	6.60	5.51E+02

ABSORBER.....TISSUE EQUIVALENT PLASTIC (SHCNKA)

ION.....DEUTERONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.056	15.99	4.34	20.33	5.78E-03
0.15	0.069	15.28	5.31	20.59	8.22E-03
0.20	0.079	14.66	6.13	20.79	1.06E-02
0.30	0.097	13.36	7.51	20.87	1.54E-02
0.50	0.125	11.45	9.70	21.15	2.50E-02
0.70	0.147	10.17	11.48	21.65	3.43E-02
1.00	0.175	8.76	13.72	22.48	4.79E-02
1.50	0.214	7.20	16.80	24.00	6.95E-02
2.00	0.246	6.27	19.40	25.67	8.97E-02
3.00	0.298	4.90	23.76	28.66	1.26E-01
5.00	0.377	3.63	30.67	34.30	1.90E-01
7.00	0.437	2.97	36.29	39.26	2.45E-01
10.00	0.508	2.24	43.38	45.62	3.15E-01
15.00	0.596	1.71	51.29	53.00	4.17E-01
20.00	0.660	1.40	58.58	59.98	5.06E-01
30.00	0.749	1.00	69.23	70.23	6.59E-01
50.00	0.849	0.67	84.66	85.33	9.16E-01
70.00	0.902	0.54	95.02	95.56	1.14E+00
100.00	0.944	0.38	103.03	103.41	1.44E+00
150.00	0.974	0.21	108.02	108.22	1.91E+00
200.00	0.987	0.16	106.54	106.69	2.37E+00
300.00	0.996	0.12	91.57	91.69	3.38E+00
400.00	0.998	0.09	78.69	78.78	4.56E+00
500.00	0.999	0.03	69.42	69.45	5.92E+00
600.00	1.000	0.03	61.97	61.99	7.44E+00
700.00	1.000	0.02	56.52	56.54	9.14E+00
800.00	1.000	0.02	52.07	52.09	1.10E+01
900.00	1.000	0.01	48.34	48.36	1.30E+01
1000.00	1.000	0.01	45.17	45.18	1.51E+01
1200.00	1.000	0.01	40.04	40.05	1.98E+01
1500.00	1.000	0.01	34.38	34.39	2.79E+01
1700.00	1.000	0.01	31.50	31.51	3.40E+01
2000.00	1.000	0.00	28.07	28.07	4.41E+01
2500.00	1.000	0.00	23.87	23.87	6.35E+01

ABSORBER.....TISSUE EQUIVALENT PLASTIC (SHONKA)

ION.....ALPHA-PARTICLES

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	39.35	5.69	45.03	2.96E-03
0.15	0.049	40.68	6.96	47.64	4.03E-03
0.20	0.056	41.13	8.04	49.17	5.07E-03
0.30	0.069	41.13	9.85	50.98	7.06E-03
0.50	0.089	38.91	12.71	51.62	1.10E-02
0.70	0.105	36.69	15.04	51.73	1.48E-02
1.00	0.126	33.73	17.98	51.71	2.06E-02
1.50	0.154	29.76	22.02	51.79	3.03E-02
2.00	0.177	26.67	25.43	52.10	3.99E-02
3.00	0.217	22.30	31.14	53.45	5.89E-02
5.00	0.279	17.15	40.21	57.36	9.50E-02
7.00	0.330	14.08	47.57	61.65	1.29E-01
10.00	0.393	11.52	56.86	68.38	1.75E-01
15.00	0.478	8.80	69.64	78.44	2.43E-01
20.00	0.548	7.32	80.41	87.74	3.03E-01
30.00	0.663	5.22	98.49	103.71	4.08E-01
50.00	0.835	3.69	127.13	130.82	5.78E-01
70.00	0.965	2.78	149.20	151.99	7.19E-01
100.00	1.115	2.18	176.72	178.90	9.00E-01
150.00	1.294	1.52	212.66	214.18	1.16E+00
200.00	1.422	1.26	241.64	242.89	1.37E+00
300.00	1.593	0.83	281.31	282.14	1.75E+00
400.00	1.701	0.70	300.78	301.48	2.09E+00
500.00	1.773	0.39	300.69	301.08	2.42E+00
600.00	1.824	0.34	296.31	296.65	2.76E+00
700.00	1.861	0.30	287.90	288.21	3.10E+00
800.00	1.889	0.27	277.73	277.99	3.45E+00
900.00	1.910	0.24	267.15	267.39	3.82E+00
1000.00	1.926	0.22	256.83	256.85	4.20E+00
1200.00	1.949	0.04	236.78	236.82	5.01E+00
1500.00	1.970	0.03	211.38	211.41	6.36E+00
1700.00	1.978	0.02	197.16	197.18	7.34E+00
1900.00	1.986	0.02	178.50	178.51	8.93E+00
2500.00	1.993	0.01	154.01	154.02	1.20E+01
3000.00	1.996	0.01	136.39	136.40	1.54E+01
4000.00	1.998	0.01	122.64	122.65	1.93E+01
5000.00	1.999	0.01	111.60	111.61	2.36E+01
6000.00	1.999	0.00	102.56	102.56	2.83E+01
7000.00	1.999	0.00	94.98	94.98	3.33E+01
8000.00	2.000	0.00	88.54	88.54	3.88E+01
9000.00	2.000	0.00	83.00	83.00	4.46E+01
10000.00	2.000	0.00	78.17	78.17	5.08E+01
15000.00	2.000	0.00	73.92	73.92	5.74E+01
20000.00	2.000	0.00	70.15	70.15	6.44E+01

ABSORBER.....TISSUE EQUIVALENT PLASTIC (SHCNKA)

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(F)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	100.08	6.32	106.40	1.43E-03
0.15	112.46	7.74	120.21	1.87E-03
0.20	119.99	8.94	128.93	2.27E-03
0.30	131.62	10.95	142.56	3.00E-03
0.50	144.85	14.13	158.98	4.32E-03
0.70	152.51	16.72	169.23	5.54E-03
1.00	157.69	19.99	177.67	7.27E-03
1.50	161.92	24.48	186.40	1.00E-02
2.00	160.49	28.27	188.76	1.27E-02
3.00	156.22	34.62	190.84	1.79E-02
5.00	143.79	44.69	188.48	2.84E-02
7.00	132.56	52.88	185.44	3.91E-02
10.00	119.32	63.21	182.52	5.55E-02
15.00	101.48	77.41	178.89	8.32E-02
20.00	88.92	89.39	178.31	1.11E-01
30.00	72.42	109.48	181.90	1.67E-01
50.00	54.03	141.34	195.36	2.73E-01
70.00	42.72	167.23	209.95	3.72E-01
100.00	34.96	199.88	234.84	5.07E-01
150.00	25.21	244.80	270.01	7.05E-01
200.00	21.27	282.67	303.94	8.80E-01
300.00	15.63	346.20	361.83	1.18E+00
400.00	12.40	399.76	412.15	1.44E+00
500.00	10.57	446.94	457.51	1.67E+00
600.00	8.87	489.60	498.47	1.88E+00
700.00	7.50	528.83	536.33	2.07E+00
800.00	6.89	565.34	572.23	2.25E+00
900.00	6.75	599.63	606.39	2.42E+00
1000.00	6.10	632.07	638.17	2.58E+00
1200.00	5.01	692.40	697.40	2.88E+00
1500.00	4.07	774.12	778.19	3.29E+00

ABSORBER.....TISSUE EQUIVALENT PLASTIC (SHONKA)

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	109.89	6.40	116.29	1.32E-03
0.15	123.99	7.84	131.82	1.72E-03
0.20	135.26	9.05	144.30	2.09E-03
0.30	147.52	11.08	158.60	2.75E-03
0.50	164.52	14.31	178.82	3.93E-03
0.70	174.20	16.93	191.12	5.01E-03
1.00	183.90	20.23	204.13	6.52E-03
1.50	190.62	24.78	215.40	8.91E-03
2.00	194.83	28.61	223.44	1.12E-02
3.00	191.05	35.04	226.09	1.56E-02
5.00	181.33	45.24	226.56	2.45E-02
7.00	170.02	53.53	223.54	3.33E-02
10.00	155.36	63.98	219.33	4.69E-02
15.00	136.49	78.35	214.84	6.99E-02
20.00	120.59	90.47	211.06	9.34E-02
30.00	99.75	110.81	210.56	1.41E-01
50.00	76.43	143.05	219.49	2.34E-01
70.00	62.69	169.26	231.95	3.23E-01
100.00	48.40	202.31	250.71	4.47E-01
150.00	37.87	247.77	285.64	6.33E-01
200.00	28.72	286.11	314.83	8.00E-01
300.00	23.02	350.41	373.42	1.09E+00
400.00	18.66	404.61	423.27	1.34E+00
500.00	15.35	452.37	467.72	1.57E+00
600.00	13.85	495.55	509.40	1.77E+00
700.00	12.08	535.25	547.33	1.96E+00
800.00	10.59	572.21	582.80	2.14E+00
900.00	9.31	606.92	616.23	2.30E+00
1000.00	8.29	639.75	648.04	2.46E+00
1200.00	8.06	700.81	708.88	2.76E+00

ABSORBER.....TISSUE EQUIVALENT PLASTIC (SHONKA)

ION.....0-16 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	118.65	6.45	125.10	1.23E-03
0.15	133.99	7.90	141.89	1.61E-03
0.20	146.81	9.12	155.93	1.94E-03
0.30	162.06	11.17	173.23	2.54E-03
0.50	182.93	14.42	197.36	3.62E-03
0.70	195.67	17.07	212.74	4.59E-03
1.00	207.56	20.40	227.96	5.95E-03
1.50	217.38	24.98	242.36	8.06E-03
2.00	224.26	28.85	253.11	1.01E-02
3.00	225.12	35.33	260.46	1.39E-02
5.00	219.73	45.61	265.35	2.15E-02
7.00	209.73	53.97	263.70	2.91E-02
10.00	195.00	64.50	259.51	4.05E-02
15.00	175.36	79.00	254.36	6.00E-02
20.00	158.25	91.22	249.47	7.99E-02
30.00	133.85	111.73	245.57	1.20E-01
50.00	103.49	144.24	247.73	2.02E-01
70.00	86.02	170.66	256.69	2.82E-01
100.00	68.81	203.98	272.79	3.95E-01
150.00	54.59	249.83	304.42	5.69E-01
200.00	43.24	288.40	331.71	7.26E-01
300.00	33.45	353.31	386.76	1.01E+00
400.00	26.29	407.97	434.25	1.25E+00
500.00	22.53	456.12	478.65	1.47E+00
600.00	19.30	499.65	518.96	1.67E+00
700.00	16.81	539.69	556.50	1.86E+00
800.00	15.86	576.95	592.81	2.03E+00
900.00	14.31	611.95	626.25	2.19E+00
1000.00	12.89	645.05	657.94	2.35E+00

ABSORBER.....TISSUE EQUIVALENT PLASTIC (SHONKA)

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(E)	SI(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	126.33	6.31	132.64	1.17E-03
0.15	143.47	7.73	151.19	1.53E-03
0.20	155.96	8.92	164.89	1.84E-03
0.30	177.20	10.93	188.12	2.41E-03
0.50	199.34	14.11	213.45	3.40E-03
0.70	214.63	16.69	231.32	4.30E-03
1.00	229.83	19.95	249.79	5.54E-03
1.50	244.99	24.44	269.43	7.47E-03
2.00	251.67	28.22	279.88	9.28E-03
3.00	262.10	34.56	296.66	1.27E-02
5.00	258.77	44.62	303.38	1.94E-02
7.00	251.63	52.79	304.42	2.60E-02
10.00	237.96	63.10	301.06	3.59E-02
15.00	217.04	77.28	294.32	5.27E-02
20.00	200.67	89.23	289.90	6.98E-02
30.00	171.86	109.29	281.15	1.05E-01
50.00	135.66	141.09	276.74	1.77E-01
70.00	114.62	166.94	281.56	2.49E-01
100.00	93.67	199.53	293.20	3.53E-01
150.00	71.44	244.37	315.81	5.17E-01
200.00	61.82	282.17	343.99	6.69E-01
300.00	43.40	345.59	388.99	9.42E-01
400.00	37.81	399.05	436.87	1.19E+00
500.00	31.36	446.15	477.51	1.40E+00
600.00	27.33	488.74	516.07	1.61E+00
700.00	24.44	527.90	552.34	1.79E+00
800.00	21.70	564.35	586.05	1.97E+00
900.00	19.54	598.58	618.12	2.13E+00



ABSORBER.....TISSUE EQUIVALENT PLASTIC (SHONKA)

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	154.14	6.48	160.62	9.74E-04
0.15	176.26	7.93	184.19	1.26E-03
0.20	195.27	9.16	204.43	1.52E-03
0.30	224.88	11.22	236.10	1.97E-03
0.50	264.30	14.48	278.78	2.75E-03
0.70	291.73	17.14	308.87	3.43E-03
1.00	324.88	20.48	345.36	4.35E-03
1.50	354.57	25.09	379.65	5.73E-03
2.00	377.84	28.97	406.81	7.00E-03
3.00	408.36	35.48	443.83	9.34E-03
5.00	441.40	45.80	487.19	1.36E-02
7.00	454.29	54.19	508.48	1.76E-02
10.00	466.92	64.77	531.69	2.34E-02
15.00	458.03	79.33	537.36	3.28E-02
20.00	447.52	91.60	539.12	4.21E-02
30.00	420.48	112.18	532.66	6.07E-02
50.00	371.84	144.83	516.67	9.89E-02
70.00	335.05	171.36	506.42	1.38E-01
100.00	288.42	204.82	493.24	1.98E-01
150.00	238.49	250.85	489.34	3.00E-01
200.00	206.08	289.66	495.73	4.01E-01
300.00	164.15	354.76	518.91	5.99E-01
400.00	136.45	409.64	546.09	7.86E-01
500.00	115.73	457.99	573.72	9.65E-01
600.00	106.34	501.70	608.04	1.13E+00

ABSORBER.....TISSUE EQUIVALENT GAS 1

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	9.26	5.92	15.19	7.81E-03
0.15	0.097	8.61	7.25	15.87	1.10E-02
0.20	0.112	7.99	8.38	16.37	1.41E-02
0.30	0.136	7.06	10.26	17.32	2.01E-02
0.50	0.175	5.82	13.25	19.07	3.11E-02
0.70	0.207	5.04	15.67	20.72	4.11E-02
1.00	0.246	4.21	18.73	22.94	5.49E-02
1.50	0.298	3.45	22.94	26.39	7.52E-02
2.00	0.340	2.83	26.49	29.32	9.31E-02
3.00	0.409	2.27	32.44	34.72	1.24E-01
5.00	0.508	1.60	41.88	43.48	1.76E-01
7.00	0.580	1.28	47.94	49.22	2.19E-01
10.00	0.660	0.96	56.55	57.51	2.75E-01
15.00	0.749	0.72	66.58	67.31	3.55E-01
20.00	0.808	0.56	74.90	75.47	4.25E-01
30.00	0.879	0.42	87.57	87.99	5.47E-01
50.00	0.944	0.28	99.50	99.77	7.58E-01
70.00	0.970	0.21	103.56	103.77	9.54E-01
100.00	0.987	0.10	101.78	101.87	1.24E+00
150.00	0.996	0.07	88.54	88.61	1.77E+00
200.00	0.998	0.06	76.58	76.64	2.38E+00
300.00	1.000	0.04	60.96	61.00	3.85E+00
400.00	1.000	0.03	51.41	51.44	5.65E+00
500.00	1.000	0.01	44.68	44.70	7.74E+00
600.00	1.000	0.00	39.66	39.66	1.01E+01
700.00	1.000	0.00	35.74	35.74	1.28E+01
800.00	1.000	0.00	32.59	32.59	1.57E+01
900.00	1.000	0.00	30.01	30.01	1.89E+01
1000.00	1.000	0.00	27.84	27.84	2.24E+01
1200.00	1.000	0.00	24.41	24.41	3.01E+01
1500.00	1.000	0.00	20.71	20.71	4.35E+01
1700.00	1.000	0.00	18.85	18.85	5.36E+01
2000.00	1.000	0.00	16.67	16.67	7.06E+01
2500.00	1.000	0.00	14.04	14.04	1.03E+02
3000.00	1.000	0.00	12.18	12.18	1.42E+02
3500.00	1.000	0.00	10.79	10.79	1.85E+02
4000.00	1.000	0.00	9.71	9.71	2.34E+02
4500.00	1.000	0.00	8.84	8.84	2.88E+02
5000.00	1.000	0.00	8.12	8.12	3.47E+02
5500.00	1.000	0.00	7.52	7.52	4.12E+02
6000.00	1.000	0.00	7.01	7.01	4.80E+02
6500.00	1.000	0.00	6.57	6.57	5.54E+02

ABSORBER.....TISSUE EQUIVALENT GAS 1

ION.....DEUTERONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.056	14.68	4.19	18.87	6.19E-03
0.15	0.069	13.99	5.13	19.12	8.82E-03
0.20	0.079	13.33	5.93	19.26	1.14E-02
0.30	0.097	12.08	7.26	19.33	1.66E-02
0.50	0.125	10.22	9.37	19.59	2.69E-02
0.70	0.147	9.00	11.09	20.09	3.70E-02
1.00	0.175	7.69	13.25	20.95	5.16E-02
1.50	0.214	6.23	16.23	22.46	7.47E-02
2.00	0.246	5.41	18.74	24.15	9.62E-02
3.00	0.298	4.13	22.95	27.08	1.35E-01
5.00	0.377	3.03	29.63	32.66	2.02E-01
7.00	0.437	2.43	35.06	37.49	2.59E-01
10.00	0.508	1.84	41.90	43.74	3.33E-01
15.00	0.596	1.36	49.49	50.85	4.40E-01
20.00	0.660	1.14	56.51	57.65	5.32E-01
30.00	0.749	0.78	66.55	67.33	6.92E-01
50.00	0.849	0.54	81.94	82.48	9.58E-01
70.00	0.902	0.41	91.92	92.34	1.19E+00
100.00	0.944	0.30	99.49	99.79	1.50E+00
150.00	0.974	0.14	103.88	104.02	1.98E+00
200.00	0.987	0.11	101.75	101.86	2.47E+00
300.00	0.996	0.08	88.50	88.58	3.52E+00
400.00	0.998	0.06	76.55	76.61	4.74E+00
500.00	0.999	0.02	67.83	67.86	6.13E+00
600.00	1.000	0.02	60.95	60.97	7.69E+00
700.00	1.000	0.00	55.73	55.73	9.41E+00
800.00	1.000	0.00	51.42	51.42	1.13E+01
900.00	1.000	0.00	47.78	47.78	1.33E+01
1000.00	1.000	0.00	44.67	44.67	1.55E+01
1200.00	1.000	0.00	39.64	39.64	2.02E+01
1500.00	1.000	0.00	34.07	34.07	2.84E+01
1700.00	1.000	0.00	31.22	31.22	3.46E+01
2000.00	1.000	0.00	27.83	27.83	4.48E+01
2500.00	1.000	0.00	23.68	23.68	6.43E+01

ABSORBER.....TISSUE EQUIVALENT GAS 1

ION.....ALPHA-PARTICLES

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	37.12	5.35	42.48	3.14E-03
0.15	0.049	38.33	6.56	44.89	4.27E-03
0.20	0.056	38.81	7.57	46.38	5.37E-03
0.30	0.069	38.70	9.28	47.97	7.48E-03
0.50	0.089	36.62	11.97	48.59	1.16E-02
0.70	0.105	34.57	14.17	48.73	1.57E-02
1.00	0.126	31.76	16.93	48.69	2.19E-02
1.50	0.154	28.00	20.74	48.74	3.22E-02
2.00	0.177	25.03	23.95	48.98	4.24E-02
3.00	0.217	20.98	29.33	50.31	6.26E-02
5.00	0.279	16.11	37.87	53.97	1.01E-01
7.00	0.330	13.11	44.80	57.91	1.37E-01
10.00	0.393	10.73	53.55	64.28	1.86E-01
15.00	0.478	8.24	65.58	73.82	2.58E-01
20.00	0.548	6.74	75.73	82.47	3.22E-01
30.00	0.663	4.90	92.75	97.66	4.33E-01
50.00	0.835	3.45	119.73	123.18	6.14E-01
70.00	0.965	2.54	140.94	143.48	7.64E-01
100.00	1.115	2.0	167.48	169.49	9.56E-01
150.00	1.294	1.42	203.67	205.09	1.22E+00
200.00	1.422	1.13	231.91	233.03	1.45E+00
300.00	1.593	0.78	269.42	270.20	1.85E+00
400.00	1.701	0.62	288.45	289.07	2.20E+00
500.00	1.773	0.35	291.38	291.74	2.55E+00
600.00	1.824	0.30	288.08	288.38	2.89E+00
700.00	1.861	0.26	280.81	281.07	3.24E+00
800.00	1.889	0.24	271.00	271.24	3.60E+00
900.00	1.910	0.21	261.20	261.41	3.98E+00
1000.00	1.926	0.19	250.77	250.96	4.37E+00
1200.00	1.949	0.08	230.97	231.05	5.20E+00
1500.00	1.970	0.00	206.66	206.66	6.58E+00
1700.00	1.978	0.00	193.57	193.57	7.58E+00
2000.00	1.986	0.00	176.51	176.51	9.20E+00
2500.00	1.993	0.00	152.48	152.48	1.23E+01
3000.00	1.996	0.00	135.11	135.11	1.58E+01
3500.00	1.998	0.00	121.55	121.55	1.97E+01
4000.00	1.999	0.00	110.65	110.65	2.40E+01
4500.00	1.999	0.00	101.70	101.70	2.87E+01
5000.00	1.999	0.00	94.21	94.21	3.38E+01
5500.00	2.000	0.00	87.85	87.85	3.93E+01
6000.00	2.000	0.00	82.36	82.36	4.52E+01
6500.00	2.000	0.00	77.58	77.58	5.14E+01
7000.00	2.000	0.00	73.38	73.38	5.81E+01
7500.00	2.000	0.00	69.65	69.65	6.51E+01

ABSORBER.....TISSUE EQUIVALENT GAS 1

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	95.78	6.16	101.94	1.49E-03
0.15	107.46	7.54	115.00	1.95E-03
0.20	115.33	8.71	124.04	2.37E-03
0.30	126.21	10.67	136.87	3.14E-03
0.50	139.03	13.77	152.80	4.51E-03
0.70	146.49	16.29	162.78	5.78E-03
1.00	152.02	19.47	171.49	7.57E-03
1.50	155.89	23.85	179.74	1.04E-02
2.00	155.60	27.54	183.14	1.32E-02
3.00	151.32	33.73	185.05	1.86E-02
5.00	139.73	43.54	183.27	2.94E-02
7.00	129.07	51.52	180.59	4.04E-02
10.00	116.30	61.58	177.88	5.72E-02
15.00	99.47	75.42	174.89	8.56E-02
20.00	87.00	87.09	174.08	1.14E-01
30.00	70.95	106.66	177.60	1.71E-01
50.00	53.22	137.70	190.92	2.80E-01
70.00	42.29	162.93	205.21	3.81E-01
100.00	33.99	194.73	228.72	5.19E-01
150.00	25.20	238.50	263.70	7.23E-01
200.00	20.46	275.39	295.86	9.01E-01
300.00	15.37	337.29	352.66	1.21E+00
400.00	12.35	389.47	401.81	1.47E+00
500.00	10.34	435.44	445.77	1.71E+00
600.00	8.85	477.00	485.84	1.93E+00
700.00	7.53	515.22	522.74	2.12E+00
800.00	6.91	550.79	557.70	2.31E+00
900.00	6.49	584.20	590.69	2.48E+00
1000.00	5.84	615.80	621.64	2.65E+00
1200.00	5.03	674.57	679.61	2.96E+00
1500.00	4.11	754.20	758.31	3.37E+00

ABSORBER.....TISSUE EQUIVALENT GAS 1

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	105.15	6.24	111.39	1.38E-03
0.15	118.62	7.64	126.26	1.80E-03
0.20	129.50	8.82	138.33	2.18E-03
0.30	141.43	10.81	152.23	2.87E-03
0.50	157.98	13.95	171.93	4.09E-03
0.70	167.57	16.51	184.08	5.22E-03
1.00	176.95	19.73	196.68	6.79E-03
1.50	183.61	24.17	207.78	9.26E-03
2.00	187.94	27.91	215.85	1.16E-02
3.00	184.82	34.18	219.00	1.62E-02
5.00	176.96	44.12	220.19	2.53E-02
7.00	165.49	52.21	217.70	3.44E-02
10.00	151.53	62.40	213.93	4.83E-02
15.00	133.55	76.43	209.97	7.19E-02
20.00	118.31	88.25	206.56	9.59E-02
30.00	98.14	108.08	206.23	1.44E-01
50.00	75.24	139.53	214.77	2.40E-01
70.00	61.75	165.10	226.85	3.30E-01
100.00	47.95	197.33	245.28	4.58E-01
150.00	37.65	241.68	279.33	6.48E-01
200.00	28.71	279.07	307.77	8.18E-01
300.00	22.89	341.79	364.68	1.12E+00
400.00	18.33	394.66	412.99	1.37E+00
500.00	15.28	441.24	456.52	1.60E+00
600.00	13.56	483.36	496.92	1.81E+00
700.00	11.81	522.09	533.89	2.01E+00
800.00	10.57	558.13	568.70	2.19E+00
900.00	9.33	591.99	601.32	2.36E+00
1000.00	8.31	624.01	632.32	2.52E+00
1200.00	7.73	683.57	691.30	2.82E+00

ABSORBER.....TISSUE EQUIVALENT GAS 1

ION.....0-16 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	112.96	6.30	119.26	1.30E-03
0.15	127.69	7.71	135.40	1.69E-03
0.20	139.61	8.91	148.51	2.04E-03
0.30	155.05	10.91	165.96	2.67E-03
0.50	174.57	14.08	188.65	3.79E-03
0.70	186.82	16.66	203.49	4.81E-03
1.00	198.34	19.92	218.25	6.23E-03
1.50	208.36	24.39	232.75	8.44E-03
2.00	214.46	28.17	242.63	1.05E-02
3.00	216.80	34.50	251.30	1.46E-02
5.00	211.35	44.54	255.88	2.24E-02
7.00	202.08	52.70	254.78	3.03E-02
10.00	188.09	62.98	251.07	4.21E-02
15.00	169.17	77.14	246.31	6.22E-02
20.00	153.21	89.07	242.29	8.27E-02
30.00	129.37	109.09	238.46	1.24E-01
50.00	100.06	140.84	240.90	2.08E-01
70.00	83.41	166.64	250.04	2.90E-01
100.00	66.92	199.17	266.09	4.06E-01
150.00	52.29	243.93	296.22	5.85E-01
200.00	42.37	281.67	324.05	7.46E-01
300.00	31.72	344.98	376.69	1.03E+00
400.00	25.73	398.34	424.08	1.28E+00
500.00	21.80	445.36	467.16	1.51E+00
600.00	18.88	487.87	506.75	1.71E+00
700.00	16.42	526.96	543.38	1.90E+00
800.00	15.24	563.34	578.59	2.08E+00
900.00	13.99	597.51	611.50	2.25E+00
1000.00	12.64	629.84	642.48	2.41E+00

ABSORBER.....TISSUE EQUIVALENT GAS 1

ION.....F-19 PECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	120.61	6.17	126.78	1.23E-03
0.15	137.02	7.55	144.57	1.60E-03
0.20	149.25	8.72	157.97	1.93E-03
0.30	169.28	10.68	179.96	2.52E-03
0.50	190.69	13.79	204.47	3.56E-03
0.70	205.53	16.32	221.84	4.49E-03
1.00	220.36	19.50	239.86	5.79E-03
1.50	235.05	23.88	258.93	7.79E-03
2.00	242.30	27.58	269.87	9.67E-03
3.00	251.90	33.78	285.67	1.33E-02
5.00	249.39	43.60	292.99	2.02E-02
7.00	243.00	51.59	294.60	2.70E-02
10.00	230.30	61.67	291.97	3.72E-02
15.00	210.41	75.52	285.93	5.45E-02
20.00	194.51	87.21	281.72	7.21E-02
30.00	167.33	106.81	274.14	1.08E-01
50.00	132.39	137.89	270.28	1.82E-01
70.00	111.79	163.15	274.94	2.55E-01
100.00	91.45	195.00	286.46	3.62E-01
150.00	70.00	238.83	308.83	5.31E-01
200.00	59.45	275.78	335.23	6.86E-01
300.00	42.84	337.76	380.60	9.65E-01
400.00	35.97	390.01	425.98	1.21E+00
500.00	30.85	436.04	466.89	1.44E+00
600.00	26.60	477.66	504.26	1.64E+00
700.00	24.01	515.93	539.94	1.84E+00
800.00	21.37	551.55	572.92	2.01E+00
900.00	19.19	585.01	604.20	2.18E+00



ABSORBER.....TISSUE EQUIVALENT GAS 1

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	149.26	6.36	155.62	1.00E-03
0.15	170.60	7.79	178.39	1.30E-03
0.20	189.08	8.99	198.07	1.57E-03
0.30	217.98	11.02	229.00	2.04E-03
0.50	256.20	14.22	270.42	2.84E-03
0.70	282.74	16.83	299.56	3.54E-03
1.00	315.33	20.11	335.44	4.48E-03
1.50	344.21	24.63	368.84	5.90E-03
2.00	367.21	28.44	395.65	7.21E-03
3.00	397.31	34.83	432.15	9.62E-03
5.00	429.86	44.97	474.83	1.40E-02
7.00	442.59	53.21	495.80	1.81E-02
10.00	455.88	63.60	519.47	2.40E-02
15.00	447.77	77.89	525.66	3.36E-02
20.00	438.33	89.94	528.27	4.31E-02
30.00	412.63	110.15	522.78	6.21E-02
50.00	365.65	142.21	507.86	1.01E-01
70.00	330.18	168.26	498.44	1.41E-01
100.00	284.70	201.11	485.81	2.02E-01
150.00	235.86	246.31	482.17	3.05E-01
200.00	203.70	284.41	488.11	4.08E-01
300.00	162.51	348.33	510.84	6.09E-01
400.00	135.41	402.22	537.83	8.00E-01
500.00	114.85	449.70	564.55	9.81E-01
600.00	105.70	492.62	598.31	1.15E+00

ABSORBER.....TISSUE EQUIVALENT GAS 2

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	9.40	6.02	15.42	7.70E-03
0.15	0.097	8.74	7.37	16.11	1.09E-02
0.20	0.112	8.11	8.51	16.62	1.39E-02
0.30	0.136	7.17	10.42	17.59	1.98E-02
0.50	0.175	5.91	13.45	19.36	3.06E-02
0.70	0.207	5.12	15.92	21.03	4.05E-02
1.00	0.246	4.27	19.02	23.29	5.41E-02
1.50	0.298	3.49	23.30	26.79	7.40E-02
2.00	0.340	2.86	26.90	29.76	9.17E-02
3.00	0.409	2.30	32.95	35.25	1.23E-01
5.00	0.508	1.61	42.54	44.15	1.73E-01
7.00	0.580	1.30	48.71	50.01	2.16E-01
10.00	0.660	0.96	57.47	58.43	2.71E-01
15.00	0.749	0.73	67.73	68.47	3.50E-01
20.00	0.808	0.57	76.07	76.64	4.19E-01
30.00	0.879	0.42	88.89	89.31	5.39E-01
50.00	0.944	0.28	101.03	101.31	7.47E-01
70.00	0.970	0.21	105.23	105.44	9.39E-01
100.00	0.987	0.10	103.73	103.83	1.22E+00
150.00	0.996	0.07	89.86	89.93	1.74E+00
200.00	0.998	0.06	77.55	77.61	2.34E+00
300.00	1.000	0.04	61.49	61.53	3.80E+00
400.00	1.000	0.03	51.79	51.83	5.58E+00
500.00	1.000	0.01	44.99	45.00	7.66E+00
600.00	1.000	0.00	39.91	39.91	1.00E+01
700.00	1.000	0.00	35.95	35.95	1.27E+01
800.00	1.000	0.00	32.78	32.78	1.56E+01
900.00	1.000	0.00	30.18	30.18	1.88E+01
1000.00	1.000	0.00	27.99	27.99	2.22E+01
1200.00	1.000	0.00	24.53	24.53	2.99E+01
1500.00	1.000	0.00	20.80	20.80	4.32E+01
1700.00	1.000	0.00	18.94	18.94	5.33E+01
2000.00	1.000	0.00	16.74	16.74	7.02E+01
2500.00	1.000	0.00	14.10	14.10	1.03E+02
3000.00	1.000	0.00	12.23	12.23	1.41E+02
3500.00	1.000	0.00	10.83	10.83	1.85E+02
4000.00	1.000	0.00	9.74	9.74	2.33E+02
4500.00	1.000	0.00	8.87	8.87	2.87E+02
5000.00	1.000	0.00	8.15	8.15	3.46E+02
5500.00	1.000	0.00	7.54	7.54	4.10E+02
6000.00	1.000	0.00	7.03	7.03	4.79E+02
6500.00	1.000	0.00	6.59	6.59	5.52E+02

ABSORBER.....TISSUE EQUIVALENT GAS 2

ION.....DEUTERONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.056	14.93	4.26	19.18	6.09E-03
0.15	0.069	14.21	5.21	19.42	8.68E-03
0.20	0.079	13.55	6.02	19.57	1.12E-02
0.30	0.097	12.27	7.37	19.64	1.63E-02
0.50	0.125	10.37	9.52	19.89	2.65E-02
0.70	0.147	9.14	11.26	20.39	3.64E-02
1.00	0.175	7.80	13.46	21.25	5.08E-02
1.50	0.214	6.31	16.48	22.79	7.36E-02
2.00	0.246	5.47	19.03	24.50	9.48E-02
3.00	0.298	4.17	23.31	27.48	1.33E-01
5.00	0.377	3.05	30.09	33.14	1.99E-01
7.00	0.437	2.46	35.60	38.06	2.56E-01
10.00	0.508	1.85	42.56	44.40	3.28E-01
15.00	0.596	1.37	50.29	51.66	4.33E-01
20.00	0.660	1.14	57.43	58.57	5.24E-01
30.00	0.749	0.79	67.70	68.49	6.81E-01
50.00	0.849	0.54	83.16	83.70	9.43E-01
70.00	0.902	0.42	93.30	93.72	1.17E+00
100.00	0.944	0.30	101.02	101.32	1.47E+00
150.00	0.974	0.14	105.61	105.75	1.95E+00
200.00	0.987	0.11	103.71	103.82	2.43E+00
300.00	0.996	0.08	89.83	89.90	3.46E+00
400.00	0.998	0.06	77.52	77.58	4.67E+00
500.00	0.999	0.02	68.58	68.60	6.04E+00
600.00	1.000	0.01	61.49	61.50	7.58E+00
700.00	1.000	0.00	56.17	56.17	9.29E+00
800.00	1.000	0.00	51.80	51.80	1.11E+01
900.00	1.000	0.00	48.12	48.12	1.31E+01
1000.00	1.000	0.00	44.98	44.98	1.53E+01
1200.00	1.000	0.00	39.89	39.89	2.00E+01
1500.00	1.000	0.00	34.27	34.27	2.82E+01
1700.00	1.000	0.00	31.40	31.40	3.43E+01
2000.00	1.000	0.00	27.98	27.98	4.44E+01
2500.00	1.000	0.00	23.79	23.79	6.39E+01

ABSORBER.....TISSUE EQUIVALENT GAS 2

ION.....ALPHA-PARTICLES

ENERGY E	Z <sub>EFF</sub>	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	37.82	5.49	43.31	3.08E-03
0.15	0.049	39.05	6.73	45.78	4.19E-03
0.20	0.056	39.51	7.77	47.27	5.27E-03
0.30	0.069	39.42	9.51	48.93	7.34E-03
0.50	0.089	37.26	12.28	49.54	1.14E-02
0.70	0.105	35.13	14.53	49.66	1.54E-02
1.00	0.126	32.25	17.37	49.62	2.15E-02
1.50	0.154	28.41	21.27	49.68	3.16E-02
2.00	0.177	25.39	24.56	49.95	4.16E-02
3.00	0.217	21.22	30.08	51.30	6.14E-02
5.00	0.279	16.26	38.83	55.09	9.90E-02
7.00	0.330	13.25	45.95	59.20	1.34E-01
10.00	0.393	10.83	54.92	65.75	1.82E-01
15.00	0.478	8.28	67.26	75.54	2.53E-01
20.00	0.548	6.81	77.66	84.47	3.15E-01
30.00	0.663	4.91	95.12	100.02	4.24E-01
50.00	0.835	3.45	122.78	126.24	6.00E-01
70.00	0.965	2.56	144.37	146.93	7.47E-01
100.00	1.115	2.02	171.34	173.36	9.34E-01
150.00	1.294	1.42	207.58	209.00	1.20E+00
200.00	1.422	1.14	236.14	237.28	1.42E+00
300.00	1.593	0.78	274.39	275.17	1.81E+00
400.00	1.701	0.63	293.57	294.20	2.16E+00
500.00	1.773	0.35	295.54	295.89	2.50E+00
600.00	1.824	0.31	291.92	292.23	2.83E+00
700.00	1.861	0.26	284.26	284.53	3.18E+00
800.00	1.889	0.24	274.29	274.52	3.54E+00
900.00	1.910	0.21	264.18	264.39	3.91E+00
1000.00	1.926	0.19	253.64	253.84	4.30E+00
1200.00	1.949	0.06	233.73	233.79	5.12E+00
1500.00	1.970	0.00	208.92	208.92	6.48E+00
1700.00	1.978	0.00	195.39	195.39	7.47E+00
2000.00	1.986	0.00	177.73	177.73	9.08E+00
2500.00	1.993	0.00	153.43	153.43	1.21E+01
3000.00	1.996	0.00	135.91	135.91	1.56E+01
3500.00	1.998	0.00	122.22	122.22	1.95E+01
4000.00	1.999	0.00	111.24	111.24	2.38E+01
4500.00	1.999	0.00	102.23	102.23	2.85E+01
5000.00	1.999	0.00	94.68	94.68	3.36E+01
5500.00	2.000	0.00	88.27	88.27	3.90E+01
6000.00	2.000	0.00	82.75	82.75	4.49E+01
6500.00	2.000	0.00	77.94	77.94	5.11E+01
7000.00	2.000	0.00	73.71	73.71	5.77E+01
7500.00	2.000	0.00	69.95	69.95	6.47E+01

ABSORBER.....TISSUE EQUIVALENT GAS 2

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	97.69	6.24	103.93	1.46E-03
0.15	109.67	7.64	117.31	1.91E-03
0.20	117.44	8.82	126.26	2.32E-03
0.30	128.61	10.80	139.41	3.08E-03
0.50	141.62	13.94	155.56	4.43E-03
0.70	149.16	16.50	165.66	5.67E-03
1.00	154.58	19.72	174.30	7.43E-03
1.50	158.59	24.15	182.73	1.02E-02
2.00	157.87	27.88	185.76	1.29E-02
3.00	153.54	34.15	187.69	1.83E-02
5.00	141.57	44.09	185.66	2.90E-02
7.00	130.65	52.17	182.81	3.98E-02
10.00	117.64	62.35	179.99	5.64E-02
15.00	100.38	76.37	176.75	8.45E-02
20.00	87.83	88.18	176.01	1.13E-01
30.00	71.56	108.00	179.56	1.69E-01
50.00	53.56	139.42	192.98	2.77E-01
70.00	42.47	164.97	207.44	3.77E-01
100.00	34.35	197.17	231.52	5.13E-01
150.00	25.20	241.49	266.69	7.14E-01
200.00	20.74	278.85	299.59	8.91E-01
300.00	15.46	341.52	356.98	1.20E+00
400.00	12.36	394.35	406.71	1.46E+00
500.00	10.41	440.89	451.30	1.69E+00
600.00	8.85	482.98	491.83	1.90E+00
700.00	7.51	521.67	529.19	2.10E+00
800.00	6.89	557.69	564.58	2.28E+00
900.00	6.58	591.52	598.10	2.45E+00
1000.00	5.93	623.52	629.45	2.62E+00
1200.00	5.02	683.03	688.05	2.92E+00
1500.00	4.09	763.65	767.74	3.33E+00

ABSORBER.....TISSUE EQUIVALENT GAS 2

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	107.25	6.32	113.57	1.35E-03
0.15	120.98	7.73	128.72	1.77E-03
0.20	132.05	8.93	140.98	2.14E-03
0.30	144.13	10.94	155.06	2.81E-03
0.50	160.88	14.12	175.01	4.02E-03
0.70	170.53	16.71	187.24	5.12E-03
1.00	180.05	19.97	200.02	6.67E-03
1.50	186.73	24.46	211.19	9.10E-03
2.00	191.02	28.24	219.26	1.14E-02
3.00	187.61	34.59	222.20	1.60E-02
5.00	178.42	44.66	223.08	2.49E-02
7.00	167.52	52.84	220.36	3.39E-02
10.00	153.24	63.15	216.39	4.77E-02
15.00	134.86	77.35	212.21	7.10E-02
20.00	119.32	89.31	208.63	9.48E-02
30.00	98.84	109.38	208.23	1.43E-01
50.00	75.73	141.22	216.94	2.37E-01
70.00	62.12	167.09	229.21	3.27E-01
100.00	48.11	199.71	247.82	4.53E-01
150.00	37.73	244.59	282.32	6.41E-01
200.00	28.70	282.43	311.13	8.09E-01
300.00	22.92	345.91	368.83	1.10E+00
400.00	18.44	399.42	417.86	1.36E+00
500.00	15.30	446.56	461.86	1.58E+00
600.00	13.65	489.18	502.83	1.79E+00
700.00	11.89	528.38	540.27	1.98E+00
800.00	10.57	564.86	575.43	2.16E+00
900.00	9.31	599.13	608.44	2.33E+00
1000.00	8.29	631.53	639.83	2.49E+00
1200.00	7.84	691.81	699.65	2.79E+00

ABSORBER.....TISSUE EQUIVALENT GAS 2

ION.....0-16 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	115.11	6.37	121.48	1.27E-03
0.15	130.05	7.80	137.86	1.66E-03
0.20	142.30	9.01	151.31	2.00E-03
0.30	157.68	11.04	168.71	2.62E-03
0.50	177.64	14.25	191.89	3.73E-03
0.70	190.07	16.86	206.93	4.73E-03
1.00	201.69	20.15	221.84	6.12E-03
1.50	211.60	24.68	236.27	8.29E-03
2.00	217.94	28.49	248.44	1.04E-02
3.00	219.70	34.90	254.60	1.43E-02
5.00	214.14	45.05	259.19	2.21E-02
7.00	204.56	53.31	257.87	2.98E-02
10.00	190.22	63.72	253.94	4.15E-02
15.00	170.99	78.04	249.03	6.14E-02
20.00	154.60	90.11	244.70	8.17E-02
30.00	130.53	110.36	240.88	1.23E-01
50.00	100.86	142.47	243.33	2.06E-01
70.00	83.95	168.57	252.52	2.87E-01
100.00	67.26	201.49	268.74	4.02E-01
150.00	52.81	246.77	299.58	5.79E-01
200.00	42.43	284.94	327.38	7.38E-01
300.00	32.12	348.98	381.11	1.02E+00
400.00	25.76	402.97	428.73	1.27E+00
500.00	21.92	450.54	472.46	1.49E+00
600.00	18.91	493.54	512.45	1.69E+00
700.00	16.44	533.08	549.52	1.88E+00
800.00	15.35	569.89	585.24	2.06E+00
900.00	14.01	604.46	618.46	2.22E+00
1000.00	12.64	637.15	649.79	2.38E+00

ABSORBER.....TISSUE EQUIVALENT GAS 2

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	122.85	6.24	129.09	1.21E-03
0.15	139.54	7.64	147.17	1.57E-03
0.20	151.87	8.82	160.69	1.89E-03
0.30	172.35	10.80	183.15	2.47E-03
0.50	194.01	13.94	207.95	3.49E-03
0.70	209.00	16.50	225.50	4.41E-03
1.00	223.96	19.72	243.68	5.69E-03
1.50	238.80	24.15	262.95	7.66E-03
2.00	245.82	27.89	273.71	9.52E-03
3.00	255.67	34.15	289.82	1.31E-02
5.00	252.75	44.09	296.84	1.99E-02
7.00	246.01	52.17	298.18	2.66E-02
10.00	232.89	62.36	295.25	3.67E-02
15.00	212.54	76.37	288.92	5.38E-02
20.00	196.43	88.19	284.62	7.12E-02
30.00	168.62	108.01	276.63	1.07E-01
50.00	133.19	139.44	272.63	1.80E-01
70.00	112.46	164.98	277.44	2.53E-01
100.00	91.93	197.19	289.12	3.59E-01
150.00	70.22	241.51	311.73	5.25E-01
200.00	60.04	278.87	338.91	6.80E-01
300.00	42.83	341.55	384.38	9.56E-01
400.00	36.45	394.38	430.83	1.20E+00
500.00	30.88	440.93	471.82	1.42E+00
600.00	26.74	483.02	509.76	1.63E+00
700.00	24.05	521.72	545.77	1.82E+00
800.00	21.39	557.74	579.13	1.99E+00
900.00	19.20	591.57	610.78	2.16E+00



ABSORBER.....TISSUE EQUIVALENT GAS 2

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	151.50	6.42	157.92	9.90E-04
0.15	173.17	7.86	181.03	1.29E-03
0.20	191.91	9.08	200.99	1.55E-03
0.30	221.16	11.12	232.28	2.01E-03
0.50	259.91	14.35	274.26	2.80E-03
0.70	286.83	16.98	303.82	3.49E-03
1.00	319.73	20.30	340.03	4.42E-03
1.50	348.91	24.86	373.77	5.82E-03
2.00	372.08	28.70	400.78	7.11E-03
3.00	402.37	35.15	437.52	9.49E-03
5.00	435.13	45.38	480.51	1.38E-02
7.00	447.88	53.70	501.58	1.79E-02
10.00	460.94	64.18	525.12	2.37E-02
15.00	452.35	78.60	530.96	3.32E-02
20.00	442.46	90.76	533.23	4.26E-02
30.00	416.10	111.16	527.26	6.15E-02
50.00	368.33	143.51	511.84	10.00E-02
70.00	332.27	169.81	502.07	1.39E-01
100.00	286.21	202.96	489.17	2.00E-01
150.00	236.88	248.57	485.45	3.03E-01
200.00	204.59	287.02	491.61	4.05E-01
300.00	163.10	351.53	514.63	6.04E-01
400.00	135.74	405.91	541.66	7.93E-01
500.00	115.09	453.82	568.92	9.74E-01
600.00	105.91	497.14	603.05	1.14E+00

ABSORBER.....WATER

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	9.27	5.75	15.02	7.78E-03
0.15	0.097	8.62	7.04	15.67	1.10E-02
0.20	0.112	7.94	8.13	16.08	1.42E-02
0.30	0.136	7.00	9.96	16.97	2.02E-02
0.50	0.175	5.76	12.86	18.62	3.15E-02
0.70	0.207	4.98	15.22	20.19	4.18E-02
1.00	0.246	4.17	18.19	22.36	5.59E-02
1.50	0.298	3.42	22.28	25.69	7.67E-02
2.00	0.340	2.82	25.72	28.54	9.52E-02
3.00	0.409	2.26	31.50	33.76	1.27E-01
5.00	0.508	1.60	40.67	42.27	1.80E-01
7.00	0.580	1.27	46.34	47.61	2.25E-01
10.00	0.660	0.98	54.57	55.55	2.83E-01
15.00	0.749	0.71	63.92	64.63	3.67E-01
20.00	0.808	0.57	72.34	72.91	4.39E-01
30.00	0.879	0.43	84.69	85.12	5.65E-01
50.00	0.944	0.29	95.79	96.07	7.84E-01
70.00	0.970	0.20	99.22	99.42	9.87E-01
100.00	0.987	0.17	96.02	96.12	1.29E+00
150.00	0.996	0.09	84.84	84.90	1.85E+00
200.00	0.998	0.05	73.93	73.98	2.48E+00
300.00	1.000	0.04	59.83	59.87	4.00E+00
400.00	1.000	0.03	50.63	50.66	5.82E+00
500.00	1.000	0.02	44.08	44.10	7.94E+00
600.00	1.000	0.00	39.18	39.18	1.04E+01
700.00	1.000	0.00	35.34	35.34	1.30E+01
800.00	1.000	0.00	32.25	32.25	1.60E+01
900.00	1.000	0.00	29.72	29.72	1.92E+01
1000.00	1.000	0.00	27.59	27.59	2.27E+01
1200.00	1.000	0.00	24.20	24.20	3.05E+01
1500.00	1.000	0.00	20.55	20.55	4.40E+01
1700.00	1.000	0.00	18.72	18.72	5.42E+01
2000.00	1.000	0.00	16.56	16.56	7.13E+01
2500.00	1.000	0.00	13.96	13.96	1.04E+02
3000.00	1.000	0.00	12.12	12.12	1.43E+02
3500.00	1.000	0.00	10.74	10.74	1.87E+02
4000.00	1.000	0.00	9.66	9.66	2.36E+02
4500.00	1.000	0.00	8.80	8.80	2.90E+02
5000.00	1.000	0.00	8.09	8.09	3.50E+02
5500.00	1.000	0.00	7.49	7.49	4.14E+02
6000.00	1.000	0.00	6.98	6.98	4.83E+02
6500.00	1.000	0.00	6.54	6.54	5.57E+02

ABSORBER.....WATER

ION.....DEUTERONS

ENERGY E	Z <sub>EFF</sub>	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GPAM/CCM)			MICRON*GRAM/CCM
0.10	0.056	14.49	4.07	18.56	6.23E-03
0.15	0.069	13.83	4.98	18.81	8.90E-03
0.20	0.079	13.12	5.75	18.87	1.16E-02
0.30	0.097	11.88	7.05	18.92	1.68E-02
0.50	0.125	10.03	9.10	19.13	2.74E-02
0.70	0.147	8.83	10.77	19.59	3.77E-02
1.00	0.175	7.58	12.87	20.45	5.27E-02
1.50	0.214	6.13	15.76	21.89	7.63E-02
2.00	0.246	5.38	18.20	23.58	9.84E-02
3.00	0.298	4.07	22.29	26.35	1.39E-01
5.00	0.377	3.02	28.77	31.79	2.07E-01
7.00	0.437	2.39	34.04	36.43	2.66E-01
10.00	0.508	1.87	40.69	42.56	3.42E-01
15.00	0.596	1.33	47.83	49.15	4.52E-01
20.00	0.660	1.16	54.53	55.68	5.47E-01
30.00	0.749	0.78	63.86	64.65	7.14E-01
50.00	0.849	0.55	79.34	79.89	9.91E-01
70.00	0.902	0.41	88.84	89.25	1.23E+00
100.00	0.944	0.31	95.77	96.08	1.55E+00
150.00	0.974	0.12	99.28	99.40	2.06E+00
200.00	0.987	0.11	95.99	96.10	2.57E+00
300.00	0.996	0.07	84.81	84.88	3.67E+00
400.00	0.998	0.06	73.89	73.95	4.95E+00
500.00	0.999	0.05	65.92	65.97	6.38E+00
600.00	1.000	0.04	59.80	59.84	7.97E+00
700.00	1.000	0.00	54.82	54.82	9.72E+00
800.00	1.000	0.00	50.64	50.64	1.16E+01
900.00	1.000	0.00	47.11	47.11	1.37E+01
1000.00	1.000	0.00	44.08	44.08	1.59E+01
1200.00	1.000	0.00	39.16	39.16	2.07E+01
1500.00	1.000	0.00	33.70	33.70	2.90E+01
1700.00	1.000	0.00	30.91	30.91	3.52E+01
2000.00	1.000	0.00	27.57	27.57	4.55E+01
2500.00	1.000	0.00	23.48	23.48	6.52E+01

ABSORBER.....WATER

ION.....ALPHA-PARTICLES

ENERGY E	Z <sub>EFF</sub>	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON)	(GRAM/CCM)		MICRON*GRAM/CCM
0.10	0.040	36.11	4.95	41.06	3.24E-03
0.15	0.049	37.18	6.06	43.23	4.41E-03
0.20	0.056	37.73	7.00	44.73	5.55E-03
0.30	0.069	37.45	8.57	46.02	7.75E-03
0.50	0.089	35.51	11.06	46.57	1.21E-02
0.70	0.105	33.63	13.09	46.71	1.63E-02
1.00	0.126	30.96	15.64	46.61	2.28E-02
1.50	0.154	27.34	19.16	46.50	3.35E-02
2.00	0.177	24.43	22.12	46.55	4.43E-02
3.00	0.217	20.65	27.09	47.75	6.55E-02
5.00	0.279	15.97	34.98	50.95	1.06E-01
7.00	0.330	12.89	41.39	54.28	1.44E-01
10.00	0.393	10.63	49.47	60.10	1.96E-01
15.00	0.478	8.29	60.58	68.88	2.74E-01
20.00	0.548	6.60	69.96	76.56	3.43E-01
30.00	0.663	5.03	85.68	90.71	4.63E-01
50.00	0.835	3.50	110.61	114.11	6.58E-01
70.00	0.965	2.53	130.88	133.40	8.20E-01
100.00	1.115	1.99	156.43	158.42	1.03E+00
150.00	1.294	1.48	193.48	194.96	1.31E+00
200.00	1.422	1.09	221.25	222.33	1.55E+00
300.00	1.593	0.82	256.62	257.45	1.96E+00
400.00	1.701	0.59	274.99	275.58	2.34E+00
500.00	1.773	0.35	281.26	281.61	2.69E+00
600.00	1.824	0.29	278.61	278.89	3.05E+00
700.00	1.861	0.25	272.38	272.63	3.41E+00
800.00	1.889	0.23	262.82	263.06	3.79E+00
900.00	1.910	0.21	253.88	254.09	4.17E+00
1000.00	1.926	0.19	243.57	243.75	4.57E+00
1200.00	1.949	0.16	223.78	223.94	5.43E+00
1500.00	1.970	0.00	200.84	200.84	6.85E+00
1700.00	1.978	0.00	189.22	189.22	7.87E+00
2000.00	1.986	0.00	174.23	174.23	9.53E+00
2500.00	1.993	0.00	150.68	150.68	1.26E+01
3000.00	1.996	0.00	133.67	133.67	1.62E+01
3500.00	1.998	0.00	120.34	120.34	2.01E+01
4000.00	1.999	0.00	109.63	109.63	2.45E+01
4500.00	1.999	0.00	100.82	100.82	2.92E+01
5000.00	1.999	0.00	93.44	93.44	3.44E+01
5500.00	2.000	0.00	87.15	87.15	3.99E+01
6000.00	2.000	0.00	81.74	81.74	4.59E+01
6500.00	2.000	0.00	77.02	77.02	5.22E+01
7000.00	2.000	0.00	72.87	72.87	5.88E+01
7500.00	2.000	0.00	69.18	69.18	6.59E+01

ABSORBER.....WATER

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	90.59	5.96	96.55	1.58E-03
0.15	101.27	7.30	108.58	2.07E-03
0.20	109.79	8.43	118.22	2.51E-03
0.30	119.72	10.33	130.05	3.31E-03
0.50	132.09	13.34	145.43	4.76E-03
0.70	139.37	15.78	155.15	6.09E-03
1.00	145.48	18.86	164.34	7.97E-03
1.50	148.78	23.10	171.88	1.09E-02
2.00	150.27	26.67	176.94	1.38E-02
3.00	145.98	32.67	178.65	1.94E-02
5.00	135.56	42.17	177.73	3.06E-02
7.00	125.69	49.90	175.59	4.19E-02
10.00	113.48	59.64	173.12	5.91E-02
15.00	98.03	73.05	171.08	8.82E-02
20.00	85.52	84.35	169.87	1.18E-01
30.00	70.01	103.31	173.32	1.76E-01
50.00	52.98	133.37	186.35	2.87E-01
70.00	42.42	157.80	200.22	3.91E-01
100.00	33.23	188.61	221.84	5.33E-01
150.00	25.80	231.00	256.80	7.42E-01
200.00	19.72	266.74	286.46	9.26E-01
300.00	15.34	326.68	342.03	1.24E+00
400.00	12.56	377.22	389.78	1.52E+00
500.00	10.25	421.75	432.00	1.76E+00
600.00	9.00	462.00	471.00	1.98E+00
700.00	7.72	499.02	506.74	2.19E+00
800.00	7.14	533.47	540.61	2.38E+00
900.00	6.30	565.83	572.13	2.56E+00
1000.00	5.60	596.44	602.04	2.73E+00
1200.00	5.17	653.37	658.53	3.04E+00
1500.00	4.30	730.49	734.78	3.48E+00

ABSORBER.....WATER

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	99.10	6.05	105.15	1.46E-03
0.15	111.79	7.41	119.20	1.91E-03
0.20	122.19	8.55	130.75	2.31E-03
0.30	133.77	10.48	144.25	3.03E-03
0.50	149.84	13.53	163.37	4.33E-03
0.70	159.39	16.00	175.40	5.50E-03
1.00	168.45	19.13	187.58	7.15E-03
1.50	175.17	23.43	198.60	9.74E-03
2.00	179.73	27.05	206.78	1.22E-02
3.00	177.65	33.13	210.78	1.70E-02
5.00	170.36	42.77	213.13	2.64E-02
7.00	160.84	50.61	211.46	3.58E-02
10.00	147.88	60.49	208.37	5.01E-02
15.00	131.07	74.09	205.16	7.43E-02
20.00	116.70	85.55	202.25	9.88E-02
30.00	97.36	104.78	202.13	1.48E-01
50.00	74.83	135.26	210.09	2.46E-01
70.00	61.52	160.05	221.57	3.39E-01
100.00	48.23	191.29	239.52	4.69E-01
150.00	38.05	234.28	272.33	6.64E-01
200.00	29.30	270.53	299.83	8.39E-01
300.00	23.20	331.33	354.53	1.14E+00
400.00	18.28	382.58	400.87	1.41E+00
500.00	15.50	427.74	443.24	1.65E+00
600.00	13.48	468.57	482.05	1.86E+00
700.00	11.69	506.11	517.80	2.06E+00
800.00	10.78	541.06	551.84	2.25E+00
900.00	9.57	573.88	583.45	2.43E+00
1000.00	8.56	604.92	613.47	2.59E+00
1200.00	7.48	662.66	670.13	2.90E+00

ABSORBER.....WATER

ION.....0-16 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	106.63	6.11	112.74	1.38E-03
0.15	120.76	7.48	128.24	1.79E-03
0.20	131.64	8.64	140.28	2.16E-03
0.30	147.59	10.58	158.18	2.83E-03
0.50	165.74	13.66	179.40	4.01E-03
0.70	177.57	16.17	193.74	5.08E-03
1.00	188.90	19.32	208.23	6.57E-03
1.50	199.53	23.67	223.19	8.88E-03
2.00	204.83	27.33	232.16	1.11E-02
3.00	209.47	33.47	242.94	1.53E-02
5.00	204.37	43.21	247.58	2.34E-02
7.00	196.20	51.13	247.32	3.15E-02
10.00	183.27	61.11	244.38	4.37E-02
15.00	165.27	74.84	240.12	6.43E-02
20.00	150.70	86.42	237.12	8.53E-02
30.00	127.34	105.85	233.18	1.28E-01
50.00	98.88	136.65	235.52	2.14E-01
70.00	82.89	161.68	244.57	2.97E-01
100.00	66.90	193.25	260.15	4.16E-01
150.00	51.28	236.68	287.95	5.99E-01
200.00	42.97	273.29	316.26	7.64E-01
300.00	30.79	334.71	365.50	1.06E+00
400.00	26.13	386.49	412.62	1.31E+00
500.00	21.74	432.11	453.86	1.55E+00
600.00	19.14	473.36	492.50	1.76E+00
700.00	16.69	511.28	527.98	1.95E+00
800.00	15.13	546.59	561.72	2.14E+00
900.00	14.19	579.74	593.93	2.31E+00
1000.00	12.89	611.10	623.99	2.47E+00

ABSORBER.....WATER

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	113.75	5.99	119.74	1.30E-03
0.15	129.37	7.33	136.70	1.69E-03
0.20	141.39	8.47	149.86	2.04E-03
0.30	159.97	10.37	170.34	2.67E-03
0.50	180.76	13.39	194.15	3.76E-03
0.70	195.27	15.84	211.11	4.74E-03
1.00	209.84	18.94	228.77	6.10E-03
1.50	224.21	23.19	247.41	8.20E-03
2.00	232.57	26.78	259.35	1.02E-02
3.00	241.33	32.80	274.13	1.39E-02
5.00	240.46	42.34	282.80	2.11E-02
7.00	235.40	50.10	285.50	2.81E-02
10.00	224.17	59.88	284.05	3.86E-02
15.00	205.74	73.34	279.08	5.63E-02
20.00	190.40	84.60	275.08	7.44E-02
30.00	165.30	103.72	269.02	1.11E-01
50.00	131.69	133.90	265.59	1.86E-01
70.00	111.20	158.44	269.63	2.61E-01
100.00	91.27	189.37	280.64	3.71E-01
150.00	70.45	231.93	302.37	5.42E-01
200.00	58.19	267.80	326.00	7.02E-01
300.00	43.70	327.99	371.70	9.87E-01
400.00	34.70	378.73	413.43	1.24E+00
500.00	31.34	423.44	454.77	1.47E+00
600.00	26.56	463.85	490.41	1.68E+00
700.00	24.28	501.02	525.29	1.88E+00
800.00	21.70	535.61	557.31	2.07E+00
900.00	19.51	568.10	587.61	2.24E+00



ABSORBER.....WATER

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	141.92	6.21	148.13	1.06E-03
0.15	162.15	7.60	169.75	1.37E-03
0.20	179.80	8.78	188.58	1.65E-03
0.30	207.69	10.75	218.44	2.14E-03
0.50	244.23	13.88	258.11	2.98E-03
0.70	269.50	16.42	285.92	3.71E-03
	.			
1.00	301.30	19.63	320.93	4.70E-03
1.50	329.39	24.04	353.43	6.18E-03
2.00	352.09	27.76	379.85	7.54E-03
3.00	381.88	34.00	415.88	1.00E-02
5.00	414.07	43.89	457.97	1.46E-02
7.00	426.94	51.94	478.88	1.89E-02
10.00	441.46	62.07	503.53	2.50E-02
15.00	435.37	76.03	511.40	3.48E-02
20.00	427.83	87.79	515.61	4.45E-02
30.00	404.64	107.52	512.15	6.40E-02
50.00	360.39	138.80	499.19	1.04E-01
70.00	326.91	164.23	491.14	1.44E-01
100.00	283.23	196.30	479.53	2.06E-01
150.00	235.68	240.41	476.09	3.11E-01
200.00	203.44	277.61	481.04	4.15E-01
300.00	162.86	340.00	502.86	6.19E-01
400.00	136.48	392.59	529.07	8.13E-01
500.00	115.98	438.93	554.91	9.97E-01
600.00	106.52	480.83	587.35	1.17E+00

ABSORBER.....HYDROGEN

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	61.62	25.58	87.20	1.21E-03
0.15	0.097	55.00	31.33	86.33	1.79E-03
0.20	0.112	49.22	36.18	85.40	2.37E-03
0.30	0.136	41.30	44.31	85.61	3.55E-03
0.50	0.175	31.73	57.20	88.94	5.85E-03
0.70	0.207	26.22	67.68	93.90	8.04E-03
1.00	0.246	20.75	80.90	101.64	1.11E-02
1.50	0.298	16.49	99.08	115.57	1.57E-02
2.00	0.340	12.76	114.40	127.17	1.98E-02
3.00	0.409	10.07	140.12	150.18	2.71E-02
5.00	0.508	6.73	180.89	187.62	3.89E-02
7.00	0.580	5.29	198.10	203.39	4.93E-02
10.00	0.660	3.76	229.48	233.24	6.31E-02
15.00	0.749	2.91	270.99	273.90	8.28E-02
20.00	0.808	2.10	301.11	303.21	1.00E-01
30.00	0.879	1.63	349.54	351.16	1.30E-01
50.00	0.944	1.04	379.59	380.64	1.85E-01
70.00	0.970	0.75	378.51	379.26	2.37E-01
100.00	0.987	0.00	348.98	348.98	3.19E-01
150.00	0.996	0.00	282.18	282.18	4.79E-01
200.00	0.998	0.00	226.26	226.26	6.81E-01
300.00	1.000	0.00	170.56	170.56	1.20E+00
400.00	1.000	0.00	138.26	138.26	1.85E+00
500.00	1.000	0.00	117.01	117.01	2.64E+00
600.00	1.000	0.00	101.85	101.85	3.56E+00
700.00	1.000	0.00	90.45	90.45	4.60E+00
800.00	1.000	0.00	81.53	81.53	5.77E+00
900.00	1.000	0.00	74.35	74.35	7.05E+00
1000.00	1.000	0.00	68.42	68.42	8.46E+00
1200.00	1.000	0.00	59.19	59.19	1.16E+01
1500.00	1.000	0.00	49.48	49.48	1.72E+01
1700.00	1.000	0.00	44.71	44.71	2.14E+01
2000.00	1.000	0.00	39.17	39.17	2.86E+01
2500.00	1.000	0.00	32.61	32.61	4.27E+01
3000.00	1.000	0.00	28.04	28.04	5.93E+01
3500.00	1.000	0.00	24.67	24.67	7.83E+01
4000.00	1.000	0.00	22.06	22.06	9.98E+01
4500.00	1.000	0.00	19.98	19.98	1.24E+02
5000.00	1.000	0.00	18.29	18.29	1.50E+02
5500.00	1.000	0.00	16.87	16.87	1.78E+02
6000.00	1.000	0.00	15.67	15.67	2.09E+02
6500.00	1.000	0.00	14.64	14.64	2.42E+02

ABSORBER.....HYDROGEN

ION.....DEUTERONS

ENERGY E KEV	ZEFF	SN(E) (KEV/MICRON) / (GRAM/CCM)	SE(E) (KEV/MICRON) / (GRAM/CCM)	ST(E) (KEV/MICRON) / (GRAM/CCM)	PATHLENGTH MICRON*GRAM/CCM
0.10	0.056	89.72	18.10	107.82	9.92E-04
0.15	0.069	82.13	22.16	104.29	1.46E-03
0.20	0.079	76.17	25.59	101.76	1.95E-03
0.30	0.097	65.59	31.34	96.94	2.96E-03
0.50	0.125	52.03	40.46	92.49	5.08E-03
0.70	0.147	43.94	47.88	91.82	7.26E-03
1.00	0.175	35.99	57.22	93.22	1.05E-02
1.50	0.214	27.64	70.09	97.73	1.58E-02
2.00	0.246	23.99	80.93	104.92	2.07E-02
3.00	0.298	17.00	99.12	116.12	2.98E-02
5.00	0.377	12.22	127.96	140.18	4.54E-02
7.00	0.437	9.50	151.40	160.90	5.87E-02
10.00	0.508	6.90	180.96	187.86	7.59E-02
15.00	0.596	5.00	203.70	208.71	1.02E-01
20.00	0.660	4.33	228.98	233.31	1.24E-01
30.00	0.749	2.80	271.18	273.98	1.64E-01
50.00	0.849	1.95	327.90	329.85	2.30E-01
70.00	0.902	1.48	362.76	364.24	2.87E-01
100.00	0.944	1.05	379.62	380.67	3.67E-01
150.00	0.974	0.00	376.25	376.25	4.98E-01
200.00	0.987	0.00	348.88	348.88	6.36E-01
300.00	0.996	0.00	282.06	282.06	9.56E-01
400.00	0.998	0.00	226.14	226.14	1.36E+00
500.00	0.999	0.00	193.99	193.99	1.84E+00
600.00	1.000	0.00	170.46	170.46	2.39E+00
700.00	1.000	0.00	152.45	152.45	3.01E+00
800.00	1.000	0.00	138.19	138.19	3.70E+00
900.00	1.000	0.00	126.58	126.58	4.46E+00
1000.00	1.000	0.00	116.94	116.94	5.28E+00
1200.00	1.000	0.00	101.79	101.79	7.12E+00
1500.00	1.000	0.00	85.69	85.69	1.03E+01
1700.00	1.000	0.00	77.71	77.71	1.28E+01
2000.00	1.000	0.00	68.38	68.38	1.69E+01
2500.00	1.000	0.00	57.25	57.25	2.50E+01

ABSORBER.....HYDROGEN

ION.....ALPHA-PARTICLES

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	203.10	19.58	222.68	5.70E-04
0.15	0.049	204.27	23.99	228.26	7.89E-04
0.20	0.056	203.64	27.70	231.34	1.01E-03
0.30	0.069	196.29	33.92	230.21	1.44E-03
0.50	0.089	178.40	43.79	222.19	2.32E-03
0.70	0.105	163.19	51.81	215.00	3.24E-03
1.00	0.126	145.44	61.93	207.37	4.66E-03
1.50	0.154	123.39	75.85	199.24	7.13E-03
2.00	0.177	106.16	87.58	193.74	9.68E-03
3.00	0.217	86.19	107.27	193.46	1.49E-02
5.00	0.279	63.65	138.48	202.13	2.50E-02
7.00	0.330	49.49	163.85	213.34	3.46E-02
10.00	0.393	40.28	195.84	236.12	4.79E-02
15.00	0.478	31.25	239.85	271.11	6.78E-02
20.00	0.548	24.42	276.96	301.38	8.53E-02
30.00	0.663	17.94	339.21	357.14	1.16E-01
50.00	0.835	12.02	437.91	449.93	1.65E-01
70.00	0.965	8.31	518.14	526.45	2.06E-01
100.00	1.115	6.86	619.30	626.16	2.58E-01
150.00	1.294	5.14	758.49	763.62	3.30E-01
200.00	1.422	3.85	875.82	879.68	3.91E-01
300.00	1.593	2.77	1035.46	1038.23	4.94E-01
400.00	1.701	2.10	1087.90	1090.00	5.88E-01
500.00	1.773	0.00	1033.02	1033.02	6.81E-01
600.00	1.824	0.00	967.48	967.48	7.81E-01
700.00	1.861	0.00	905.81	905.81	8.88E-01
800.00	1.889	0.00	849.43	849.43	1.00E+00
900.00	1.910	0.00	798.54	798.54	1.12E+00
1000.00	1.926	0.00	752.75	752.75	1.25E+00
1200.00	1.949	0.00	674.56	674.56	1.53E+00
1500.00	1.970	0.00	582.91	582.91	2.01E+00
1700.00	1.978	0.00	534.79	534.79	2.37E+00
2000.00	1.986	0.00	470.20	470.20	2.97E+00
2500.00	1.993	0.00	389.80	389.80	4.16E+00
3000.00	1.996	0.00	339.67	339.67	5.53E+00
3500.00	1.998	0.00	301.63	301.63	7.10E+00
4000.00	1.999	0.00	271.75	271.75	8.85E+00
4500.00	1.999	0.00	247.63	247.63	1.08E+01
5000.00	1.999	0.00	227.72	227.72	1.29E+01
5500.00	2.000	0.00	210.99	210.99	1.52E+01
6000.00	2.000	0.00	196.73	196.73	1.76E+01
6500.00	2.000	0.00	184.41	184.41	2.03E+01
7000.00	2.000	0.00	173.65	173.65	2.30E+01
7500.00	2.000	0.00	164.17	164.17	2.60E+01

ABSORBER.....HYDROGEN

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	354.21	19.01	373.22	4.06E-04
0.15	391.41	23.28	414.69	5.31E-04
0.20	421.72	26.88	448.60	6.47E-04
0.30	460.80	32.92	493.72	8.59E-04
0.50	503.83	42.50	546.34	1.24E-03
0.70	529.64	50.29	579.93	1.60E-03
1.00	545.44	60.11	605.54	2.10E-03
1.50	548.82	73.62	622.44	2.91E-03
2.00	547.21	85.00	632.22	3.70E-03
3.00	527.67	104.11	631.78	5.28E-03
5.00	479.79	134.40	614.20	8.49E-03
7.00	439.01	159.03	598.03	1.18E-02
10.00	391.41	190.08	581.48	1.69E-02
15.00	332.20	232.79	564.99	2.57E-02
20.00	285.89	268.81	554.70	3.46E-02
30.00	232.15	329.22	561.37	5.26E-02
50.00	171.53	425.02	596.55	8.72E-02
70.00	133.41	502.89	636.30	1.20E-01
100.00	108.65	601.07	709.72	1.64E-01
150.00	84.25	736.16	820.41	2.30E-01
200.00	65.87	850.04	915.91	2.88E-01
300.00	48.38	1041.08	1089.47	3.87E-01
400.00	39.73	1202.14	1241.87	4.73E-01
500.00	32.43	1344.03	1376.47	5.50E-01
600.00	26.66	1472.32	1498.98	6.19E-01
700.00	22.43	1590.28	1612.71	6.83E-01
800.00	23.34	1700.08	1723.43	7.43E-01
900.00	20.80	1803.21	1824.01	8.00E-01
1000.00	18.52	1900.75	1919.27	8.53E-01
1200.00	14.78	2082.17	2096.94	9.53E-01
1500.00	13.85	2327.94	2341.79	1.09E+00

ABSORBER.....HYDROGEN

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	363.75	18.69	382.44	4.00E-04
0.15	410.30	22.89	433.19	5.23E-04
0.20	446.67	26.43	473.10	6.33E-04
0.30	486.26	32.37	518.63	8.36E-04
0.50	539.93	41.78	581.71	1.20E-03
0.70	571.07	49.44	620.51	1.53E-03
1.00	601.88	59.09	660.98	2.00E-03
1.50	622.48	72.37	694.85	2.74E-03
2.00	634.00	83.57	717.57	3.44E-03
3.00	618.66	102.35	721.01	4.84E-03
5.00	581.99	132.13	714.12	7.62E-03
7.00	543.99	156.34	700.33	1.04E-02
10.00	494.79	186.86	681.65	1.48E-02
15.00	431.73	228.86	660.58	2.22E-02
20.00	379.51	264.26	643.77	2.99E-02
30.00	311.97	323.65	635.63	4.55E-02
50.00	239.35	417.84	657.18	7.66E-02
70.00	194.55	494.39	688.94	1.06E-01
100.00	149.01	590.91	739.92	1.48E-01
150.00	115.61	723.71	839.32	2.11E-01
200.00	87.23	835.67	922.90	2.68E-01
300.00	70.13	1023.49	1093.62	3.67E-01
400.00	57.30	1181.82	1239.12	4.53E-01
500.00	46.76	1321.32	1368.08	5.29E-01
600.00	42.53	1447.43	1489.96	5.99E-01
700.00	36.79	1563.40	1600.20	6.64E-01
800.00	31.94	1671.35	1703.29	7.24E-01
900.00	27.98	1772.73	1800.71	7.82E-01
1000.00	24.90	1868.62	1893.52	8.36E-01
1200.00	24.79	2046.97	2071.77	9.37E-01

ABSORBER.....HYDROGEN

ION.....0-16 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	368.38	18.38	386.76	3.98E-04
0.15	415.63	22.51	438.14	5.19E-04
0.20	455.65	25.99	481.65	6.28E-04
0.30	501.74	31.83	533.57	8.23E-04
0.50	566.32	41.10	607.41	1.17E-03
0.70	605.52	48.63	654.15	1.49E-03
1.00	641.73	58.12	699.85	1.93E-03
1.50	670.77	71.18	741.95	2.62E-03
2.00	692.15	82.19	774.35	3.28E-03
3.00	692.31	100.67	792.98	4.54E-03
5.00	674.53	129.96	804.49	7.03E-03
7.00	642.66	153.77	796.43	9.53E-03
10.00	596.18	183.79	779.97	1.33E-02
15.00	535.01	225.10	760.11	1.98E-02
20.00	481.44	259.92	741.36	2.65E-02
30.00	406.37	318.34	724.71	4.02E-02
50.00	313.18	410.97	724.15	6.80E-02
70.00	259.60	486.27	745.87	9.53E-02
100.00	207.06	581.20	788.26	1.34E-01
150.00	164.96	711.82	876.78	1.95E-01
200.00	129.32	821.94	951.26	2.50E-01
300.00	101.13	1006.67	1107.80	3.47E-01
400.00	78.44	1162.40	1240.84	4.32E-01
500.00	67.66	1299.61	1367.26	5.09E-01
600.00	57.66	1423.65	1481.30	5.79E-01
700.00	50.02	1537.71	1587.73	6.45E-01
800.00	47.55	1643.89	1691.44	7.06E-01
900.00	42.68	1743.60	1786.28	7.63E-01
1000.00	38.35	1837.92	1876.27	8.18E-01

ABSORBER.....HYDROGEN

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	367.77	17.60	385.37	4.05E-04
0.15	417.64	21.55	439.19	5.26E-04
0.20	453.76	24.88	478.65	6.34E-04
0.30	516.10	30.48	546.58	8.29E-04
0.50	581.25	39.34	620.60	1.17E-03
0.70	626.43	46.55	672.98	1.48E-03
1.00	671.67	55.64	727.31	1.91E-03
1.50	716.35	68.15	784.49	2.57E-03
2.00	735.90	78.69	814.59	3.19E-03
3.00	767.79	96.37	864.16	4.38E-03
5.00	759.91	124.42	884.33	6.66E-03
7.00	740.30	147.21	887.51	8.91E-03
10.00	701.40	175.95	877.36	1.23E-02
15.00	640.66	215.50	856.16	1.81E-02
20.00	593.28	248.84	842.12	2.40E-02
30.00	509.21	304.76	813.97	3.61E-02
50.00	402.57	393.44	796.02	6.10E-02
70.00	339.99	465.53	805.92	8.60E-02
100.00	278.05	556.41	834.47	1.23E-01
150.00	212.69	681.47	894.16	1.81E-01
200.00	184.77	786.89	971.66	2.34E-01
300.00	129.97	963.74	1093.71	3.31E-01
400.00	113.47	1112.83	1226.30	4.18E-01
500.00	93.64	1244.18	1337.82	4.96E-01
600.00	79.33	1362.93	1442.26	5.68E-01
700.00	72.95	1472.13	1545.08	6.35E-01
800.00	64.87	1573.78	1638.65	6.98E-01
900.00	58.19	1669.24	1727.43	7.57E-01



ABSORBER.....HYDROGEN

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	369.18	16.38	385.56	4.06E-04
0.15	422.04	20.06	442.09	5.27E-04
0.20	469.28	23.16	492.44	6.34E-04
0.30	541.72	28.36	570.09	8.22E-04
0.50	638.63	36.62	675.25	1.14E-03
0.70	704.80	43.33	748.13	1.42E-03
1.00	789.55	51.78	841.33	1.80E-03
1.50	866.68	63.42	930.10	2.36E-03
2.00	932.07	73.23	1005.31	2.88E-03
3.00	1012.97	89.69	1102.66	3.82E-03
5.00	1101.37	115.79	1217.16	5.54E-03
7.00	1139.24	137.01	1276.25	7.14E-03
10.00	1183.15	163.75	1346.91	9.42E-03
15.00	1176.71	200.56	1377.26	1.31E-02
20.00	1166.60	231.58	1398.18	1.67E-02
30.00	1111.66	283.63	1395.29	2.38E-02
50.00	998.13	366.17	1364.30	3.83E-02
70.00	911.80	433.25	1345.06	5.31E-02
100.00	797.77	517.84	1315.60	7.57E-02
150.00	669.65	634.22	1303.87	1.14E-01
200.00	572.03	732.33	1304.36	1.52E-01
300.00	463.35	896.92	1360.27	2.27E-01
400.00	392.71	1035.67	1428.38	2.99E-01
500.00	336.63	1157.92	1494.55	3.68E-01
600.00	292.81	1268.44	1561.25	4.33E-01

ABSORBER.....CARBON

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	3.91	4.08	7.99	1.84E-02
0.15	0.097	3.87	5.00	8.87	2.43E-02
0.20	0.112	3.82	5.78	9.60	2.97E-02
0.30	0.136	3.62	7.07	10.69	3.96E-02
0.50	0.175	3.24	9.13	12.37	5.69E-02
0.70	0.207	2.95	10.80	13.75	7.22E-02
1.00	0.246	2.57	12.91	15.48	9.27E-02
1.50	0.298	2.14	15.82	17.96	1.23E-01
2.00	0.340	1.83	18.26	20.09	1.49E-01
3.00	0.409	1.49	22.37	23.85	1.94E-01
5.00	0.508	1.07	28.88	29.94	2.69E-01
7.00	0.580	0.89	34.17	35.06	3.30E-01
10.00	0.660	0.65	40.84	41.48	4.09E-01
15.00	0.749	0.51	48.20	48.71	5.19E-01
20.00	0.808	0.40	54.09	54.49	6.16E-01
30.00	0.879	0.29	63.19	63.48	7.85E-01
50.00	0.944	0.19	73.91	74.10	1.07E+00
70.00	0.970	0.16	79.17	79.33	1.33E+00
100.00	0.987	0.11	81.85	81.96	1.70E+00
150.00	0.996	0.08	72.10	72.18	2.35E+00
200.00	0.998	0.06	63.72	63.78	3.09E+00
300.00	1.000	0.04	50.87	50.92	4.85E+00
400.00	1.000	0.04	43.28	43.32	6.99E+00
500.00	1.000	0.00	37.87	37.87	9.46E+00
600.00	1.000	0.00	33.75	33.75	1.23E+01
700.00	1.000	0.00	30.51	30.51	1.54E+01
800.00	1.000	0.00	27.90	27.90	1.88E+01
900.00	1.000	0.00	25.74	25.74	2.26E+01
1000.00	1.000	0.00	23.93	23.93	2.66E+01
1200.00	1.000	0.00	21.03	21.03	3.55E+01
1500.00	1.000	0.00	17.90	17.90	5.10E+01
1700.00	1.000	0.00	16.32	16.32	6.28E+01
2000.00	1.000	0.00	14.46	14.46	8.23E+01
2500.00	1.000	0.00	12.21	12.21	1.20E+02
3000.00	1.000	0.00	10.61	10.61	1.64E+02
3500.00	1.000	0.00	9.41	9.41	2.14E+02
4000.00	1.000	0.00	8.48	8.48	2.70E+02
4500.00	1.000	0.00	7.72	7.72	3.32E+02
5000.00	1.000	0.00	7.10	7.10	4.00E+02
5500.00	1.000	0.00	6.58	6.58	4.73E+02
6000.00	1.000	0.00	6.14	6.14	5.52E+02
6500.00	1.000	0.00	5.76	5.76	6.36E+02

ABSORBER.....CARBON

ION.....DEUTERONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.056	7.20	2.89	10.09	1.34E-02
0.15	0.069	7.18	3.54	10.72	1.81E-02
0.20	0.079	7.12	4.09	11.21	2.27E-02
0.30	0.097	6.80	5.00	11.81	3.14E-02
0.50	0.125	6.12	6.46	12.58	4.78E-02
0.70	0.147	5.60	7.64	13.25	6.33E-02
1.00	0.175	4.91	9.13	14.05	8.52E-02
1.50	0.214	4.13	11.19	15.32	1.19E-01
2.00	0.246	3.53	12.92	16.45	1.51E-01
3.00	0.298	2.86	15.82	18.69	2.08E-01
5.00	0.377	2.09	20.43	22.52	3.05E-01
7.00	0.437	1.75	24.17	25.92	3.88E-01
10.00	0.508	1.29	28.89	30.18	4.94E-01
15.00	0.596	1.02	35.38	36.40	6.45E-01
20.00	0.660	0.79	40.85	41.64	7.73E-01
30.00	0.749	0.58	48.15	48.73	9.93E-01
50.00	0.849	0.38	59.04	59.43	1.36E+00
70.00	0.902	0.31	66.77	67.08	1.68E+00
100.00	0.944	0.21	73.90	74.12	2.10E+00
150.00	0.974	0.16	80.04	80.20	2.75E+00
200.00	0.987	0.12	81.83	81.95	3.36E+00
300.00	0.996	0.09	72.07	72.15	4.65E+00
400.00	0.998	0.07	63.69	63.76	6.13E+00
500.00	0.999	0.00	56.77	56.77	7.80E+00
600.00	1.000	0.00	50.89	50.89	9.66E+00
700.00	1.000	0.00	46.73	46.73	1.17E+01
800.00	1.000	0.00	43.30	43.30	1.39E+01
900.00	1.000	0.00	40.37	40.37	1.63E+01
1000.00	1.000	0.00	37.85	37.85	1.89E+01
1200.00	1.000	0.00	33.73	33.73	2.45E+01
1500.00	1.000	0.00	29.13	29.13	3.41E+01
1700.00	1.000	0.00	26.76	26.76	4.13E+01
2000.00	1.000	0.00	23.92	23.92	5.31E+01
2500.00	1.000	0.00	20.42	20.42	7.59E+01

ABSORBER.....CARBON

ION.....ALPHA-PARTICLES

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	21.18	4.33	25.51	5.51E-03
0.15	0.049	22.53	5.30	27.83	7.38E-03
0.20	0.056	23.04	6.12	29.16	9.14E-03
0.30	0.069	23.84	7.50	31.34	1.24E-02
0.50	0.089	23.23	9.68	32.90	1.87E-02
0.70	0.105	22.36	11.45	33.81	2.47E-02
1.00	0.126	20.93	13.69	34.62	3.34E-02
1.50	0.154	18.89	16.76	35.66	4.76E-02
2.00	0.177	17.33	19.36	36.68	6.15E-02
3.00	0.217	14.61	23.71	38.32	8.81E-02
5.00	0.279	11.37	30.60	41.98	1.38E-01
7.00	0.330	9.59	36.21	45.80	1.83E-01
10.00	0.393	7.81	43.28	51.09	2.45E-01
15.00	0.478	5.82	53.01	58.83	3.36E-01
20.00	0.548	5.05	61.21	66.25	4.16E-01
30.00	0.663	3.44	74.96	78.40	5.54E-01
50.00	0.835	2.50	96.76	99.27	7.79E-01
70.00	0.965	1.96	112.89	114.85	9.66E-01
100.00	1.115	1.52	132.80	134.32	1.21E+00
150.00	1.294	0.99	157.54	158.53	1.55E+00
200.00	1.422	0.88	176.93	177.81	1.84E+00
300.00	1.593	0.54	203.25	203.79	2.37E+00
400.00	1.701	0.49	218.80	219.29	2.84E+00
500.00	1.773	0.39	224.41	224.80	3.29E+00
600.00	1.824	0.35	226.96	227.31	3.73E+00
700.00	1.861	0.30	224.36	224.67	4.17E+00
800.00	1.889	0.26	219.24	219.50	4.62E+00
900.00	1.910	0.24	212.90	213.14	5.08E+00
1000.00	1.926	0.22	206.07	206.29	5.56E+00
1200.00	1.949	0.00	192.54	192.54	6.56E+00
1500.00	1.970	0.00	173.75	173.75	8.20E+00
1700.00	1.978	0.00	162.82	162.82	9.39E+00
2000.00	1.986	0.00	148.66	148.66	1.13E+01
2500.00	1.993	0.00	129.90	129.90	1.49E+01
3000.00	1.996	0.00	115.54	115.54	1.90E+01
3500.00	1.998	0.00	104.23	104.23	2.36E+01
4000.00	1.999	0.00	95.10	95.10	2.86E+01
4500.00	1.999	0.00	87.57	87.57	3.41E+01
5000.00	1.999	0.00	81.25	81.25	4.00E+01
5500.00	2.000	0.00	75.86	75.86	4.64E+01
6000.00	2.000	0.00	71.21	71.21	5.32E+01
6500.00	2.000	0.00	67.14	67.14	6.04E+01
7000.00	2.000	0.00	63.56	63.56	6.81E+01
7500.00	2.000	0.00	60.38	60.38	7.62E+01

ABSORBER.....CARBON

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	74.57	5.03	79.60	1.91E-03
0.15	84.62	6.16	90.78	2.50E-03
0.20	89.58	7.12	96.69	3.03E-03
0.30	98.45	8.72	107.17	4.01E-03
0.50	108.64	11.25	119.89	5.76E-03
0.70	114.39	13.32	127.71	7.38E-03
1.00	118.31	15.91	134.23	9.66E-03
1.50	122.77	19.49	142.26	1.33E-02
2.00	120.89	22.51	143.39	1.68E-02
3.00	118.07	27.56	145.64	2.37E-02
5.00	109.03	35.59	144.61	3.74E-02
7.00	100.65	42.11	142.76	5.13E-02
10.00	90.85	50.33	141.18	7.29E-02
15.00	77.00	61.64	138.64	1.08E-01
20.00	68.00	71.17	139.17	1.44E-01
30.00	55.35	87.17	142.52	2.16E-01
50.00	41.28	112.53	153.81	3.51E-01
70.00	32.78	133.15	165.93	4.76E-01
100.00	27.01	159.14	186.16	6.47E-01
150.00	18.52	194.91	213.44	8.97E-01
200.00	16.47	225.06	241.53	1.12E+00
300.00	12.03	275.65	287.68	1.50E+00
400.00	9.32	318.29	327.61	1.82E+00
500.00	8.17	355.86	364.03	2.11E+00
600.00	6.85	389.82	396.67	2.37E+00
700.00	5.79	421.06	426.85	2.62E+00
800.00	4.98	450.13	455.11	2.84E+00
900.00	5.25	477.43	482.69	3.06E+00
1000.00	4.75	503.26	508.01	3.26E+00
1200.00	3.89	551.29	555.18	3.63E+00
1500.00	2.93	616.37	619.29	4.14E+00

ABSORBER.....CARBON

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	84.75	5.15	89.90	1.71E-03
0.15	95.60	6.31	101.91	2.23E-03
0.20	104.36	7.29	111.65	2.70E-03
0.30	113.79	8.92	122.72	3.55E-03
0.50	127.01	11.52	138.54	5.08E-03
0.70	134.42	13.63	148.05	6.47E-03
1.00	141.93	16.29	158.23	8.43E-03
1.50	147.10	19.96	167.06	1.15E-02
2.00	150.45	23.04	173.50	1.44E-02
3.00	147.51	28.22	175.74	2.02E-02
5.00	140.12	36.44	176.56	3.15E-02
7.00	131.28	43.11	174.40	4.29E-02
10.00	119.94	51.53	171.46	6.03E-02
15.00	105.39	63.11	168.49	8.96E-02
20.00	93.07	72.87	165.94	1.20E-01
30.00	76.93	89.25	166.18	1.80E-01
50.00	58.77	115.22	173.99	2.98E-01
70.00	48.32	136.33	184.65	4.09E-01
100.00	37.25	162.95	200.19	5.65E-01
150.00	29.20	199.57	228.77	7.98E-01
200.00	22.07	230.44	252.51	1.01E+00
300.00	17.70	282.23	299.93	1.37E+00
400.00	14.40	325.89	340.29	1.68E+00
500.00	11.81	364.36	376.17	1.96E+00
600.00	10.68	399.13	409.82	2.21E+00
700.00	9.32	431.11	440.44	2.45E+00
800.00	8.15	460.88	469.03	2.67E+00
900.00	7.16	488.84	496.00	2.88E+00
1000.00	6.36	515.28	521.64	3.07E+00
1200.00	6.27	564.46	570.73	3.44E+00

ABSORBER.....CARBON

ION.....0-16 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	93.15	5.24	98.40	1.57E-03
0.15	105.10	6.42	111.53	2.04E-03
0.20	115.23	7.42	122.64	2.47E-03
0.30	126.90	9.08	135.98	3.23E-03
0.50	143.25	11.73	154.97	4.60E-03
0.70	153.18	13.88	167.05	5.84E-03
1.00	162.35	16.58	178.93	7.57E-03
1.50	169.71	20.31	190.02	1.03E-02
2.00	175.13	23.45	198.59	1.28E-02
3.00	175.22	28.72	203.94	1.78E-02
5.00	170.76	37.08	207.85	2.74E-02
7.00	162.73	43.88	206.60	3.71E-02
10.00	150.98	52.44	203.43	5.17E-02
15.00	135.52	64.23	199.75	7.65E-02
20.00	121.98	74.17	196.15	1.02E-01
30.00	102.98	90.84	193.82	1.53E-01
50.00	79.38	117.27	196.64	2.56E-01
70.00	65.81	138.75	204.56	3.56E-01
100.00	52.50	165.84	218.34	4.98E-01
150.00	41.83	203.11	244.94	7.15E-01
200.00	32.81	234.54	267.35	9.11E-01
300.00	25.65	287.25	312.90	1.26E+00
400.00	19.90	331.68	351.58	1.56E+00
500.00	17.16	370.83	387.99	1.83E+00
600.00	14.63	406.23	420.86	2.08E+00
700.00	12.69	438.78	451.46	2.31E+00
800.00	12.06	469.07	481.13	2.52E+00
900.00	10.83	497.53	508.35	2.72E+00
1000.00	9.73	524.44	534.17	2.91E+00

ABSORBER.....CARBON

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	102.15	5.17	107.32	1.45E-03
0.15	115.93	6.33	122.26	1.89E-03
0.20	125.93	7.31	133.24	2.28E-03
0.30	143.06	8.95	152.01	2.98E-03
0.50	160.58	11.56	172.14	4.21E-03
0.70	172.64	13.68	186.32	5.32E-03
1.00	184.60	16.35	200.95	6.87E-03
1.50	196.52	20.02	216.54	9.26E-03
2.00	201.46	23.12	224.58	1.15E-02
3.00	209.53	28.32	237.85	1.58E-02
5.00	205.91	36.56	242.46	2.42E-02
7.00	199.53	43.25	242.78	3.24E-02
10.00	188.03	51.70	239.73	4.48E-02
15.00	170.85	63.32	234.17	6.59E-02
20.00	157.59	73.11	230.70	8.75E-02
30.00	134.18	89.55	223.73	1.32E-01
50.00	105.28	115.60	220.88	2.22E-01
70.00	88.88	136.78	225.66	3.11E-01
100.00	72.42	163.49	235.91	4.42E-01
150.00	54.85	200.23	255.08	6.45E-01
200.00	47.70	231.21	278.91	8.33E-01
300.00	32.99	283.17	316.16	1.17E+00
400.00	29.15	326.98	356.13	1.47E+00
500.00	23.90	365.57	389.47	1.74E+00
600.00	21.25	400.46	421.72	1.98E+00
700.00	18.69	432.55	451.23	2.21E+00
800.00	16.55	462.41	478.97	2.43E+00
900.00	14.85	490.46	505.32	2.63E+00



ABSORBER.....CARBON

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	133.99	5.48	139.47	1.12E-03
0.15	153.19	6.71	159.90	1.46E-03
0.20	169.54	7.75	177.28	1.75E-03
0.30	194.97	9.49	204.47	2.28E-03
0.50	228.83	12.25	241.09	3.17E-03
0.70	252.57	14.50	267.06	3.96E-03
1.00	280.57	17.33	297.90	5.02E-03
1.50	305.28	21.22	326.50	6.63E-03
2.00	324.21	24.51	348.71	8.11E-03
3.00	349.38	30.01	379.39	1.09E-02
5.00	376.53	38.75	415.28	1.59E-02
7.00	386.53	45.85	432.37	2.06E-02
10.00	395.39	54.80	450.19	2.74E-02
15.00	385.08	67.11	452.19	3.85E-02
20.00	373.80	77.50	451.30	4.96E-02
30.00	348.59	94.91	443.50	7.19E-02
50.00	305.72	122.53	428.25	1.18E-01
70.00	273.49	144.98	418.47	1.65E-01
100.00	233.28	173.29	406.56	2.38E-01
150.00	191.31	212.23	403.54	3.61E-01
200.00	165.97	245.06	411.03	4.84E-01
300.00	131.13	300.14	431.27	7.22E-01
400.00	107.81	346.57	454.38	9.47E-01
500.00	90.86	387.48	478.34	1.16E+00
600.00	85.55	424.46	510.01	1.36E+00

ABSORBER.....NITROGEN

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	3.20	3.62	6.82	2.20E-02
0.15	0.097	3.22	4.44	7.66	2.89E-02
0.20	0.112	3.21	5.12	8.34	3.51E-02
0.30	0.136	3.10	6.28	9.38	4.64E-02
0.50	0.175	2.82	8.10	10.93	6.61E-02
0.70	0.207	2.58	9.59	12.17	8.34E-02
1.00	0.246	2.31	11.46	13.77	1.06E-01
1.50	0.298	1.96	14.04	15.99	1.40E-01
2.00	0.340	1.69	16.21	17.89	1.70E-01
3.00	0.409	1.37	19.85	21.22	2.21E-01
5.00	0.508	1.01	25.62	26.64	3.04E-01
7.00	0.580	0.79	30.32	31.11	3.74E-01
10.00	0.660	0.64	36.24	36.88	4.62E-01
15.00	0.749	0.50	44.38	44.88	5.84E-01
20.00	0.808	0.39	51.25	51.64	6.88E-01
30.00	0.879	0.29	62.77	63.05	8.62E-01
50.00	0.944	0.19	74.69	74.89	1.15E+00
70.00	0.970	0.13	78.79	78.92	1.41E+00
100.00	0.987	0.11	77.47	77.57	1.79E+00
150.00	0.996	0.08	69.39	69.47	2.47E+00
200.00	0.998	0.06	60.88	60.94	3.24E+00
300.00	1.000	0.04	47.47	47.51	5.11E+00
400.00	1.000	0.03	40.73	40.77	7.39E+00
500.00	1.000	0.00	35.83	35.83	1.00E+01
600.00	1.000	0.00	32.05	32.05	1.30E+01
700.00	1.000	0.00	29.06	29.06	1.63E+01
800.00	1.000	0.00	26.63	26.63	1.99E+01
900.00	1.000	0.00	24.61	24.61	2.38E+01
1000.00	1.000	0.00	22.91	22.91	2.80E+01
1200.00	1.000	0.00	20.19	20.19	3.73E+01
1500.00	1.000	0.00	17.22	17.22	5.34E+01
1700.00	1.000	0.00	15.72	15.72	6.56E+01
2000.00	1.000	0.00	13.95	13.95	8.59E+01
2500.00	1.000	0.00	11.80	11.80	1.25E+02
3000.00	1.000	0.00	10.27	10.27	1.71E+02
3500.00	1.000	0.00	9.12	9.12	2.22E+02
4000.00	1.000	0.00	8.22	8.22	2.80E+02
4500.00	1.000	0.00	7.50	7.50	3.44E+02
5000.00	1.000	0.00	6.90	6.90	4.13E+02
5500.00	1.000	0.00	6.40	6.40	4.89E+02
6000.00	1.000	0.00	5.97	5.97	5.70E+02
6500.00	1.000	0.00	5.60	5.60	6.56E+02

ABSORBER.....NITROGEN

ION.....DEUTERONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.056	5.95	2.56	8.51	1.61E-02
0.15	0.069	6.15	3.14	9.29	2.17E-02
0.20	0.079	6.03	3.63	9.65	2.70E-02
0.30	0.097	5.85	4.44	10.29	3.70E-02
0.50	0.125	5.36	5.73	11.10	5.57E-02
0.70	0.147	4.93	6.78	11.71	7.32E-02
1.00	0.175	4.43	8.11	12.53	9.80E-02
1.50	0.214	3.72	9.93	13.65	1.36E-01
2.00	0.246	3.27	11.46	14.74	1.71E-01
3.00	0.298	2.66	14.04	16.70	2.35E-01
5.00	0.377	1.98	18.13	20.11	3.44E-01
7.00	0.437	1.55	21.45	23.00	4.37E-01
10.00	0.508	1.27	25.63	26.91	5.57E-01
15.00	0.596	0.87	31.40	32.26	7.26E-01
20.00	0.660	0.77	36.25	37.03	8.70E-01
30.00	0.749	0.57	44.40	44.97	1.11E+00
50.00	0.849	0.38	57.32	57.70	1.50E+00
70.00	0.902	0.27	66.94	67.21	1.82E+00
100.00	0.944	0.22	74.67	74.89	2.24E+00
150.00	0.974	0.13	79.09	79.22	2.89E+00
200.00	0.987	0.12	77.44	77.56	3.52E+00
300.00	0.996	0.09	69.36	69.45	4.88E+00
400.00	0.998	0.07	60.85	60.92	6.42E+00
500.00	0.999	0.06	53.16	53.21	8.18E+00
600.00	1.000	0.00	47.49	47.49	1.02E+01
700.00	1.000	0.00	43.82	43.82	1.24E+01
800.00	1.000	0.00	40.75	40.75	1.47E+01
900.00	1.000	0.00	38.11	38.11	1.73E+01
1000.00	1.000	0.00	35.82	35.82	2.00E+01
1200.00	1.000	0.00	32.03	32.03	2.59E+01
1500.00	1.000	0.00	27.77	27.77	3.60E+01
1700.00	1.000	0.00	25.56	25.56	4.35E+01
2000.00	1.000	0.00	22.90	22.90	5.59E+01
2500.00	1.000	0.00	19.60	19.60	7.96E+01

ABSORBER.....NITROGEN

ION.....ALPHA-PARTICLES

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	17.73	3.42	21.15	6.71E-03
0.15	0.049	18.91	4.18	23.10	8.97E-03
0.20	0.056	19.43	4.83	24.26	1.11E-02
0.30	0.069	20.27	5.92	26.19	1.50E-02
0.50	0.089	20.06	7.64	27.70	2.24E-02
0.70	0.105	19.55	9.04	28.58	2.95E-02
1.00	0.126	18.52	10.80	29.32	3.99E-02
1.50	0.154	16.91	13.23	30.15	5.67E-02
2.00	0.177	15.66	15.28	30.94	7.30E-02
3.00	0.217	13.44	18.71	32.16	1.05E-01
5.00	0.279	10.63	24.16	34.79	1.65E-01
7.00	0.330	8.98	28.58	37.56	2.20E-01
10.00	0.393	7.34	34.16	41.50	2.96E-01
15.00	0.478	5.62	41.84	47.46	4.08E-01
20.00	0.548	4.88	48.31	53.19	5.08E-01
30.00	0.663	3.43	59.17	62.60	6.81E-01
50.00	0.835	2.47	76.39	78.86	9.63E-01
70.00	0.965	1.93	90.39	92.31	1.20E+00
100.00	1.115	1.40	108.03	109.43	1.49E+00
150.00	1.294	1.01	132.31	133.32	1.91E+00
200.00	1.422	0.88	152.78	153.66	2.26E+00
300.00	1.593	0.56	186.88	187.44	2.84E+00
400.00	1.701	0.49	211.18	211.67	3.34E+00
500.00	1.773	0.39	218.82	219.21	3.80E+00
600.00	1.824	0.32	220.60	220.93	4.25E+00
700.00	1.861	0.30	217.25	217.55	4.71E+00
800.00	1.889	0.26	210.60	210.86	5.18E+00
900.00	1.910	0.23	203.84	204.07	5.66E+00
1000.00	1.926	0.21	196.27	196.48	6.16E+00
1200.00	1.949	0.19	179.52	179.71	7.22E+00
1500.00	1.970	0.00	163.27	163.27	8.97E+00
1700.00	1.978	0.00	153.50	153.50	1.02E+01
2000.00	1.986	0.00	140.68	140.68	1.23E+01
2500.00	1.993	0.00	123.47	123.47	1.61E+01
3000.00	1.996	0.00	110.17	110.17	2.04E+01
3500.00	1.998	0.00	99.62	99.62	2.52E+01
4000.00	1.999	0.00	91.06	91.06	3.04E+01
4500.00	1.999	0.00	83.98	83.98	3.61E+01
5000.00	1.999	0.00	78.02	78.02	4.23E+01
5500.00	2.000	0.00	72.92	72.92	4.89E+01
6000.00	2.000	0.00	68.51	68.51	5.60E+01
6500.00	2.000	0.00	64.66	64.66	6.35E+01
7000.00	2.000	0.00	61.25	61.25	7.15E+01
7500.00	2.000	0.00	58.22	58.22	7.99E+01

ABSORBER.....NITROGEN

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	64.82	4.65	69.47	2.19E-03
0.15	73.72	5.70	79.41	2.86E-03
0.20	78.34	6.58	84.92	3.46E-03
0.30	86.81	8.06	94.87	4.57E-03
0.50	95.92	10.40	106.32	6.55E-03
0.70	101.21	12.31	113.52	8.37E-03
1.00	105.08	14.71	119.78	1.09E-02
1.50	109.62	18.01	127.63	1.50E-02
2.00	108.73	20.80	129.53	1.88E-02
3.00	107.54	25.48	133.02	2.64E-02
5.00	100.09	32.89	132.98	4.14E-02
7.00	93.03	38.92	131.95	5.65E-02
10.00	84.64	46.51	131.15	7.94E-02
15.00	72.63	56.97	129.60	1.18E-01
20.00	64.54	65.78	130.32	1.56E-01
30.00	51.86	80.56	132.43	2.33E-01
50.00	39.65	104.01	143.65	3.78E-01
70.00	31.91	123.06	154.97	5.12E-01
100.00	26.34	147.09	173.43	6.95E-01
150.00	18.52	180.14	198.66	9.64E-01
200.00	16.17	208.01	224.19	1.20E+00
300.00	11.31	254.76	266.07	1.61E+00
400.00	9.24	294.17	303.42	1.96E+00
500.00	7.54	328.90	336.43	2.27E+00
600.00	6.85	360.29	367.14	2.56E+00
700.00	5.86	389.15	395.01	2.82E+00
800.00	5.05	416.02	421.07	3.06E+00
900.00	4.43	441.26	445.69	3.30E+00
1000.00	4.73	465.13	469.86	3.51E+00
1200.00	3.95	509.52	513.47	3.92E+00
1500.00	3.02	569.66	572.69	4.47E+00

ABSORBER.....NITROGEN

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	74.36	4.78	70.14	1.95E-03
0.15	83.89	5.86	89.74	2.54E-03
0.20	91.83	6.76	98.59	3.07E-03
0.30	100.49	8.28	108.77	4.03E-03
0.50	112.75	10.69	123.45	5.75E-03
0.70	119.97	12.65	132.62	7.31E-03
1.00	126.75	15.12	141.87	9.49E-03
1.50	131.83	18.52	150.35	1.29E-02
2.00	135.49	21.38	156.87	1.62E-02
3.00	133.93	26.19	160.12	2.25E-02
5.00	128.70	33.81	162.51	3.48E-02
7.00	121.43	40.00	161.43	4.71E-02
10.00	111.67	47.81	159.48	6.58E-02
15.00	99.09	58.56	157.64	9.74E-02
20.00	88.20	67.62	155.81	1.29E-01
30.00	73.57	82.81	156.38	1.93E-01
50.00	56.37	106.91	163.29	3.19E-01
70.00	46.43	126.50	172.93	4.38E-01
100.00	36.42	151.20	187.61	6.05E-01
150.00	28.84	185.18	214.02	8.54E-01
200.00	22.06	213.82	235.89	1.08E+00
300.00	17.54	261.88	279.42	1.46E+00
400.00	13.54	302.39	315.93	1.80E+00
500.00	11.71	338.09	349.80	2.10E+00
600.00	9.90	370.36	380.26	2.37E+00
700.00	9.24	400.03	409.27	2.63E+00
800.00	8.17	427.65	435.82	2.86E+00
900.00	7.24	453.59	460.83	3.09E+00
1000.00	6.44	478.13	484.57	3.30E+00
1200.00	5.26	523.76	529.02	3.69E+00

ABSORBER.....NITROGEN

ION.....0-16 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	82.44	4.88	87.32	1.77E-03
0.15	93.84	5.98	99.82	2.31E-03
0.20	101.97	6.91	108.87	2.79E-03
0.30	115.13	8.46	123.59	3.64E-03
0.50	128.44	10.92	139.36	5.17E-03
0.70	137.39	12.92	150.31	6.55E-03
1.00	145.81	15.44	161.25	8.47E-03
1.50	154.78	18.91	173.69	1.15E-02
2.00	158.13	21.84	179.97	1.43E-02
3.00	162.76	26.74	189.50	1.97E-02
5.00	157.56	34.53	192.09	3.02E-02
7.00	150.90	40.85	191.76	4.06E-02
10.00	140.64	48.83	189.47	5.64E-02
15.00	126.35	59.80	186.15	8.30E-02
20.00	115.33	69.05	184.38	1.10E-01
30.00	96.62	84.57	181.20	1.65E-01
50.00	74.83	109.19	184.02	2.74E-01
70.00	62.96	129.19	192.15	3.80E-01
100.00	51.03	154.41	205.44	5.31E-01
150.00	37.76	189.11	226.88	7.63E-01
200.00	32.55	218.37	250.92	9.71E-01
300.00	22.05	267.45	289.50	1.34E+00
400.00	19.75	308.82	328.57	1.66E+00
500.00	16.15	345.27	361.42	1.95E+00
600.00	14.49	378.23	392.72	2.22E+00
700.00	12.60	408.53	421.13	2.46E+00
800.00	11.15	436.74	447.89	2.69E+00
900.00	10.76	463.23	473.99	2.91E+00
1000.00	9.75	488.29	498.04	3.12E+00

ABSORBER.....NITROGEN

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	91.18	4.83	96.01	1.63E-03
0.15	103.57	5.91	109.49	2.11E-03
0.20	112.54	6.83	119.37	2.55E-03
0.30	128.02	8.36	136.39	3.33E-03
0.50	144.31	10.80	155.11	4.69E-03
0.70	155.63	12.77	168.41	5.93E-03
1.00	166.98	15.27	182.25	7.63E-03
1.50	178.18	18.70	196.88	1.03E-02
2.00	183.15	21.59	204.74	1.27E-02
3.00	191.21	26.44	217.65	1.75E-02
5.00	189.60	34.14	223.74	2.65E-02
7.00	184.96	40.39	225.35	3.54E-02
10.00	175.48	48.28	223.76	4.87E-02
15.00	160.50	59.13	219.63	7.13E-02
20.00	148.77	68.28	217.05	9.42E-02
30.00	127.95	83.63	211.58	1.41E-01
50.00	101.36	107.96	209.32	2.36E-01
70.00	85.61	127.74	213.35	3.31E-01
100.00	70.08	152.68	222.76	4.69E-01
150.00	53.74	186.99	240.73	6.85E-01
200.00	46.66	215.92	262.58	8.85E-01
300.00	32.97	264.45	297.42	1.24E+00
400.00	28.69	305.36	334.05	1.56E+00
500.00	23.73	341.40	365.12	1.85E+00
600.00	20.09	373.98	394.07	2.11E+00
700.00	18.46	403.95	422.41	2.35E+00
800.00	16.44	431.84	448.27	2.58E+00
900.00	14.75	458.03	472.78	2.80E+00



ABSORBER.....NITROGEN

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	123.09	5.19	128.28	1.22E-03
0.15	140.63	6.36	146.99	1.58E-03
0.20	155.70	7.34	163.04	1.90E-03
0.30	179.56	8.99	188.55	2.47E-03
0.50	210.78	11.61	222.38	3.44E-03
0.70	232.59	13.73	246.32	4.30E-03
1.00	259.23	16.41	275.64	5.44E-03
1.50	282.42	20.10	302.52	7.18E-03
2.00	300.51	23.21	323.72	8.77E-03
3.00	324.82	28.43	353.25	1.17E-02
5.00	350.96	36.70	387.66	1.71E-02
7.00	360.79	43.43	404.21	2.22E-02
10.00	370.92	51.90	422.82	2.94E-02
15.00	362.81	63.57	426.38	4.12E-02
20.00	353.69	73.40	427.09	5.29E-02
30.00	331.65	89.90	421.54	7.65E-02
50.00	292.62	116.06	408.68	1.25E-01
70.00	263.27	137.32	400.59	1.74E-01
100.00	225.78	164.13	389.91	2.50E-01
150.00	186.13	201.02	387.15	3.79E-01
200.00	161.52	232.12	393.63	5.07E-01
300.00	128.09	284.28	412.37	7.56E-01
400.00	106.11	328.26	434.37	9.92E-01
500.00	89.51	367.01	456.52	1.22E+00
600.00	84.44	402.04	486.48	1.43E+00

ABSORBER.....OXYGEN

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	2.68	3.26	5.94	2.57E-02
0.15	0.097	2.79	3.99	6.78	3.36E-02
0.20	0.112	2.75	4.61	7.36	4.07E-02
0.30	0.136	2.69	5.65	8.34	5.34E-02
0.50	0.175	2.49	7.29	9.78	7.54E-02
0.70	0.207	2.30	8.63	10.93	9.47E-02
1.00	0.246	2.08	10.31	12.40	1.20E-01
1.50	0.298	1.77	12.63	14.40	1.58E-01
2.00	0.340	1.57	14.59	16.15	1.90E-01
3.00	0.409	1.28	17.87	19.14	2.47E-01
5.00	0.508	0.95	23.06	24.02	3.40E-01
7.00	0.580	0.76	27.29	28.05	4.17E-01
10.00	0.660	0.63	32.62	33.24	5.15E-01
15.00	0.749	0.43	37.92	38.35	6.56E-01
20.00	0.808	0.38	43.63	44.01	7.77E-01
30.00	0.879	0.28	51.45	51.73	9.85E-01
50.00	0.944	0.19	60.18	60.37	1.34E+00
70.00	0.970	0.14	64.19	64.33	1.66E+00
100.00	0.987	0.11	64.31	64.42	2.12E+00
150.00	0.996	0.07	60.13	60.20	2.92E+00
200.00	0.998	0.06	54.87	54.93	3.79E+00
300.00	1.000	0.04	45.99	46.04	5.79E+00
400.00	1.000	0.03	39.69	39.73	8.13E+00
500.00	1.000	0.03	34.98	35.00	1.08E+01
600.00	1.000	0.00	31.36	31.36	1.38E+01
700.00	1.000	0.00	28.47	28.47	1.72E+01
800.00	1.000	0.00	26.11	26.11	2.09E+01
900.00	1.000	0.00	24.15	24.15	2.49E+01
1000.00	1.000	0.00	22.50	22.50	2.91E+01
1200.00	1.000	0.00	19.84	19.84	3.86E+01
1500.00	1.000	0.00	16.95	16.95	5.51E+01
1700.00	1.000	0.00	15.48	15.48	6.74E+01
2000.00	1.000	0.00	13.75	13.75	8.80E+01
2500.00	1.000	0.00	11.64	11.64	1.28E+02
3000.00	1.000	0.00	10.14	10.14	1.74E+02
3500.00	1.000	0.00	9.01	9.01	2.26E+02
4000.00	1.000	0.00	8.12	8.12	2.85E+02
4500.00	1.000	0.00	7.41	7.41	3.49E+02
5000.00	1.000	0.00	6.82	6.82	4.20E+02
5500.00	1.000	0.00	6.32	6.32	4.96E+02
6000.00	1.000	0.00	5.90	5.90	5.78E+02
6500.00	1.000	0.00	5.54	5.54	6.65E+02

ABSORBER.....OXYGEN

ION.....DEUTERONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.056	5.02	2.31	7.33	1.90E-02
0.15	0.069	5.24	2.83	8.06	2.55E-02
0.20	0.079	5.19	3.26	8.45	3.15E-02
0.30	0.097	5.12	4.00	9.12	4.29E-02
0.50	0.125	4.75	5.16	9.91	6.39E-02
0.70	0.147	4.41	6.10	10.52	8.34E-02
1.00	0.175	4.01	7.30	11.30	1.11E-01
1.50	0.214	3.43	8.94	12.37	1.53E-01
2.00	0.246	3.05	10.32	13.36	1.92E-01
3.00	0.298	2.44	12.64	15.08	2.62E-01
5.00	0.377	1.87	16.31	18.18	3.83E-01
7.00	0.437	1.50	19.30	20.80	4.85E-01
10.00	0.508	1.24	23.07	24.31	6.18E-01
15.00	0.596	0.86	28.26	29.12	8.05E-01
20.00	0.660	0.76	32.63	33.39	9.66E-01
30.00	0.749	0.53	37.84	38.37	1.25E+00
50.00	0.849	0.38	48.14	48.52	1.71E+00
70.00	0.902	0.27	54.46	54.74	2.09E+00
100.00	0.944	0.22	60.16	60.38	2.61E+00
150.00	0.974	0.14	64.54	64.68	3.41E+00
200.00	0.987	0.12	64.29	64.41	4.18E+00
300.00	0.996	0.08	60.11	60.19	5.78E+00
400.00	0.998	0.07	54.85	54.92	7.52E+00
500.00	0.999	0.05	49.91	49.96	9.43E+00
600.00	1.000	0.05	45.97	46.02	1.15E+01
700.00	1.000	0.00	42.63	42.63	1.38E+01
800.00	1.000	0.00	39.71	39.71	1.62E+01
900.00	1.000	0.00	37.19	37.19	1.88E+01
1000.00	1.000	0.00	34.99	34.99	2.16E+01
1200.00	1.000	0.00	31.34	31.34	2.76E+01
1500.00	1.000	0.00	27.22	27.22	3.79E+01
1700.00	1.000	0.00	25.08	25.08	4.56E+01
2000.00	1.000	0.00	22.49	22.49	5.83E+01
2500.00	1.000	0.00	19.27	19.27	8.24E+01

ABSORBER.....OXYGEN

ION.....ALPHA-PARTICLES

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	15.11	3.11	18.22	7.89E-03
0.15	0.049	16.16	3.81	19.97	1.05E-02
0.20	0.056	16.87	4.40	21.27	1.29E-02
0.30	0.069	17.48	5.39	22.87	1.75E-02
0.50	0.089	17.55	6.96	24.51	2.58E-02
0.70	0.105	17.35	8.23	25.57	3.38E-02
1.00	0.126	16.58	9.84	26.42	4.53E-02
1.50	0.154	15.28	12.05	27.32	6.39E-02
2.00	0.177	14.16	13.91	28.07	8.20E-02
3.00	0.217	12.43	17.04	29.46	1.17E-01
5.00	0.279	9.99	21.99	31.98	1.82E-01
7.00	0.330	8.30	26.02	34.33	2.42E-01
10.00	0.393	6.91	31.10	38.01	3.25E-01
15.00	0.478	5.41	38.09	43.51	4.48E-01
20.00	0.548	4.37	43.99	48.35	5.57E-01
30.00	0.663	3.42	53.87	57.29	7.46E-01
50.00	0.835	2.44	69.55	71.99	1.06E+00
70.00	0.965	1.80	82.29	84.09	1.31E+00
100.00	1.115	1.38	98.36	99.74	1.64E+00
150.00	1.294	1.02	122.61	123.62	2.09E+00
200.00	1.422	0.74	139.13	139.87	2.46E+00
300.00	1.593	0.58	158.90	159.48	3.13E+00
400.00	1.701	0.40	173.01	173.41	3.73E+00
500.00	1.773	0.39	187.02	187.41	4.29E+00
600.00	1.824	0.33	192.30	192.63	4.81E+00
700.00	1.861	0.28	193.07	193.35	5.33E+00
800.00	1.889	0.26	189.40	189.66	5.85E+00
900.00	1.910	0.23	185.73	185.97	6.38E+00
1000.00	1.926	0.21	179.87	180.08	6.93E+00
1200.00	1.949	0.18	167.41	167.59	8.08E+00
1500.00	1.970	0.00	153.09	153.09	9.96E+00
1700.00	1.978	0.00	146.06	146.06	1.13E+01
2000.00	1.986	0.00	137.29	137.29	1.34E+01
2500.00	1.993	0.00	120.86	120.86	1.73E+01
3000.00	1.996	0.00	107.99	107.99	2.17E+01
3500.00	1.998	0.00	97.75	97.75	2.66E+01
4000.00	1.999	0.00	89.43	89.43	3.19E+01
4500.00	1.999	0.00	82.53	82.53	3.77E+01
5000.00	1.999	0.00	76.71	76.71	4.40E+01
5500.00	2.000	0.00	71.74	71.74	5.08E+01
6000.00	2.000	0.00	67.43	67.43	5.80E+01
6500.00	2.000	0.00	63.65	63.65	6.56E+01
7000.00	2.000	0.00	60.32	60.32	7.37E+01
7500.00	2.000	0.00	57.36	57.36	8.22E+01

ABSORBER.....OXYGEN

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	57.52	4.33	61.85	2.48E-03
0.15	64.88	5.31	70.19	3.24E-03
0.20	70.66	6.13	76.79	3.92E-03
0.30	76.94	7.50	84.44	5.17E-03
0.50	85.47	9.69	95.16	7.39E-03
0.70	90.43	11.46	101.89	9.41E-03
1.00	95.33	13.70	109.03	1.23E-02
1.50	98.62	16.78	115.40	1.67E-02
2.00	100.51	19.37	119.88	2.10E-02
3.00	98.14	23.73	121.87	2.93E-02
5.00	92.42	30.63	123.05	4.56E-02
7.00	86.43	36.24	122.68	6.18E-02
10.00	78.66	43.32	121.98	8.64E-02
15.00	68.70	53.06	121.76	1.27E-01
20.00	60.43	61.26	121.69	1.68E-01
30.00	49.71	75.03	124.74	2.49E-01
50.00	38.14	96.87	135.01	4.04E-01
70.00	31.03	114.62	145.65	5.46E-01
100.00	23.78	136.99	160.78	7.42E-01
150.00	18.48	167.78	186.26	1.03E+00
200.00	13.94	193.74	207.68	1.28E+00
300.00	11.21	237.28	248.49	1.72E+00
400.00	9.15	273.98	283.14	2.10E+00
500.00	7.47	306.32	313.80	2.43E+00
600.00	6.79	335.56	342.35	2.74E+00
700.00	5.89	362.45	368.33	3.02E+00
800.00	5.11	387.47	392.59	3.28E+00
900.00	4.48	410.97	415.46	3.53E+00
1000.00	3.99	433.21	437.19	3.76E+00
1200.00	3.97	474.55	478.52	4.20E+00
1500.00	3.10	530.57	533.67	4.79E+00

ABSORBER.....OXYGEN

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	65.92	4.47	70.39	2.19E-03
0.15	74.37	5.47	79.85	2.85E-03
0.20	81.52	6.32	87.84	3.45E-03
0.30	89.59	7.74	97.32	4.52E-03
0.50	100.95	9.99	110.95	6.43E-03
0.70	107.80	11.82	119.62	8.16E-03
1.00	114.13	14.13	128.26	1.06E-02
1.50	119.12	17.31	136.43	1.43E-02
2.00	122.80	19.98	142.78	1.79E-02
3.00	122.40	24.47	146.87	2.48E-02
5.00	118.80	31.60	150.39	3.82E-02
7.00	112.86	37.39	150.24	5.15E-02
10.00	104.43	44.68	149.12	7.15E-02
15.00	93.43	54.73	148.15	1.05E-01
20.00	83.81	63.19	147.00	1.39E-01
30.00	70.50	77.39	147.89	2.07E-01
50.00	54.24	99.92	154.15	3.40E-01
70.00	44.87	118.22	163.09	4.66E-01
100.00	35.63	141.30	176.93	6.43E-01
150.00	28.35	173.06	201.41	9.08E-01
200.00	22.06	199.83	221.89	1.14E+00
300.00	17.33	244.74	262.08	1.56E+00
400.00	13.40	282.60	296.00	1.92E+00
500.00	11.59	315.96	327.55	2.24E+00
600.00	9.85	346.12	355.97	2.53E+00
700.00	8.55	373.85	382.40	2.80E+00
800.00	8.13	399.66	407.80	3.05E+00
900.00	7.27	423.91	431.18	3.29E+00
1000.00	6.51	446.84	453.35	3.52E+00
1200.00	5.31	489.49	494.80	3.94E+00

ABSORBER.....OXYGEN

ION.....0-16 PECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	73.84	4.58	78.41	1.99E-03
0.15	83.82	5.61	89.42	2.58E-03
0.20	91.05	6.47	97.52	3.12E-03
0.30	103.23	7.93	111.16	4.08E-03
0.50	115.56	10.23	125.79	5.77E-03
0.70	123.96	12.11	136.07	7.29E-03
1.00	132.19	14.47	146.66	9.41E-03
1.50	140.51	17.73	158.24	1.27E-02
2.00	143.80	20.47	164.27	1.58E-02
3.00	149.01	25.07	174.08	2.17E-02
5.00	145.50	32.36	177.86	3.31E-02
7.00	140.30	38.29	178.59	4.43E-02
10.00	131.59	45.77	177.36	6.11E-02
15.00	118.99	56.06	175.05	8.95E-02
20.00	109.31	64.73	174.03	1.18E-01
30.00	92.42	79.28	171.69	1.76E-01
50.00	72.06	102.34	174.41	2.92E-01
70.00	60.78	121.09	181.87	4.04E-01
100.00	49.37	144.74	194.11	5.64E-01
150.00	37.05	177.26	214.31	8.08E-01
200.00	32.17	204.69	236.86	1.03E+00
300.00	21.98	250.69	272.67	1.42E+00
400.00	19.59	289.47	309.06	1.77E+00
500.00	16.00	323.64	339.64	2.07E+00
600.00	14.32	354.53	368.85	2.36E+00
700.00	12.53	382.94	395.46	2.62E+00
800.00	11.07	409.38	420.45	2.86E+00
900.00	10.63	434.21	444.84	3.09E+00
1000.00	9.71	457.70	467.41	3.31E+00

ABSORBER.....OXYGEN

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	81.96	4.54	86.49	1.81E-03
0.15	93.29	5.56	98.85	2.34E-03
0.20	102.30	6.42	108.72	2.83E-03
0.30	115.39	7.86	123.25	3.69E-03
0.50	130.63	10.15	140.78	5.19E-03
0.70	141.30	12.00	153.31	6.55E-03
1.00	152.04	14.35	166.38	8.42E-03
1.50	162.62	17.57	180.19	1.13E-02
2.00	169.59	20.29	189.88	1.40E-02
3.00	175.44	24.85	200.29	1.91E-02
5.00	175.46	32.08	207.54	2.89E-02
7.00	172.22	37.96	210.19	3.84E-02
10.00	164.46	45.37	209.83	5.27E-02
15.00	151.32	55.57	206.90	7.67E-02
20.00	139.99	64.17	204.16	1.01E-01
30.00	122.28	78.59	200.87	1.50E-01
50.00	97.81	101.46	199.27	2.51E-01
70.00	82.58	120.05	202.63	3.51E-01
100.00	67.91	143.49	211.39	4.96E-01
150.00	52.66	175.73	228.39	7.23E-01
200.00	42.35	202.92	245.27	9.35E-01
300.00	32.92	248.52	281.44	1.31E+00
400.00	24.83	286.97	311.81	1.65E+00
500.00	23.54	320.84	344.39	1.95E+00
600.00	19.96	351.47	371.43	2.23E+00
700.00	18.19	379.63	397.82	2.49E+00
800.00	16.30	405.84	422.14	2.74E+00
900.00	14.68	430.46	445.13	2.97E+00



ABSORBER.....OXYGEN

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	113.57	4.94	118.51	1.32E-03
0.15	129.74	6.05	135.78	1.71E-03
0.20	143.70	6.98	150.68	2.06E-03
0.30	166.03	8.55	174.58	2.67E-03
0.50	195.03	11.04	206.08	3.72E-03
0.70	215.20	13.07	228.27	4.64E-03
1.00	240.40	15.62	256.02	5.88E-03
1.50	262.37	19.13	281.49	7.74E-03
2.00	279.73	22.09	301.82	9.45E-03
3.00	303.14	27.05	330.19	1.26E-02
5.00	328.31	34.92	363.24	1.84E-02
7.00	338.06	41.32	379.38	2.37E-02
10.00	348.90	49.39	398.29	3.14E-02
15.00	342.84	60.49	403.33	4.39E-02
20.00	335.60	69.85	405.45	5.63E-02
30.00	316.36	85.54	401.91	8.10E-02
50.00	280.76	110.44	391.19	1.31E-01
70.00	253.86	130.67	384.54	1.83E-01
100.00	218.96	156.18	375.14	2.62E-01
150.00	181.46	191.28	372.75	3.96E-01
200.00	157.40	220.88	378.27	5.29E-01
300.00	125.32	270.52	395.84	7.88E-01
400.00	104.46	312.37	416.82	1.03E+00
500.00	88.40	349.24	437.64	1.27E+00
600.00	83.26	382.57	465.83	1.49E+00

ABSORBER.....FLUORINE

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	2.08	2.81	4.89	3.20E-02
0.15	0.097	2.15	3.44	5.59	4.16E-02
0.20	0.112	2.19	3.97	6.16	5.01E-02
0.30	0.136	2.13	4.87	7.00	6.53E-02
0.50	0.175	2.00	6.28	8.28	9.15E-02
0.70	0.207	1.86	7.43	9.30	1.14E-01
1.00	0.246	1.69	8.89	10.58	1.44E-01
1.50	0.298	1.47	10.88	12.35	1.88E-01
2.00	0.340	1.29	12.57	13.86	2.26E-01
3.00	0.409	1.06	15.39	16.45	2.92E-01
5.00	0.508	0.81	19.87	20.68	4.00E-01
7.00	0.580	0.66	23.51	24.17	4.89E-01
10.00	0.660	0.50	28.10	28.60	6.03E-01
15.00	0.749	0.39	33.31	33.70	7.64E-01
20.00	0.808	0.29	38.07	38.37	9.03E-01
30.00	0.879	0.24	44.65	44.89	1.14E+00
50.00	0.944	0.16	53.22	53.38	1.55E+00
70.00	0.970	0.12	57.31	57.43	1.91E+00
100.00	0.987	0.08	58.15	58.23	2.42E+00
150.00	0.996	0.06	53.65	53.71	3.31E+00
200.00	0.998	0.04	48.31	48.36	4.29E+00
300.00	1.000	0.04	39.74	39.78	6.57E+00
400.00	1.000	0.03	33.81	33.84	9.31E+00
500.00	1.000	0.02	30.09	30.11	1.25E+01
600.00	1.000	0.02	27.15	27.17	1.60E+01
700.00	1.000	0.00	24.79	24.79	1.98E+01
800.00	1.000	0.00	22.83	22.83	2.40E+01
900.00	1.000	0.00	21.19	21.19	2.86E+01
1000.00	1.000	0.00	19.79	19.79	3.35E+01
1200.00	1.000	0.00	17.53	17.53	4.42E+01
1500.00	1.000	0.00	15.04	15.04	6.28E+01
1700.00	1.000	0.00	13.77	13.77	7.67E+01
2000.00	1.000	0.00	12.26	12.26	9.98E+01
2500.00	1.000	0.00	10.42	10.42	1.44E+02
3000.00	1.000	0.00	9.10	9.10	1.96E+02
3500.00	1.000	0.00	8.10	8.10	2.54E+02
4000.00	1.000	0.00	7.31	7.31	3.19E+02
4500.00	1.000	0.00	6.68	6.68	3.91E+02
5000.00	1.000	0.00	6.16	6.16	4.69E+02
5500.00	1.000	0.00	5.71	5.71	5.53E+02
6000.00	1.000	0.00	5.34	5.34	6.44E+02
6500.00	1.000	0.00	5.01	5.01	7.40E+02

ABSORBER.....FLUORINE

ION.....DEUTERONS

ENERGY E KEV	ZEFF	SN(E) (KEV/MICRON)/(GRAM/CCM)	SE(E)	ST(E)	PATHLENGTH MICRON*GRAM/CCM
0.10	0.056	3.93	1.99	5.92	2.42E-02
0.15	0.069	4.07	2.43	6.51	3.22E-02
0.20	0.079	4.15	2.81	6.96	3.97E-02
0.30	0.097	4.06	3.44	7.50	5.35E-02
0.50	0.125	3.83	4.44	8.27	7.88E-02
0.70	0.147	3.58	5.26	8.84	1.02E-01
1.00	0.175	3.26	6.29	9.55	1.35E-01
1.50	0.214	2.85	7.70	10.55	1.84E-01
2.00	0.246	2.51	8.89	11.40	2.30E-01
3.00	0.298	2.07	10.89	12.96	3.12E-01
5.00	0.377	1.59	14.06	15.64	4.52E-01
7.00	0.437	1.29	16.63	17.92	5.71E-01
10.00	0.508	0.99	19.88	20.87	7.26E-01
15.00	0.596	0.77	24.35	25.12	9.43E-01
20.00	0.660	0.58	28.11	28.70	1.13E+00
30.00	0.749	0.47	33.25	33.71	1.45E+00
50.00	0.849	0.31	41.79	42.11	1.98E+00
70.00	0.902	0.25	47.31	47.56	2.42E+00
100.00	0.944	0.17	53.22	53.39	3.02E+00
150.00	0.974	0.13	57.82	57.95	3.91E+00
200.00	0.987	0.09	58.14	58.23	4.76E+00
300.00	0.996	0.07	53.63	53.70	6.55E+00
400.00	0.998	0.06	48.28	48.34	8.51E+00
500.00	0.999	0.05	43.89	43.94	1.07E+01
600.00	1.000	0.04	39.72	39.76	1.31E+01
700.00	1.000	0.04	36.41	36.45	1.57E+01
800.00	1.000	0.00	33.83	33.83	1.86E+01
900.00	1.000	0.00	31.85	31.85	2.16E+01
1000.00	1.000	0.00	30.10	30.10	2.48E+01
2000.00	1.000	0.00	27.16	27.16	3.18E+01
5000.00	1.000	0.00	23.76	23.76	4.37E+01
7000.00	1.000	0.00	21.97	21.97	5.24E+01
10000.00	1.000	0.00	19.78	19.78	6.69E+01
50000.00	1.000	0.00	17.04	17.04	9.42E+01

ABSORBER.....FLUORINE

ION.....ALPHA-PARTICLES

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	11.82	2.71	14.53	1.00E-02
0.15	0.049	12.71	3.31	16.02	1.33E-02
0.20	0.056	13.29	3.83	17.12	1.63E-02
0.30	0.069	13.82	4.69	18.51	2.19E-02
0.50	0.089	14.05	6.05	20.10	3.22E-02
0.70	0.105	13.98	7.16	21.14	4.18E-02
1.00	0.126	13.49	8.56	22.05	5.57E-02
1.50	0.154	12.55	10.48	23.03	7.79E-02
2.00	0.177	11.71	12.10	23.81	9.92E-02
3.00	0.217	10.39	14.82	25.21	1.40E-01
5.00	0.279	8.46	19.13	27.60	2.16E-01
7.00	0.330	7.08	22.64	29.72	2.86E-01
10.00	0.393	5.91	27.06	32.97	3.81E-01
15.00	0.478	4.68	33.14	37.82	5.23E-01
20.00	0.548	3.82	38.27	42.08	6.48E-01
30.00	0.663	3.02	46.87	49.89	8.65E-01
50.00	0.835	2.14	60.51	62.65	1.22E+00
70.00	0.965	1.60	71.59	73.19	1.52E+00
100.00	1.115	1.23	85.57	86.79	1.89E+00
150.00	1.294	0.91	104.80	105.71	2.41E+00
200.00	1.422	0.67	121.01	121.69	2.85E+00
300.00	1.593	0.53	148.21	148.73	3.59E+00
400.00	1.701	0.37	163.61	163.98	4.22E+00
500.00	1.773	0.35	168.13	168.48	4.82E+00
600.00	1.824	0.29	167.40	167.69	5.42E+00
700.00	1.861	0.25	165.05	165.30	6.02E+00
800.00	1.889	0.22	161.59	161.81	6.63E+00
900.00	1.910	0.21	157.69	157.90	7.26E+00
1000.00	1.926	0.19	157.11	157.30	7.89E+00
1200.00	1.949	0.16	146.00	146.16	9.20E+00
1500.00	1.970	0.13	134.85	134.98	1.13E+01
1700.00	1.978	0.00	127.90	127.90	1.29E+01
2000.00	1.986	0.00	118.27	118.27	1.53E+01
2500.00	1.993	0.00	104.89	104.89	1.98E+01
3000.00	1.996	0.00	94.27	94.27	2.48E+01
3500.00	1.998	0.00	85.71	85.71	3.04E+01
4000.00	1.999	0.00	78.68	78.68	3.65E+01
4500.00	1.999	0.00	72.81	72.81	4.31E+01
5000.00	1.999	0.00	67.84	67.84	5.02E+01
5500.00	2.000	0.00	63.56	63.56	5.78E+01
6000.00	2.000	0.00	59.84	59.84	6.60E+01
6500.00	2.000	0.00	56.58	56.58	7.46E+01
7000.00	2.000	0.00	53.69	53.69	8.36E+01
7500.00	2.000	0.00	51.11	51.11	9.32E+01

ABSORBER.....FLUORINE

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	47.09	3.84	50.94	3.03E-03
0.15	53.12	4.71	57.83	3.95E-03
0.20	58.02	5.44	63.45	4.77E-03
0.30	63.29	6.66	69.95	6.27E-03
0.50	70.70	8.59	79.29	8.94E-03
0.70	74.86	10.17	85.02	1.14E-02
1.00	79.07	12.15	91.22	1.48E-02
1.50	81.98	14.88	96.87	2.01E-02
2.00	83.91	17.19	101.10	2.51E-02
3.00	82.36	21.05	103.41	3.49E-02
5.00	78.36	27.18	105.53	5.40E-02
7.00	73.48	32.15	105.64	7.30E-02
10.00	67.19	38.43	105.62	1.01E-01
15.00	59.12	47.07	106.19	1.49E-01
20.00	52.26	54.35	106.61	1.96E-01
30.00	43.26	66.57	109.82	2.88E-01
50.00	33.05	85.94	118.99	4.63E-01
70.00	27.20	101.68	128.88	6.24E-01
100.00	21.00	121.53	142.54	8.46E-01
150.00	16.50	148.85	165.34	1.17E+00
200.00	12.48	171.87	184.36	1.46E+00
300.00	10.00	210.50	220.50	1.95E+00
400.00	8.12	243.07	251.19	2.37E+00
500.00	6.67	271.76	278.43	2.75E+00
600.00	6.03	297.69	303.72	3.09E+00
700.00	5.27	321.55	326.82	3.41E+00
800.00	4.61	343.75	348.36	3.71E+00
900.00	4.06	364.60	368.66	3.99E+00
1000.00	3.60	384.32	387.92	4.25E+00
1200.00	3.54	421.00	424.55	4.74E+00
1500.00	2.82	470.70	473.51	5.41E+00

ABSORBER.....FLUORINE

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	54.50	3.98	58.48	2.65E-03
0.15	61.49	4.87	66.36	3.44E-03
0.20	67.42	5.62	73.04	4.16E-03
0.30	74.34	6.89	81.22	5.44E-03
0.50	83.99	8.89	92.88	7.73E-03
0.70	89.88	10.52	100.40	9.79E-03
1.00	95.32	12.57	107.89	1.27E-02
1.50	99.73	15.40	115.13	1.71E-02
2.00	102.96	17.78	120.74	2.14E-02
3.00	103.23	21.78	125.00	2.94E-02
5.00	100.82	28.12	128.94	4.51E-02
7.00	96.24	33.27	129.50	6.05E-02
10.00	89.42	39.76	129.18	8.37E-02
15.00	80.40	48.70	129.10	1.23E-01
20.00	72.50	56.23	128.73	1.61E-01
30.00	61.33	68.87	130.20	2.39E-01
50.00	47.32	88.91	136.23	3.90E-01
70.00	39.27	105.20	144.47	5.33E-01
100.00	31.41	125.73	157.15	7.32E-01
150.00	25.04	153.99	179.03	1.03E+00
200.00	19.73	177.82	197.55	1.30E+00
300.00	15.38	217.78	233.16	1.76E+00
400.00	11.96	251.47	263.43	2.17E+00
500.00	10.29	281.15	291.44	2.53E+00
600.00	8.79	307.99	316.78	2.85E+00
700.00	7.63	332.66	340.29	3.16E+00
800.00	7.24	355.63	362.87	3.44E+00
900.00	6.51	377.20	383.72	3.71E+00
1000.00	5.87	397.61	403.47	3.97E+00
1200.00	4.80	435.56	440.36	4.44E+00

ABSORBER.....FLUORINE

ION.....0-16 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	61.59	4.08	65.68	2.38E-03
0.15	69.90	5.00	74.90	3.09E-03
0.20	75.93	5.77	81.70	3.73E-03
0.30	86.24	7.07	93.31	4.87E-03
0.50	96.78	9.13	105.91	6.87E-03
0.70	104.01	10.80	114.82	8.68E-03
1.00	111.19	12.91	124.10	1.12E-02
1.50	118.35	15.81	134.16	1.51E-02
2.00	121.30	18.26	139.56	1.87E-02
3.00	126.12	22.37	148.48	2.56E-02
5.00	123.85	28.87	152.72	3.89E-02
7.00	119.95	34.16	154.11	5.19E-02
10.00	112.97	40.83	153.81	7.14E-02
15.00	102.60	50.01	152.61	1.04E-01
20.00	94.59	57.75	152.34	1.37E-01
30.00	80.48	70.73	151.21	2.03E-01
50.00	63.10	91.31	154.41	3.34E-01
70.00	53.27	108.04	161.30	4.61E-01
100.00	43.39	129.13	172.52	6.40E-01
150.00	32.83	158.15	190.98	9.16E-01
200.00	28.55	182.61	211.16	1.16E+00
300.00	19.71	223.65	243.37	1.60E+00
400.00	17.44	258.25	275.69	1.99E+00
500.00	14.29	288.74	303.02	2.34E+00
600.00	12.72	316.30	329.01	2.65E+00
700.00	11.17	341.64	352.81	2.95E+00
800.00	9.90	365.23	375.12	3.22E+00
900.00	8.88	387.38	396.26	3.48E+00
1000.00	8.65	408.34	416.99	3.73E+00

ABSORBER.....FLUORINE

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	68.98	4.06	73.04	2.14E-03
0.15	78.65	4.97	83.62	2.77E-03
0.20	86.25	5.74	91.98	3.34E-03
0.30	97.29	7.03	104.32	4.36E-03
0.50	110.43	9.07	119.51	6.13E-03
0.70	120.15	10.74	130.89	7.72E-03
1.00	129.14	12.83	141.97	9.92E-03
1.50	138.14	15.71	153.86	1.33E-02
2.00	144.24	18.15	162.39	1.65E-02
3.00	149.45	22.22	171.68	2.24E-02
5.00	150.22	28.69	178.92	3.37E-02
7.00	148.52	33.95	182.46	4.48E-02
10.00	142.08	40.57	182.65	6.12E-02
15.00	130.98	49.69	180.67	8.88E-02
20.00	121.49	57.38	178.87	1.17E-01
30.00	106.66	70.28	176.94	1.73E-01
50.00	85.81	90.73	176.53	2.86E-01
70.00	71.37	107.35	178.72	3.99E-01
100.00	59.40	128.31	187.70	5.63E-01
150.00	46.59	157.14	203.73	8.18E-01
200.00	37.59	181.45	219.04	1.05E+00
300.00	29.44	222.24	251.67	1.48E+00
400.00	22.24	256.62	278.86	1.86E+00
500.00	20.99	286.91	307.89	2.20E+00
600.00	17.85	314.29	332.13	2.51E+00
700.00	15.52	339.47	354.99	2.80E+00
800.00	14.52	362.91	377.43	3.07E+00
900.00	13.11	384.92	398.03	3.33E+00



ABSORBER.....FLUORINE

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	98.89	4.47	103.35	1.51E-03
0.15	112.96	5.47	118.43	1.96E-03
0.20	125.14	6.32	131.45	2.36E-03
0.30	144.66	7.74	152.39	3.07E-03
0.50	170.00	9.99	179.98	4.27E-03
0.70	187.57	11.82	199.39	5.32E-03
1.00	209.68	14.12	223.80	6.74E-03
1.50	229.01	17.30	246.31	8.86E-03
2.00	244.36	19.97	264.33	1.08E-02
3.00	265.04	24.46	289.50	1.44E-02
5.00	287.30	31.58	318.87	2.10E-02
7.00	296.01	37.36	333.38	2.71E-02
10.00	305.89	44.66	350.54	3.58E-02
15.00	301.11	54.70	355.81	5.00E-02
20.00	295.20	63.16	358.36	6.40E-02
30.00	278.82	77.35	356.17	9.19E-02
50.00	247.97	99.86	347.83	1.49E-01
70.00	224.61	118.16	342.76	2.07E-01
100.00	194.15	141.22	335.37	2.95E-01
150.00	161.22	172.96	334.19	4.45E-01
200.00	139.80	199.72	339.52	5.94E-01
300.00	111.48	244.60	356.09	8.82E-01
400.00	93.11	282.44	375.56	1.16E+00
500.00	78.93	315.78	394.71	1.42E+00
600.00	74.25	345.92	420.17	1.66E+00

BSORBER.....SILICON

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	1.23	2.05	3.28	5.03E-02
0.15	0.097	1.31	2.51	3.82	6.44E-02
0.20	0.112	1.34	2.89	4.24	7.68E-02
0.30	0.136	1.40	3.54	4.94	9.86E-02
0.50	0.175	1.37	4.58	5.94	1.35E-01
0.70	0.207	1.33	5.41	6.74	1.67E-01
1.00	0.246	1.25	6.47	7.72	2.08E-01
1.50	0.298	1.13	7.92	9.06	2.68E-01
2.00	0.340	1.04	9.15	10.19	3.20E-01
3.00	0.409	0.89	11.21	12.09	4.10E-01
5.00	0.508	0.69	14.47	15.16	5.56E-01
7.00	0.580	0.59	17.12	17.70	6.78E-01
10.00	0.660	0.48	20.46	20.94	8.33E-01
15.00	0.749	0.36	25.06	25.42	1.05E+00
20.00	0.808	0.31	28.93	29.25	1.23E+00
30.00	0.879	0.22	34.52	34.74	1.55E+00
50.00	0.944	0.16	42.27	42.42	2.06E+00
70.00	0.970	0.12	45.47	45.59	2.51E+00
100.00	0.987	0.09	44.01	44.10	3.17E+00
150.00	0.996	0.06	39.39	39.45	4.38E+00
200.00	0.998	0.06	36.24	36.30	5.70E+00
300.00	1.000	0.03	32.22	32.26	8.66E+00
400.00	1.000	0.03	29.31	29.34	1.19E+01
500.00	1.000	0.02	26.66	26.68	1.55E+01
600.00	1.000	0.02	24.40	24.42	1.94E+01
700.00	1.000	0.02	22.49	22.51	2.37E+01
800.00	1.000	0.02	20.88	20.90	2.83E+01
900.00	1.000	0.01	19.50	19.51	3.32E+01
1000.00	1.000	0.01	18.31	18.32	3.85E+01
1200.00	1.000	0.00	16.36	16.36	5.01E+01
1500.00	1.000	0.00	14.16	14.16	6.99E+01
1700.00	1.000	0.00	13.02	13.02	8.46E+01
2000.00	1.000	0.00	11.65	11.65	1.09E+02
2500.00	1.000	0.00	9.96	9.96	1.56E+02
3000.00	1.000	0.00	8.74	8.74	2.09E+02
3500.00	1.000	0.00	7.81	7.81	2.70E+02
4000.00	1.000	0.00	7.07	7.07	3.37E+02
4500.00	1.000	0.00	6.47	6.47	4.11E+02
5000.00	1.000	0.00	5.98	5.98	4.92E+02
5500.00	1.000	0.00	5.56	5.56	5.79E+02
6000.00	1.000	0.00	5.20	5.20	6.72E+02
6500.00	1.000	0.00	4.89	4.89	7.71E+02

ABSORBER.....SILICON

ION.....DEUTERONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.056	2.37	1.45	3.81	3.97E-02
0.15	0.069	2.52	1.77	4.29	5.20E-02
0.20	0.079	2.59	2.05	4.63	6.32E-02
0.30	0.097	2.69	2.51	5.20	8.35E-02
0.50	0.125	2.65	3.24	5.89	1.19E-01
0.70	0.147	2.57	3.83	6.40	1.52E-01
1.00	0.175	2.43	4.58	7.00	1.97E-01
1.50	0.214	2.21	5.61	7.81	2.64E-01
2.00	0.246	2.04	6.47	8.51	3.25E-01
3.00	0.298	1.74	7.93	9.67	4.35E-01
5.00	0.377	1.37	10.23	11.60	6.23E-01
7.00	0.437	1.15	12.11	13.26	7.84E-01
10.00	0.508	0.94	14.47	15.41	9.94E-01
15.00	0.596	0.71	17.73	18.44	1.29E+00
20.00	0.660	0.62	20.47	21.09	1.54E+00
30.00	0.749	0.43	25.07	25.50	1.97E+00
50.00	0.849	0.31	31.72	32.03	2.66E+00
70.00	0.902	0.24	36.91	37.15	3.24E+00
100.00	0.944	0.19	42.25	42.44	3.99E+00
150.00	0.974	0.15	45.58	45.71	5.11E+00
200.00	0.987	0.11	43.98	44.09	6.22E+00
300.00	0.996	0.07	39.37	39.44	8.63E+00
400.00	0.998	0.06	36.22	36.29	1.13E+01
500.00	0.999	0.05	33.42	33.47	1.41E+01
600.00	1.000	0.04	32.21	32.25	1.72E+01
700.00	1.000	0.04	30.74	30.78	2.04E+01
800.00	1.000	0.03	29.30	29.33	2.37E+01
900.00	1.000	0.03	27.92	27.95	2.72E+01
1000.00	1.000	0.03	26.64	26.67	3.08E+01
1200.00	1.000	0.02	24.38	24.41	3.87E+01
1500.00	1.000	0.00	21.66	21.66	5.18E+01
1700.00	1.000	0.00	20.17	20.17	6.13E+01
2000.00	1.000	0.00	18.31	18.31	7.70E+01
2500.00	1.000	0.00	15.93	15.93	1.06E+02

ABSORBER.....SILICON

ION.....ALPHA-PARTICLES

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	7.16	2.04	9.19	1.65E-02
0.15	0.049	7.85	2.49	10.34	2.16E-02
0.20	0.056	8.30	2.88	11.18	2.62E-02
0.30	0.069	8.87	3.53	12.40	3.47E-02
0.50	0.089	9.37	4.55	13.92	4.98E-02
0.70	0.105	9.65	5.39	15.04	6.36E-02
1.00	0.126	9.50	6.44	15.94	8.30E-02
1.50	0.154	9.23	7.88	17.11	1.13E-01
2.00	0.177	8.84	9.10	17.95	1.42E-01
3.00	0.217	8.11	11.15	19.26	1.95E-01
5.00	0.279	6.99	14.39	21.39	2.94E-01
7.00	0.330	6.08	17.03	23.11	3.83E-01
10.00	0.393	5.18	20.36	25.54	5.07E-01
15.00	0.478	4.21	24.93	29.14	6.90E-01
20.00	0.548	3.59	28.79	32.38	8.52E-01
30.00	0.663	2.76	35.26	38.02	1.14E+00
50.00	0.835	2.02	45.52	47.54	1.60E+00
70.00	0.965	1.47	53.86	55.33	1.99E+00
100.00	1.115	1.23	64.38	65.60	2.49E+00
150.00	1.294	0.91	78.84	79.74	3.18E+00
200.00	1.422	0.69	91.04	91.73	3.76E+00
300.00	1.593	0.51	111.50	112.01	4.74E+00
400.00	1.701	0.37	126.61	126.98	5.57E+00
500.00	1.773	0.35	132.64	132.99	6.34E+00
600.00	1.824	0.28	134.71	135.00	7.08E+00
700.00	1.861	0.23	134.77	135.00	7.82E+00
800.00	1.889	0.20	133.81	134.01	8.57E+00
900.00	1.910	0.22	131.79	132.01	9.32E+00
1000.00	1.926	0.20	129.82	130.01	1.01E+01
1200.00	1.949	0.16	124.86	125.02	1.17E+01
1500.00	1.970	0.14	117.38	117.52	1.41E+01
1700.00	1.978	0.12	112.40	112.53	1.59E+01
2000.00	1.986	0.11	104.93	105.03	1.86E+01
2500.00	1.993	0.09	94.49	94.58	2.36E+01
3000.00	1.996	0.00	85.99	85.99	2.92E+01
3500.00	1.998	0.00	78.85	78.85	3.53E+01
4000.00	1.999	0.00	72.86	72.86	4.19E+01
4500.00	1.999	0.00	67.79	67.79	4.90E+01
5000.00	1.999	0.00	63.43	63.43	5.66E+01
5500.00	2.000	0.00	59.65	59.65	6.48E+01
6000.00	2.000	0.00	56.34	56.34	7.34E+01
6500.00	2.000	0.00	53.42	53.42	8.25E+01
7000.00	2.000	0.00	50.81	50.81	9.21E+01
7500.00	2.000	0.00	48.48	48.48	1.02E+02

ABSORBER.....SILICON

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(F)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	31.05	3.10	34.14	4.59E-03
0.15	35.24	3.79	39.04	5.96E-03
0.20	38.28	4.38	42.67	7.18E-03
0.30	43.41	5.37	48.77	9.36E-03
0.50	48.59	6.93	55.52	1.32E-02
0.70	52.13	8.20	60.32	1.67E-02
1.00	55.59	9.80	65.39	2.14E-02
1.50	59.09	12.00	71.09	2.87E-02
2.00	60.47	13.86	74.33	3.56E-02
3.00	62.67	16.97	79.64	4.86E-02
5.00	61.20	21.91	83.10	7.32E-02
7.00	59.01	25.92	84.93	9.70E-02
10.00	55.35	30.98	86.33	1.32E-01
15.00	50.05	37.95	88.00	1.89E-01
20.00	45.98	43.82	89.80	2.46E-01
30.00	38.88	53.66	92.55	3.55E-01
50.00	30.32	69.28	99.60	5.63E-01
70.00	25.57	81.97	107.55	7.56E-01
100.00	20.77	97.98	118.75	1.02E+00
150.00	15.59	120.00	135.59	1.41E+00
200.00	13.54	138.56	152.10	1.76E+00
300.00	9.25	169.70	178.95	2.37E+00
400.00	8.24	195.96	204.20	2.89E+00
500.00	6.73	219.09	225.82	3.35E+00
600.00	6.03	240.00	246.02	3.78E+00
700.00	5.27	259.23	264.50	4.17E+00
800.00	4.66	277.12	281.78	4.53E+00
900.00	4.47	293.93	298.41	4.88E+00
1000.00	4.09	309.83	313.92	5.21E+00
1200.00	3.42	339.41	342.82	5.82E+00
1500.00	2.67	379.47	382.13	6.64E+00

ABSORBER.....SILICCN

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	36.67	3.24	39.91	3.93E-03
0.15	41.73	3.97	45.70	5.10E-03
0.20	45.76	4.58	50.35	6.14E-03
0.30	51.62	5.61	57.23	8.00E-03
0.50	58.42	7.25	65.67	1.12E-02
0.70	63.18	8.57	71.76	1.41E-02
1.00	67.97	10.25	78.22	1.81E-02
1.50	72.69	12.55	85.25	2.42E-02
2.00	75.80	14.49	90.29	2.99E-02
3.00	78.40	17.75	96.15	4.07E-02
5.00	78.37	22.92	101.29	6.08E-02
7.00	76.90	27.11	104.02	8.02E-02
10.00	73.41	32.41	105.81	1.09E-01
15.00	67.52	39.69	107.21	1.56E-01
20.00	62.45	45.83	108.28	2.02E-01
30.00	54.52	56.13	110.65	2.93E-01
50.00	43.59	72.47	116.05	4.70E-01
70.00	36.80	85.74	122.54	6.38E-01
100.00	30.25	102.48	132.74	8.74E-01
150.00	23.45	125.51	148.96	1.23E+00
200.00	18.85	144.93	163.78	1.55E+00
300.00	14.64	177.50	192.15	2.11E+00
400.00	11.05	204.96	216.01	2.60E+00
500.00	10.48	229.16	239.63	3.04E+00
600.00	8.88	251.03	259.91	3.44E+00
700.00	8.10	271.14	279.24	3.81E+00
800.00	7.25	289.86	297.12	4.16E+00
900.00	6.53	307.45	313.97	4.48E+00
1000.00	5.92	324.08	330.00	4.79E+00
1200.00	5.38	355.01	360.39	5.37E+00

ABSORBER.....SILICON

ION.....0-16 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	86.92	3.36	90.28	1.73E-03
0.15	100.00	4.12	104.12	2.24E-03
0.20	109.29	4.75	114.04	2.70E-03
0.30	123.30	5.82	129.12	3.52E-03
0.50	143.97	7.51	151.49	4.94E-03
0.70	154.02	8.89	162.92	6.22E-03
1.00	166.44	10.63	177.06	7.98E-03
1.50	179.44	13.01	192.45	1.07E-02
2.00	187.55	15.03	202.57	1.32E-02
3.00	195.34	18.41	213.75	1.80E-02
5.00	203.34	23.76	227.10	2.70E-02
7.00	198.75	28.12	226.86	3.59E-02
10.00	192.47	33.60	226.07	4.91E-02
15.00	179.62	41.16	220.78	7.15E-02
20.00	167.92	47.52	215.45	9.44E-02
30.00	149.54	58.20	207.74	1.42E-01
50.00	120.50	75.14	195.64	2.41E-01
70.00	102.78	88.91	191.69	3.44E-01
100.00	85.80	106.27	192.06	5.01E-01
150.00	67.82	130.15	197.97	7.58E-01
200.00	55.83	150.28	206.11	1.01E+00
300.00	44.32	184.06	228.38	1.47E+00
400.00	34.14	212.53	246.67	1.89E+00
500.00	27.45	237.62	265.07	2.28E+00
600.00	27.01	260.30	287.31	2.64E+00
700.00	23.51	281.15	304.67	2.98E+00
800.00	20.83	300.57	321.40	3.30E+00
900.00	19.74	318.80	338.53	3.60E+00
1000.00	18.05	336.04	354.09	3.89E+00

ABSORBER.....SILICCN

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(F)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	87.77	3.37	91.14	1.71E-03
0.15	101.25	4.12	105.38	2.22E-03
0.20	110.98	4.76	115.75	2.67E-03
0.30	126.33	5.83	132.16	3.48E-03
0.50	147.22	7.53	154.75	4.87E-03
0.70	158.34	8.91	167.25	6.11E-03
1.00	173.13	10.65	183.78	7.81E-03
1.50	187.46	13.04	200.50	1.04E-02
2.00	196.72	15.06	211.78	1.28E-02
3.00	208.94	18.45	227.39	1.74E-02
5.00	218.01	23.81	241.83	2.59E-02
7.00	215.94	28.18	244.12	3.41E-02
10.00	213.30	33.68	246.98	4.63E-02
15.00	201.89	41.25	243.14	6.67E-02
20.00	190.79	47.63	238.42	8.75E-02
30.00	171.59	58.33	229.92	1.30E-01
50.00	143.10	75.31	218.41	2.19E-01
70.00	123.94	89.11	213.04	3.12E-01
100.00	101.98	106.50	208.48	4.55E-01
150.00	82.95	130.44	213.39	6.92E-01
200.00	69.66	150.62	220.28	9.23E-01
300.00	51.62	184.47	236.08	1.36E+00
400.00	44.57	213.00	257.58	1.76E+00
500.00	36.12	238.15	274.27	2.14E+00
600.00	30.21	260.88	291.08	2.49E+00
700.00	30.41	281.78	312.19	2.82E+00
800.00	27.05	301.23	328.29	3.14E+00
900.00	24.29	319.51	343.79	3.43E+00



ABSORBER.....SILICON

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	89.63	3.87	93.50	1.68E-03
0.15	104.27	4.74	109.00	2.17E-03
0.20	114.10	5.47	119.57	2.61E-03
0.30	131.91	6.70	138.61	3.38E-03
0.50	156.58	8.65	165.22	4.69E-03
0.70	174.37	10.23	184.60	5.83E-03
1.00	193.66	12.23	205.88	7.37E-03
1.50	218.77	14.97	233.74	9.64E-03
2.00	231.18	17.29	248.47	1.17E-02
3.00	253.04	21.18	274.22	1.55E-02
5.00	277.28	27.34	304.62	2.24E-02
7.00	291.81	32.35	324.15	2.88E-02
10.00	300.85	38.66	339.51	3.78E-02
15.00	309.87	47.35	357.23	5.21E-02
20.00	303.48	54.68	358.16	6.62E-02
30.00	293.77	66.97	360.74	9.39E-02
50.00	268.29	86.46	354.74	1.50E-01
70.00	246.13	102.30	348.43	2.07E-01
100.00	220.28	122.27	342.55	2.93E-01
150.00	184.71	149.75	334.45	4.41E-01
200.00	162.01	172.91	334.93	5.90E-01
300.00	131.66	211.77	343.43	8.86E-01
400.00	111.99	244.54	356.53	1.17E+00
500.00	97.69	273.40	371.09	1.45E+00
600.00	85.85	299.49	385.34	1.71E+00

ABSORBER.....PHOSPHORUS

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	38.69	1.87	40.56	3.39E-03
0.15	0.097	41.26	2.30	43.55	4.58E-03
0.20	0.112	42.38	2.65	45.03	5.70E-03
0.30	0.136	44.22	3.25	47.47	7.86E-03
0.50	0.175	43.76	4.19	47.95	1.20E-02
0.70	0.207	42.63	4.96	47.59	1.62E-02
1.00	0.246	40.39	5.93	46.32	2.26E-02
1.50	0.298	36.89	7.26	44.15	3.37E-02
2.00	0.340	34.16	8.38	42.54	4.52E-02
3.00	0.409	29.32	10.26	39.59	6.96E-02
5.00	0.508	23.18	13.25	36.43	1.23E-01
7.00	0.580	19.58	15.68	35.25	1.79E-01
10.00	0.660	16.01	18.74	34.75	2.65E-01
15.00	0.749	12.25	22.95	35.20	4.08E-01
20.00	0.808	10.64	26.50	37.14	5.47E-01
30.00	0.879	7.48	32.46	39.94	8.07E-01
50.00	0.944	5.39	40.07	45.46	1.27E+00
70.00	0.970	4.20	42.01	46.21	1.70E+00
100.00	0.987	3.05	41.51	44.56	2.36E+00
150.00	0.996	2.19	38.90	41.09	3.53E+00
200.00	0.998	1.91	35.30	37.21	4.81E+00
300.00	1.000	1.22	30.68	31.90	7.73E+00
400.00	1.000	1.07	26.83	27.90	1.11E+01
500.00	1.000	0.85	24.12	24.97	1.49E+01
600.00	1.000	0.71	22.22	22.93	1.91E+01
700.00	1.000	0.65	20.54	21.19	2.36E+01
800.00	1.000	0.58	19.13	19.71	2.85E+01
900.00	1.000	0.51	17.92	18.43	3.38E+01
1000.00	1.000	0.46	16.86	17.32	3.94E+01
1200.00	1.000	0.41	15.09	15.50	5.16E+01
1500.00	1.000	0.00	13.44	13.44	7.25E+01
1700.00	1.000	0.00	12.37	12.37	8.80E+01
2000.00	1.000	0.00	11.08	11.08	1.14E+02
2500.00	1.000	0.00	9.49	9.49	1.63E+02
3000.00	1.000	0.00	8.33	8.33	2.19E+02
3500.00	1.000	0.00	7.45	7.45	2.83E+02
4000.00	1.000	0.00	6.75	6.75	3.53E+02
4500.00	1.000	0.00	6.18	6.18	4.31E+02
5000.00	1.000	0.00	5.71	5.71	5.15E+02
5500.00	1.000	0.00	5.31	5.31	6.06E+02
6000.00	1.000	0.00	4.97	4.97	7.03E+02
6500.00	1.000	0.00	4.68	4.68	8.07E+02

ABSORBER.....PHOSPHORUS

ION.....DEUTERONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.056	48.16	1.33	49.48	2.77E-03
0.15	0.069	51.40	1.62	53.03	3.75E-03
0.20	0.079	52.86	1.87	54.74	4.67E-03
0.30	0.097	55.22	2.30	57.51	6.45E-03
0.50	0.125	54.83	2.96	57.79	9.90E-03
0.70	0.147	53.54	3.51	57.05	1.34E-02
1.00	0.175	50.85	4.19	55.04	1.87E-02
1.50	0.214	46.56	5.13	51.69	2.81E-02
2.00	0.246	43.18	5.93	49.11	3.81E-02
3.00	0.298	37.20	7.26	44.46	5.95E-02
5.00	0.377	29.52	9.37	38.89	1.08E-01
7.00	0.437	24.93	11.09	36.02	1.62E-01
10.00	0.508	20.42	13.26	33.68	2.48E-01
15.00	0.596	15.69	16.24	31.92	4.01E-01
20.00	0.660	13.61	18.75	32.36	5.59E-01
30.00	0.749	9.66	22.96	32.62	8.68E-01
50.00	0.849	6.94	29.64	36.58	1.45E+00
70.00	0.902	5.39	35.07	40.47	1.97E+00
100.00	0.944	3.92	41.54	45.46	2.66E+00
150.00	0.974	2.81	43.29	46.14	3.74E+00
200.00	0.987	2.46	42.09	44.55	4.84E+00
300.00	0.996	1.59	39.49	41.08	7.17E+00
400.00	0.998	1.38	35.82	37.20	9.73E+00
500.00	0.999	1.11	32.99	34.09	1.25E+01
600.00	1.000	0.91	30.98	31.89	1.56E+01
700.00	1.000	0.84	28.86	29.70	1.88E+01
800.00	1.000	0.74	27.15	27.89	2.23E+01
900.00	1.000	0.66	25.44	26.10	2.60E+01
1000.00	1.000	0.60	24.37	24.96	3.00E+01
1200.00	1.000	0.52	22.41	22.92	3.83E+01
1500.00	1.000	0.00	20.41	20.41	5.22E+01
1700.00	1.000	0.00	19.04	19.04	6.24E+01
2000.00	1.000	0.00	17.32	17.32	7.89E+01
2500.00	1.000	0.00	15.10	15.10	1.10E+02

ABSORBER.....PHOSPHORUS

ION.....ALPHA-PARTICLES

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	45.19	1.87	47.06	3.09E-03
0.15	0.049	49.70	2.29	51.99	4.09E-03
0.20	0.056	52.79	2.65	55.44	5.02E-03
0.30	0.069	56.44	3.24	59.68	6.76E-03
0.50	0.089	59.81	4.19	64.00	9.97E-03
0.70	0.105	61.84	4.96	66.79	1.30E-02
1.00	0.126	61.22	5.92	67.14	1.75E-02
1.50	0.154	59.86	7.25	67.12	2.49E-02
2.00	0.177	57.76	8.38	66.13	3.24E-02
3.00	0.217	53.18	10.26	63.44	4.79E-02
5.00	0.279	46.23	13.25	59.47	8.05E-02
7.00	0.330	40.48	15.67	56.15	1.15E-01
10.00	0.393	34.68	18.73	53.42	1.70E-01
15.00	0.478	28.24	22.94	51.18	2.67E-01
20.00	0.548	23.99	26.49	50.48	3.65E-01
30.00	0.663	18.78	32.44	51.22	5.62E-01
50.00	0.835	13.83	41.89	55.72	9.39E-01
70.00	0.965	10.19	49.56	59.75	1.29E+00
100.00	1.115	8.44	59.24	67.67	1.76E+00
150.00	1.294	6.16	72.55	78.71	2.44E+00
200.00	1.422	4.78	83.77	88.55	3.04E+00
300.00	1.593	3.52	102.60	106.12	4.07E+00
400.00	1.701	2.56	116.42	118.98	4.95E+00
500.00	1.773	2.44	121.55	123.99	5.77E+00
600.00	1.824	2.00	123.10	125.10	6.57E+00
700.00	1.861	1.65	123.45	125.10	7.37E+00
800.00	1.889	1.39	123.42	124.81	8.17E+00
900.00	1.910	1.51	121.51	123.01	8.98E+00
1000.00	1.926	1.36	118.85	120.22	9.80E+00
1200.00	1.949	1.13	114.39	115.52	1.15E+01
1500.00	1.970	0.96	107.63	108.59	1.42E+01
1700.00	1.978	0.86	103.22	104.08	1.61E+01
2000.00	1.986	0.73	97.40	98.13	1.90E+01
2500.00	1.993	0.60	88.30	88.89	2.44E+01
3000.00	1.996	0.00	81.04	81.04	3.03E+01
3500.00	1.998	0.00	74.46	74.46	3.67E+01
4000.00	1.999	0.00	68.91	68.91	4.37E+01
4500.00	1.999	0.00	64.18	64.18	5.12E+01
5000.00	1.999	0.00	60.12	60.12	5.93E+01
5500.00	2.000	0.00	56.58	56.58	6.79E+01
6000.00	2.000	0.00	53.48	53.48	7.69E+01
6500.00	2.000	0.00	50.74	50.74	8.66E+01
7000.00	2.000	0.00	48.29	48.29	9.67E+01
7500.00	2.000	0.00	46.09	46.09	1.07E+02

ABSORBER.....PHOSPHORUS

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	36.37	2.88	39.25	3.99E-03
0.15	41.27	3.53	44.80	5.17E-03
0.20	44.83	4.07	48.90	6.24E-03
0.30	50.92	4.99	55.91	8.14E-03
0.50	57.14	6.44	63.58	1.15E-02
0.70	61.41	7.62	69.03	1.45E-02
1.00	65.65	9.11	74.75	1.87E-02
1.50	69.87	11.15	81.03	2.51E-02
2.00	71.61	12.88	84.49	3.11E-02
3.00	74.46	15.77	90.23	4.25E-02
5.00	73.11	20.36	93.48	6.43E-02
7.00	70.81	24.09	94.90	8.55E-02
10.00	66.69	28.80	95.49	1.17E-01
15.00	60.56	35.27	95.83	1.69E-01
20.00	55.83	40.73	96.56	2.21E-01
30.00	47.50	49.88	97.38	3.24E-01
50.00	37.24	64.40	101.64	5.25E-01
70.00	31.44	76.19	107.63	7.17E-01
100.00	25.61	91.07	116.68	9.84E-01
150.00	19.37	111.54	130.91	1.39E+00
200.00	16.85	128.79	145.64	1.75E+00
300.00	11.63	157.74	169.37	2.39E+00
400.00	10.29	182.14	192.43	2.94E+00
500.00	8.43	203.64	212.07	3.43E+00
600.00	7.51	223.07	230.58	3.89E+00
700.00	6.59	240.95	247.54	4.30E+00
800.00	5.84	257.58	263.42	4.69E+00
900.00	5.24	273.21	278.45	5.06E+00
1000.00	5.11	287.98	293.09	5.41E+00
1200.00	4.31	315.47	319.78	6.07E+00
1500.00	3.38	352.71	356.09	6.95E+00

ABSORBER.....PHOSPHORUS

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	44.19	3.02	47.20	3.31E-03
0.15	50.38	3.70	54.07	4.29E-03
0.20	55.24	4.27	59.51	5.17E-03
0.30	62.32	5.23	67.54	6.75E-03
0.50	70.73	6.75	77.48	9.48E-03
0.70	76.95	7.98	84.94	1.19E-02
1.00	82.70	9.54	92.24	1.53E-02
1.50	88.46	11.69	100.15	2.05E-02
2.00	92.37	13.49	105.86	2.54E-02
3.00	95.70	16.53	112.23	3.45E-02
5.00	96.18	21.33	117.52	5.18E-02
7.00	95.08	25.24	120.32	6.86E-02
10.00	90.94	30.17	121.12	9.34E-02
15.00	83.83	36.95	120.78	1.35E-01
20.00	77.75	42.67	120.42	1.76E-01
30.00	68.25	52.26	120.51	2.59E-01
50.00	54.90	67.47	122.36	4.24E-01
70.00	45.66	79.83	125.48	5.86E-01
100.00	38.00	95.41	133.41	8.18E-01
150.00	29.80	116.86	146.66	1.17E+00
200.00	24.04	134.93	158.97	1.50E+00
300.00	18.82	165.26	184.08	2.08E+00
400.00	14.22	190.82	205.04	2.60E+00
500.00	13.42	213.35	226.77	3.06E+00
600.00	11.41	233.71	245.12	3.48E+00
700.00	9.92	252.44	262.36	3.88E+00
800.00	9.29	269.87	279.15	4.25E+00
900.00	8.38	286.24	294.62	4.60E+00
1000.00	7.61	301.72	309.33	4.93E+00
1200.00	6.89	330.52	337.41	5.55E+00

ABSORBER.....PHOSPHORUS

ION.....0-16 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	77.87	3.13	81.01	1.92E-03
0.15	89.79	3.84	93.62	2.49E-03
0.20	98.11	4.43	102.54	3.00E-03
0.30	110.69	5.43	116.11	3.91E-03
0.50	129.57	7.01	136.58	5.49E-03
0.70	138.71	8.29	147.00	6.91E-03
1.00	150.15	9.91	160.06	8.85E-03
1.50	162.25	12.13	174.38	1.18E-02
2.00	169.69	14.01	183.70	1.46E-02
3.00	177.06	17.16	194.22	1.99E-02
5.00	185.11	22.16	207.26	2.98E-02
7.00	181.39	26.21	207.60	3.95E-02
10.00	176.34	31.33	207.67	5.39E-02
15.00	165.25	38.37	203.63	7.82E-02
20.00	154.88	44.31	199.19	1.03E-01
30.00	138.49	54.27	192.76	1.54E-01
50.00	112.29	70.06	182.36	2.61E-01
70.00	96.14	82.90	179.04	3.72E-01
100.00	80.29	99.08	179.37	5.40E-01
150.00	63.64	121.35	184.99	8.15E-01
200.00	52.68	140.12	192.80	1.08E+00
300.00	41.91	171.61	213.53	1.57E+00
400.00	32.57	198.16	230.73	2.02E+00
500.00	26.13	221.55	247.68	2.44E+00
600.00	25.62	242.70	268.31	2.83E+00
700.00	22.37	262.14	284.51	3.19E+00
800.00	19.79	280.24	300.04	3.53E+00
900.00	18.68	297.24	315.92	3.86E+00
1000.00	17.13	313.32	330.45	4.17E+00

ABSORBER.....PHOSPHORUS

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	78.85	3.14	82.00	1.91E-03
0.15	91.01	3.85	94.87	2.47E-03
0.20	99.93	4.45	104.38	2.97E-03
0.30	113.73	5.45	119.17	3.86E-03
0.50	132.59	7.03	139.62	5.41E-03
0.70	142.88	8.32	151.20	6.78E-03
1.00	156.41	9.94	166.36	8.66E-03
1.50	169.91	12.18	182.09	1.15E-02
2.00	178.27	14.06	192.34	1.42E-02
3.00	189.60	17.22	206.82	1.92E-02
5.00	198.25	22.23	220.48	2.86E-02
7.00	197.04	26.31	223.34	3.75E-02
10.00	195.19	31.44	226.63	5.08E-02
15.00	185.82	38.51	224.33	7.30E-02
20.00	175.70	44.47	220.16	9.55E-02
30.00	158.53	54.46	212.99	1.42E-01
50.00	132.99	70.31	203.30	2.38E-01
70.00	115.53	83.19	198.72	3.38E-01
100.00	95.24	99.43	194.67	4.91E-01
150.00	77.13	121.78	198.91	7.45E-01
200.00	65.33	140.62	205.95	9.92E-01
300.00	48.65	172.22	220.87	1.46E+00
400.00	42.17	198.86	241.04	1.89E+00
500.00	34.37	222.33	256.70	2.29E+00
600.00	28.69	243.56	272.24	2.67E+00
700.00	28.73	263.07	291.80	3.03E+00
800.00	25.64	281.23	306.87	3.36E+00
900.00	23.04	298.29	321.33	3.68E+00



ABSORBER.....PHOSPHORUS

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	81.64	3.63	85.27	1.84E-03
0.15	95.01	4.45	99.46	2.38E-03
0.20	103.94	5.14	109.08	2.86E-03
0.30	120.19	6.29	126.48	3.71E-03
0.50	142.85	8.12	150.98	5.14E-03
0.70	159.06	9.61	168.67	6.39E-03
1.00	176.65	11.49	188.14	8.07E-03
1.50	199.84	14.07	213.91	1.06E-02
2.00	211.24	16.25	227.49	1.28E-02
3.00	231.47	19.90	251.37	1.70E-02
5.00	254.03	25.69	279.72	2.45E-02
7.00	267.50	30.40	297.90	3.14E-02
10.00	276.01	36.34	312.34	4.12E-02
15.00	284.94	44.50	329.44	5.68E-02
20.00	279.41	51.39	330.80	7.20E-02
30.00	271.14	62.93	334.07	1.02E-01
50.00	248.35	81.25	329.60	1.62E-01
70.00	228.23	96.13	324.37	2.23E-01
100.00	204.76	114.90	319.66	3.16E-01
150.00	172.17	140.73	312.89	4.75E-01
200.00	151.30	162.50	313.80	6.34E-01
300.00	123.01	199.02	322.02	9.50E-01
400.00	104.75	229.80	334.55	1.25E+00
500.00	91.51	256.93	348.44	1.55E+00
600.00	80.60	281.45	362.05	1.83E+00

ABSORBER.....SULFUR

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	37.79	1.83	39.62	3.50E-03
0.15	0.097	40.41	2.24	42.64	4.71E-03
0.20	0.112	42.12	2.58	44.70	5.85E-03
0.30	0.136	43.55	3.16	46.71	8.05E-03
0.50	0.175	43.48	4.08	47.56	1.23E-02
0.70	0.207	42.63	4.83	47.46	1.65E-02
1.00	0.246	40.65	5.78	46.43	2.28E-02
1.50	0.298	37.36	7.07	44.44	3.38E-02
2.00	0.340	34.53	8.17	42.70	4.53E-02
3.00	0.409	30.11	10.00	40.12	6.95E-02
5.00	0.508	24.04	12.92	36.95	1.22E-01
7.00	0.580	20.30	15.28	35.58	1.77E-01
10.00	0.660	16.68	18.26	34.94	2.63E-01
15.00	0.749	12.90	22.37	35.27	4.05E-01
20.00	0.808	10.37	25.83	36.20	5.46E-01
30.00	0.879	8.04	31.64	39.67	8.07E-01
50.00	0.944	5.76	40.85	46.61	1.27E+00
70.00	0.970	4.45	43.63	48.08	1.69E+00
100.00	0.987	3.25	42.83	46.08	2.33E+00
150.00	0.996	2.3	38.23	40.61	3.49E+00
200.00	0.998	1.73	34.87	36.60	4.79E+00
300.00	1.000	1.34	29.75	31.10	7.77E+00
400.00	1.000	0.93	26.67	27.60	1.12E+01
500.00	1.000	0.92	24.11	25.04	1.50E+01
600.00	1.000	0.76	22.29	23.05	1.92E+01
700.00	1.000	0.70	20.64	21.34	2.37E+01
800.00	1.000	0.62	19.26	19.87	2.86E+01
900.00	1.000	0.55	18.06	18.61	3.38E+01
1000.00	1.000	0.50	17.01	17.50	3.93E+01
1200.00	1.000	0.42	15.26	15.68	5.14E+01
1500.00	1.000	0.00	13.61	13.61	7.20E+01
1700.00	1.000	0.00	12.54	12.54	8.73E+01
2000.00	1.000	0.00	11.24	11.24	1.13E+02
2500.00	1.000	0.00	9.64	9.64	1.61E+02
3000.00	1.000	0.00	8.47	8.47	2.16E+02
3500.00	1.000	0.00	7.58	7.58	2.79E+02
4000.00	1.000	0.00	6.87	6.87	3.48E+02
4500.00	1.000	0.00	6.29	6.29	4.24E+02
5000.00	1.000	0.00	5.82	5.82	5.07E+02
5500.00	1.000	0.00	5.41	5.41	5.96E+02
6000.00	1.000	0.00	5.07	5.07	6.92E+02
6500.00	1.000	0.00	4.76	4.76	7.94E+02

ABSORBER.....SULFUR

ION.....DEUTERONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.056	47.10	1.29	48.39	2.86E-03
0.15	0.069	50.40	1.58	51.98	3.85E-03
0.20	0.079	52.58	1.83	54.41	4.79E-03
0.30	0.097	54.42	2.24	56.66	6.59E-03
0.50	0.125	54.51	2.89	57.40	1.01E-02
0.70	0.147	53.76	3.42	57.18	1.36E-02
1.00	0.175	51.21	4.09	55.29	1.89E-02
1.50	0.214	47.17	5.00	52.17	2.82E-02
2.00	0.246	43.67	5.78	49.45	3.81E-02
3.00	0.298	38.20	7.08	45.28	5.92E-02
5.00	0.377	30.61	9.14	39.75	1.07E-01
7.00	0.437	25.44	10.81	36.25	1.60E-01
10.00	0.508	21.27	12.92	34.19	2.45E-01
15.00	0.596	16.52	15.82	32.35	3.96E-01
20.00	0.660	13.30	18.27	31.57	5.53E-01
30.00	0.749	10.36	22.38	32.74	8.61E-01
50.00	0.849	7.40	28.89	36.30	1.45E+00
70.00	0.902	5.48	34.18	39.66	1.97E+00
100.00	0.944	4.19	42.43	46.62	2.67E+00
150.00	0.974	3.08	45.05	48.13	3.72E+00
200.00	0.987	2.24	43.83	46.07	4.77E+00
300.00	0.996	1.75	38.85	40.60	7.09E+00
400.00	0.998	1.21	35.38	36.59	9.70E+00
500.00	0.999	1.19	32.21	33.40	1.26E+01
600.00	1.000	0.99	30.10	31.09	1.57E+01
700.00	1.000	0.84	28.44	29.29	1.90E+01
800.00	1.000	0.80	26.80	27.59	2.25E+01
900.00	1.000	0.71	25.41	26.12	2.62E+01
1000.00	1.000	0.64	24.39	25.03	3.02E+01
1200.00	1.000	0.54	22.50	23.04	3.85E+01
1500.00	1.000	0.00	20.57	20.57	5.23E+01
1700.00	1.000	0.00	19.21	19.21	6.24E+01
2000.00	1.000	0.00	17.50	17.50	7.87E+01
2500.00	1.000	0.00	15.28	15.28	1.09E+02

ABSORBER.....SULFUR

ION.....ALPHA-PARTICLES

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	44.01	1.83	45.84	3.18E-03
0.15	0.049	48.75	2.25	50.99	4.21E-03
0.20	0.056	51.66	2.59	54.26	5.16E-03
0.30	0.069	55.40	3.18	58.58	6.93E-03
0.50	0.089	58.91	4.10	63.01	1.02E-02
0.70	0.105	61.07	4.85	65.92	1.33E-02
1.00	0.126	60.86	5.80	66.66	1.78E-02
1.50	0.154	60.13	7.10	67.23	2.52E-02
2.00	0.177	58.08	8.20	66.28	3.27E-02
3.00	0.217	53.81	10.04	63.86	4.81E-02
5.00	0.279	47.16	12.96	60.12	8.05E-02
7.00	0.330	41.62	15.34	56.96	1.15E-01
10.00	0.393	35.87	18.33	54.20	1.69E-01
15.00	0.478	28.80	22.45	51.26	2.64E-01
20.00	0.548	24.95	25.93	50.87	3.62E-01
30.00	0.663	19.68	31.75	51.44	5.58E-01
50.00	0.835	14.59	41.00	55.59	9.36E-01
70.00	0.965	10.94	48.51	59.44	1.28E+00
100.00	1.115	8.95	57.98	66.93	1.76E+00
150.00	1.294	6.2	71.01	77.26	2.46E+00
200.00	1.422	5.11	81.99	87.10	3.06E+00
300.00	1.593	3.78	100.42	104.20	4.11E+00
400.00	1.701	2.78	116.19	118.97	5.01E+00
500.00	1.773	2.61	121.39	124.01	5.82E+00
600.00	1.824	2.18	122.82	125.00	6.62E+00
700.00	1.861	1.81	122.69	124.51	7.42E+00
800.00	1.889	1.53	120.49	122.01	8.24E+00
900.00	1.910	1.32	118.70	120.01	9.06E+00
1000.00	1.926	1.46	116.55	118.01	9.90E+00
1200.00	1.949	1.22	112.80	114.01	1.16E+01
1500.00	1.970	0.96	106.68	107.65	1.43E+01
1700.00	1.978	0.92	102.35	103.27	1.62E+01
2000.00	1.986	0.79	97.64	98.43	1.92E+01
2500.00	1.993	0.63	88.77	89.40	2.45E+01
3000.00	1.996	0.56	81.11	81.67	3.04E+01
3500.00	1.998	0.00	75.14	75.14	3.68E+01
4000.00	1.999	0.00	69.62	69.62	4.37E+01
4500.00	1.999	0.00	64.91	64.91	5.11E+01
5000.00	1.999	0.00	60.84	60.84	5.91E+01
5500.00	2.000	0.00	57.30	57.30	6.76E+01
6000.00	2.000	0.00	54.19	54.19	7.66E+01
6500.00	2.000	0.00	51.43	51.43	8.60E+01
7000.00	2.000	0.00	48.97	48.97	9.60E+01
7500.00	2.000	0.00	46.76	46.76	1.06E+02

ABSORBER.....SULFUR

ION.....C-12 PECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	35.36	2.84	38.20	4.10E-03
0.15	40.15	3.48	43.63	5.32E-03
0.20	43.62	4.02	47.64	6.41E-03
0.30	49.61	4.93	54.54	8.36E-03
0.50	55.86	6.36	62.22	1.18E-02
0.70	60.19	7.53	67.71	1.48E-02
1.00	64.52	9.00	73.52	1.91E-02
1.50	68.80	11.02	79.82	2.56E-02
2.00	70.67	12.72	83.39	3.17E-02
3.00	73.71	15.58	89.30	4.33E-02
5.00	72.92	20.12	93.03	6.51E-02
7.00	71.01	23.80	94.81	8.64E-02
10.00	67.25	28.45	95.70	1.18E-01
15.00	61.40	34.84	96.24	1.70E-01
20.00	56.84	40.23	97.07	2.22E-01
30.00	48.76	49.27	98.03	3.24E-01
50.00	38.52	63.61	102.14	5.24E-01
70.00	32.53	75.27	107.80	7.15E-01
100.00	26.60	89.96	116.56	9.83E-01
150.00	20.33	110.18	130.51	1.39E+00
200.00	17.66	127.23	144.89	1.75E+00
300.00	12.41	155.82	168.23	2.39E+00
400.00	10.84	179.92	190.77	2.95E+00
500.00	8.94	201.16	210.11	3.45E+00
600.00	7.58	220.36	227.94	3.90E+00
700.00	6.97	238.02	244.99	4.33E+00
800.00	6.20	254.45	260.65	4.72E+00
900.00	5.56	269.89	275.44	5.10E+00
1000.00	5.05	284.49	289.54	5.45E+00
1200.00	4.59	311.64	316.23	6.11E+00
1500.00	3.64	348.42	352.06	7.01E+00

ABSORBER.....SULFUR

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	42.99	2.99	45.98	3.40E-03
0.15	49.16	3.66	52.81	4.41E-03
0.20	53.89	4.22	58.11	5.31E-03
0.30	60.79	5.17	65.96	6.92E-03
0.50	69.28	6.67	75.95	9.70E-03
0.70	75.50	7.90	83.40	1.22E-02
1.00	81.34	9.44	90.78	1.57E-02
1.50	87.25	11.56	98.81	2.09E-02
2.00	91.22	13.35	104.57	2.58E-02
3.00	94.74	16.35	111.09	3.51E-02
5.00	95.91	21.11	117.02	5.24E-02
7.00	95.21	24.98	120.18	6.93E-02
10.00	91.59	29.85	121.45	9.41E-02
15.00	84.90	36.56	121.46	1.35E-01
20.00	79.03	42.22	121.25	1.76E-01
30.00	69.86	51.70	121.57	2.59E-01
50.00	56.66	66.75	123.41	4.23E-01
70.00	47.28	78.98	126.26	5.83E-01
100.00	39.42	94.40	133.81	8.14E-01
150.00	31.11	115.61	146.73	1.17E+00
200.00	25.27	133.50	158.77	1.50E+00
300.00	19.94	163.50	183.45	2.08E+00
400.00	15.17	188.79	203.96	2.60E+00
500.00	14.16	211.08	225.24	3.07E+00
600.00	12.11	231.22	243.33	3.49E+00
700.00	10.52	249.75	260.27	3.89E+00
800.00	9.79	267.00	276.79	4.26E+00
900.00	8.88	283.19	292.07	4.61E+00
1000.00	8.08	298.51	306.59	4.95E+00
1200.00	6.83	327.00	333.84	5.57E+00

ABSORBER.....SULFUR

ION.....0-16 RECOILS

ENERGY E	SN(F)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	76.14	3.10	79.24	1.96E-03
0.15	87.97	3.80	91.77	2.55E-03
0.20	96.20	4.39	100.59	3.07E-03
0.30	108.54	5.38	113.92	4.00E-03
0.50	127.38	6.94	134.32	5.60E-03
0.70	136.58	8.21	144.79	7.04E-03
1.00	148.23	9.82	158.04	9.01E-03
1.50	160.63	12.02	172.66	1.20E-02
2.00	168.21	13.88	182.09	1.48E-02
3.00	175.98	17.00	192.99	2.01E-02
5.00	184.90	21.95	206.85	3.01E-02
7.00	181.96	25.97	207.93	3.97E-02
10.00	177.86	31.04	208.91	5.41E-02
15.00	167.68	38.02	205.69	7.82E-02
20.00	157.73	43.90	201.63	1.03E-01
30.00	141.81	53.76	195.57	1.53E-01
50.00	116.07	69.41	185.48	2.58E-01
70.00	99.89	82.13	182.01	3.67E-01
100.00	83.44	98.16	181.60	5.33E-01
150.00	66.44	120.22	186.66	8.06E-01
200.00	55.38	138.82	194.20	1.07E+00
300.00	44.14	170.02	214.16	1.56E+00
400.00	34.77	196.32	231.09	2.01E+00
500.00	27.95	219.49	247.44	2.43E+00
600.00	27.11	240.44	267.55	2.82E+00
700.00	23.80	259.71	283.51	3.18E+00
800.00	21.08	277.64	298.72	3.53E+00
900.00	18.95	294.48	313.43	3.85E+00
1000.00	18.14	310.41	328.55	4.16E+00

ABSORBER.....SULFUR

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	77.16	3.12	80.28	1.94E-03
0.15	89.12	3.82	92.94	2.52E-03
0.20	98.36	4.41	102.77	3.03E-03
0.30	111.63	5.40	117.03	3.94E-03
0.50	130.22	6.97	137.19	5.51E-03
0.70	140.79	8.25	149.04	6.89E-03
1.00	154.32	9.86	164.19	8.80E-03
1.50	168.13	12.08	180.21	1.17E-02
2.00	177.03	13.95	190.98	1.44E-02
3.00	188.33	17.08	205.42	1.94E-02
5.00	197.55	22.05	219.61	2.88E-02
7.00	197.44	26.09	223.54	3.78E-02
10.00	196.34	31.19	227.53	5.10E-02
15.00	188.10	38.20	226.30	7.30E-02
20.00	178.54	44.11	222.65	9.53E-02
30.00	161.89	54.02	215.91	1.41E-01
50.00	137.01	69.74	206.75	2.36E-01
70.00	119.55	82.52	202.07	3.34E-01
100.00	99.00	98.63	197.63	4.84E-01
150.00	80.29	120.79	201.08	7.36E-01
200.00	67.99	139.48	207.47	9.80E-01
300.00	51.29	170.83	222.11	1.45E+00
400.00	44.59	197.25	241.84	1.88E+00
500.00	36.69	220.54	257.22	2.28E+00
600.00	30.66	241.58	272.24	2.66E+00
700.00	30.33	260.94	291.27	3.01E+00
800.00	27.20	278.96	306.16	3.35E+00
900.00	24.51	295.88	320.39	3.67E+00



ABSORBER.....SULFUR

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)	(GRAM/CCM)		MICRON*GRAM/CCM
0.10	80.29	3.63	83.92	1.87E-03
0.15	93.50	4.44	97.94	2.42E-03
0.20	102.26	5.13	107.39	2.91E-03
0.30	118.29	6.28	124.57	3.77E-03
0.50	141.35	8.11	149.46	5.22E-03
0.70	156.93	9.59	166.52	6.49E-03
1.00	174.28	11.47	185.75	8.19E-03
1.50	197.66	14.04	211.71	1.07E-02
2.00	209.18	16.22	225.39	1.30E-02
3.00	229.77	19.86	249.63	1.72E-02
5.00	253.35	25.64	278.99	2.47E-02
7.00	266.71	30.34	297.05	3.16E-02
10.00	275.71	36.26	311.97	4.15E-02
15.00	285.85	44.41	330.27	5.70E-02
20.00	281.22	51.28	332.50	7.21E-02
30.00	274.34	62.81	337.15	1.02E-01
50.00	252.93	81.09	334.02	1.61E-01
70.00	233.30	95.94	329.25	2.22E-01
100.00	210.35	114.67	325.02	3.13E-01
150.00	178.01	140.44	318.45	4.69E-01
200.00	157.05	162.17	319.22	6.26E-01
300.00	127.80	198.62	326.42	9.37E-01
400.00	109.06	229.35	338.40	1.24E+00
500.00	95.21	256.42	351.63	1.53E+00
600.00	84.61	280.89	365.49	1.81E+00

ABSORBER.....POTASSIUM

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	29.17	1.53	30.70	4.59E-03
0.15	0.097	31.46	1.88	33.33	6.15E-03
0.20	0.112	32.88	2.17	35.05	7.61E-03
0.30	0.136	34.26	2.65	36.91	1.04E-02
0.50	0.175	35.69	3.42	39.11	1.56E-02
0.70	0.207	34.89	4.05	38.95	2.08E-02
1.00	0.246	33.81	4.84	38.66	2.85E-02
1.50	0.298	31.58	5.93	37.51	4.16E-02
2.00	0.340	29.53	6.85	36.38	5.52E-02
3.00	0.409	26.32	8.39	34.70	8.33E-02
5.00	0.508	21.23	10.83	32.06	1.43E-01
7.00	0.580	18.12	12.81	30.93	2.07E-01
10.00	0.660	15.12	15.32	30.44	3.05E-01
15.00	0.749	11.96	18.76	30.72	4.69E-01
20.00	0.808	9.85	21.66	31.51	6.30E-01
30.00	0.879	7.83	26.53	34.35	9.34E-01
50.00	0.944	4.85	34.26	39.12	1.48E+00
70.00	0.970	4.16	37.71	41.87	1.97E+00
100.00	0.987	3.19	37.87	41.06	2.69E+00
150.00	0.996	2.37	34.73	37.09	3.97E+00
200.00	0.998	1.77	31.62	33.40	5.39E+00
300.00	1.000	1.38	27.02	28.39	8.65E+00
400.00	1.000	0.99	24.20	25.19	1.24E+01
500.00	1.000	0.74	21.78	22.53	1.66E+01
600.00	1.000	0.77	20.08	20.85	2.12E+01
700.00	1.000	0.66	18.76	19.41	2.62E+01
800.00	1.000	0.57	17.59	18.16	3.15E+01
900.00	1.000	0.54	16.51	17.06	3.72E+01
1000.00	1.000	0.49	15.59	16.09	4.32E+01
1200.00	1.000	0.41	14.06	14.47	5.64E+01
1500.00	1.000	0.34	12.28	12.62	7.86E+01
1700.00	1.000	0.32	11.33	11.65	9.51E+01
2000.00	1.000	0.00	10.47	10.47	1.22E+02
2500.00	1.000	0.00	9.00	9.00	1.74E+02
3000.00	1.000	0.00	7.93	7.93	2.33E+02
3500.00	1.000	0.00	7.10	7.10	3.00E+02
4000.00	1.000	0.00	6.45	6.45	3.74E+02
4500.00	1.000	0.00	5.92	5.92	4.55E+02
5000.00	1.000	0.00	5.47	5.47	5.43E+02
5500.00	1.000	0.00	5.10	5.10	6.38E+02
6000.00	1.000	0.00	4.77	4.77	7.39E+02
6500.00	1.000	0.00	4.49	4.49	8.47E+02

ABSORBER.....POTASSIUM

ION.....DEUTERONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.056	36.53	1.08	37.61	3.74E-03
0.15	0.069	39.44	1.33	40.77	5.01E-03
0.20	0.079	41.24	1.53	42.78	6.20E-03
0.30	0.097	43.01	1.88	44.89	8.48E-03
0.50	0.125	44.91	2.42	47.33	1.28E-02
0.70	0.147	43.97	2.87	46.84	1.71E-02
1.00	0.175	42.69	3.43	46.12	2.35E-02
1.50	0.214	39.96	4.20	44.15	3.46E-02
2.00	0.246	37.42	4.85	42.27	4.62E-02
3.00	0.298	33.42	5.93	39.35	7.07E-02
5.00	0.377	27.04	7.66	34.71	1.25E-01
7.00	0.437	23.13	9.06	32.19	1.85E-01
10.00	0.508	19.31	10.83	30.15	2.82E-01
15.00	0.596	15.29	13.27	28.56	4.53E-01
20.00	0.660	12.64	15.32	27.96	6.30E-01
30.00	0.749	10.05	18.77	28.82	9.85E-01
50.00	0.849	6.25	24.23	30.48	1.66E+00
70.00	0.902	5.35	28.66	34.02	2.28E+00
100.00	0.944	4.10	35.02	39.12	3.09E+00
150.00	0.974	3.04	39.03	42.08	4.31E+00
200.00	0.987	2.29	38.76	41.06	5.51E+00
300.00	0.996	1.78	35.31	37.08	8.07E+00
400.00	0.998	1.28	32.10	33.39	1.09E+01
500.00	0.999	0.96	29.72	30.69	1.40E+01
600.00	1.000	0.99	27.39	28.38	1.74E+01
700.00	1.000	0.85	25.93	26.78	2.11E+01
800.00	1.000	0.74	24.44	25.18	2.49E+01
900.00	1.000	0.70	23.29	23.98	2.90E+01
1000.00	1.000	0.64	21.88	22.51	3.33E+01
1200.00	1.000	0.53	20.31	20.84	4.25E+01
1500.00	1.000	0.43	18.32	18.76	5.77E+01
1700.00	1.000	0.40	17.18	17.58	6.87E+01
2000.00	1.000	0.00	16.08	16.08	8.66E+01
2500.00	1.000	0.00	14.11	14.11	1.20E+02

ABSORBER.....POTASSIUM

ION.....ALPHA-PARTICLES

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	34.62	1.55	36.17	4.15E-03
0.15	0.049	37.78	1.90	39.68	5.47E-03
0.20	0.056	40.28	2.20	42.48	6.68E-03
0.30	0.069	43.66	2.69	46.35	8.93E-03
0.50	0.089	47.28	3.47	50.76	1.30E-02
0.70	0.105	48.69	4.11	52.80	1.69E-02
1.00	0.126	50.26	4.91	55.17	2.24E-02
1.50	0.154	49.39	6.02	55.41	3.15E-02
2.00	0.177	48.35	6.95	55.30	4.05E-02
3.00	0.217	45.58	8.51	54.09	5.88E-02
5.00	0.279	40.46	10.99	51.44	9.67E-02
7.00	0.330	36.59	13.00	49.59	1.36E-01
10.00	0.393	31.56	15.54	47.10	1.98E-01
15.00	0.478	26.16	19.03	45.19	3.07E-01
20.00	0.548	22.69	21.97	44.66	4.19E-01
30.00	0.663	18.07	26.91	44.98	6.43E-01
50.00	0.835	12.75	34.74	47.49	1.08E+00
70.00	0.965	10.65	41.11	51.75	1.48E+00
100.00	1.115	7.60	49.13	56.74	2.03E+00
150.00	1.294	6.08	60.18	66.26	2.84E+00
200.00	1.422	4.93	69.48	74.42	3.56E+00
300.00	1.593	3.44	85.10	88.54	4.78E+00
400.00	1.701	2.81	97.17	99.98	5.84E+00
500.00	1.773	2.20	102.79	104.99	6.81E+00
600.00	1.824	2.16	103.84	106.00	7.76E+00
700.00	1.861	1.86	104.65	106.50	8.70E+00
800.00	1.889	1.60	104.01	105.60	9.64E+00
900.00	1.910	1.38	103.72	105.10	1.06E+01
1000.00	1.926	1.20	103.70	104.91	1.15E+01
1200.00	1.949	1.21	100.31	101.51	1.35E+01
1500.00	1.970	0.96	95.49	96.45	1.65E+01
1700.00	1.978	0.84	92.60	93.44	1.86E+01
2000.00	1.986	0.77	87.55	88.32	2.19E+01
2500.00	1.993	0.62	80.40	81.02	2.78E+01
3000.00	1.996	0.52	73.96	74.48	3.43E+01
3500.00	1.998	0.46	68.38	68.84	4.13E+01
4000.00	1.999	0.00	64.00	64.00	4.88E+01
4500.00	1.999	0.00	59.83	59.83	5.69E+01
5000.00	1.999	0.00	56.21	56.21	6.55E+01
5500.00	2.000	0.00	53.04	53.04	7.47E+01
6000.00	2.000	0.00	50.24	50.24	8.44E+01
6500.00	2.000	0.00	47.75	47.75	9.46E+01
7000.00	2.000	0.00	45.52	45.52	1.05E+02
7500.00	2.000	0.00	43.51	43.51	1.17E+02

ABSORBER.....POTASSIUM

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	27.32	2.47	29.79	5.26E-03
0.15	31.16	3.02	34.18	6.82E-03
0.20	34.17	3.49	37.66	8.21E-03
0.30	38.54	4.28	42.82	1.07E-02
0.50	43.77	5.52	49.29	1.50E-02
0.70	47.64	6.53	54.17	1.89E-02
1.00	51.22	7.81	59.03	2.41E-02
1.50	54.81	9.56	64.38	3.22E-02
2.00	57.25	11.04	68.29	3.98E-02
3.00	59.34	13.52	72.86	5.39E-02
5.00	59.71	17.46	77.16	8.04E-02
7.00	59.07	20.66	79.72	1.06E-01
10.00	56.55	24.69	81.24	1.43E-01
15.00	52.18	30.24	82.42	2.04E-01
20.00	48.42	34.92	83.34	2.64E-01
30.00	42.56	42.76	85.32	3.83E-01
50.00	34.28	55.21	89.49	6.12E-01
70.00	28.52	65.32	93.84	8.31E-01
100.00	23.74	78.08	101.82	1.14E+00
150.00	18.64	95.62	114.27	1.60E+00
200.00	15.06	110.41	125.47	2.02E+00
300.00	11.81	135.23	147.04	2.75E+00
400.00	8.93	156.15	165.08	3.39E+00
500.00	8.41	174.58	182.99	3.96E+00
600.00	7.16	191.24	198.40	4.49E+00
700.00	6.22	206.57	212.79	4.98E+00
800.00	5.82	220.83	226.65	5.43E+00
900.00	5.26	234.23	239.48	5.86E+00
1000.00	4.78	246.89	251.67	6.27E+00
1200.00	4.32	270.46	274.78	7.03E+00
1500.00	3.52	302.38	305.91	8.06E+00

ABSORBER.....POTASSIUM

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	33.61	2.60	36.21	4.32E-03
0.15	38.79	3.19	41.97	5.59E-03
0.20	42.39	3.68	46.07	6.73E-03
0.30	47.83	4.50	52.33	8.75E-03
0.50	56.05	5.82	61.87	1.22E-02
0.70	60.04	6.88	66.92	1.54E-02
1.00	65.06	8.22	73.28	1.96E-02
1.50	70.38	10.07	80.46	2.61E-02
2.00	73.64	11.63	85.28	3.21E-02
3.00	76.93	14.25	91.17	4.34E-02
5.00	80.60	18.39	98.99	6.43E-02
7.00	79.11	21.76	100.87	8.44E-02
10.00	77.07	26.01	103.08	1.14E-01
15.00	72.40	31.86	104.26	1.62E-01
20.00	67.96	36.78	104.74	2.10E-01
30.00	60.90	45.05	105.95	3.05E-01
50.00	49.57	58.16	107.73	4.92E-01
70.00	42.53	68.81	111.34	6.74E-01
100.00	35.52	82.25	117.77	9.37E-01
150.00	28.21	100.73	128.94	1.34E+00
200.00	23.42	116.32	139.73	1.71E+00
300.00	18.65	142.46	161.11	2.38E+00
400.00	14.57	164.50	179.07	2.97E+00
500.00	11.69	183.92	195.60	3.50E+00
600.00	11.42	201.47	212.89	3.99E+00
700.00	9.99	217.61	227.60	4.45E+00
800.00	8.84	232.64	241.48	4.87E+00
900.00	7.97	246.75	254.72	5.28E+00
1000.00	7.64	260.10	267.73	5.66E+00
1200.00	6.50	284.92	291.42	6.38E+00

ABSORBER.....POTASSIUM

ION.....0-16 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	61.21	2.71	63.93	2.45E-03
0.15	70.67	3.32	73.99	3.17E-03
0.20	77.65	3.84	81.49	3.81E-03
0.30	88.36	4.70	93.06	4.96E-03
0.50	103.03	6.07	109.10	6.93E-03
0.70	111.12	7.18	118.30	8.68E-03
1.00	121.70	8.58	130.28	1.11E-02
1.50	132.30	10.51	142.82	1.47E-02
2.00	138.89	12.14	151.03	1.81E-02
3.00	147.78	14.87	162.65	2.45E-02
5.00	154.65	19.19	173.85	3.64E-02
7.00	153.93	22.71	176.64	4.77E-02
10.00	152.65	27.14	179.80	6.45E-02
15.00	145.57	33.24	178.81	9.24E-02
20.00	137.77	38.38	176.16	1.21E-01
30.00	124.48	47.01	171.49	1.78E-01
50.00	104.67	60.69	165.36	2.97E-01
70.00	91.04	71.81	162.85	4.19E-01
100.00	75.13	85.83	160.96	6.05E-01
150.00	60.86	105.12	165.98	9.11E-01
200.00	51.60	121.38	172.99	1.21E+00
300.00	38.52	148.66	187.18	1.76E+00
400.00	33.43	171.66	205.09	2.27E+00
500.00	27.31	191.92	219.23	2.74E+00
600.00	22.79	210.24	233.03	3.18E+00
700.00	22.76	227.09	249.85	3.60E+00
800.00	20.34	242.76	263.10	3.99E+00
900.00	18.29	257.49	275.78	4.36E+00
1000.00	16.61	271.42	288.02	4.71E+00

ABSORBER.....POTASSIUM

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	62.13	2.74	64.87	2.39E-03
0.15	71.84	3.35	75.19	3.11E-03
0.20	79.61	3.87	83.48	3.74E-03
0.30	90.48	4.74	95.22	4.85E-03
0.50	105.60	6.12	111.71	6.78E-03
0.70	117.18	7.24	124.42	8.47E-03
1.00	126.28	8.65	134.93	1.08E-02
1.50	138.38	10.60	148.98	1.43E-02
2.00	146.39	12.23	158.62	1.75E-02
3.00	156.32	14.98	171.31	2.36E-02
5.00	165.03	19.35	184.37	3.48E-02
7.00	169.90	22.89	192.79	4.54E-02
10.00	167.08	27.36	194.44	6.09E-02
15.00	162.15	33.51	195.65	8.64E-02
20.00	155.26	38.69	193.95	1.12E-01
30.00	142.28	47.39	189.66	1.64E-01
50.00	122.48	61.17	183.66	2.71E-01
70.00	106.38	72.38	178.76	3.82E-01
100.00	90.52	86.51	177.03	5.51E-01
150.00	73.59	105.96	179.55	8.32E-01
200.00	62.67	122.35	185.02	1.11E+00
300.00	48.23	149.85	198.08	1.63E+00
400.00	41.83	173.03	214.86	2.12E+00
500.00	35.20	193.45	228.65	2.57E+00
600.00	29.77	211.91	241.68	2.99E+00
700.00	25.55	228.89	254.44	3.40E+00
800.00	25.77	244.70	270.47	3.78E+00
900.00	23.44	259.54	282.98	4.14E+00



ABSORBER.....POTASSIUM

ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	66.51	3.23	69.74	2.22E-03
0.15	77.42	3.96	81.38	2.88E-03
0.20	84.73	4.57	89.30	3.46E-03
0.30	98.35	5.60	103.95	4.49E-03
0.50	117.65	7.23	124.88	6.24E-03
0.70	130.64	8.55	139.19	7.75E-03
1.00	145.12	10.22	155.34	9.78E-03
1.50	165.02	12.52	177.54	1.28E-02
2.00	175.28	14.46	189.73	1.55E-02
3.00	194.14	17.71	211.85	2.05E-02
5.00	214.36	22.86	237.22	2.93E-02
7.00	226.12	27.05	253.17	3.75E-02
10.00	234.65	32.33	266.97	4.89E-02
15.00	244.67	39.59	284.26	6.70E-02
20.00	242.45	45.72	288.17	8.44E-02
30.00	239.57	55.99	295.56	1.19E-01
50.00	222.64	72.29	294.92	1.86E-01
70.00	206.77	85.53	292.30	2.54E-01
100.00	187.94	102.23	290.17	3.58E-01
150.00	161.03	125.20	286.23	5.31E-01
200.00	142.99	144.57	287.57	7.06E-01
300.00	114.82	177.07	291.89	1.05E+00
400.00	99.45	204.46	303.91	1.39E+00
500.00	87.70	228.59	316.30	1.71E+00
600.00	78.48	250.41	328.89	2.02E+00

ABSORBER.....CALCIUM

ION.....PROTONS

ENERGY E	ZEFF	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.079	28.60	1.50	30.10	4.70E-03
0.15	0.097	30.94	1.84	32.78	6.29E-03
0.20	0.112	32.37	2.13	34.50	7.77E-03
0.30	0.136	33.81	2.60	36.42	1.06E-02
0.50	0.175	35.43	3.36	38.79	1.59E-02
0.70	0.207	34.77	3.98	38.75	2.10E-02
1.00	0.246	33.87	4.75	38.63	2.88E-02
1.50	0.298	31.82	5.82	37.64	4.19E-02
2.00	0.340	29.86	6.72	36.59	5.54E-02
3.00	0.409	26.76	8.23	35.00	8.34E-02
5.00	0.508	21.78	10.63	32.41	1.43E-01
7.00	0.580	18.68	12.58	31.26	2.06E-01
10.00	0.660	15.61	15.03	30.64	3.03E-01
15.00	0.749	12.39	18.41	30.81	4.66E-01
20.00	0.808	10.29	21.26	31.55	6.27E-01
30.00	0.879	8.19	26.04	34.23	9.33E-01
50.00	0.944	5.13	33.62	38.75	1.48E+00
70.00	0.970	4.39	39.52	43.91	1.96E+00
100.00	0.987	3.35	42.65	46.00	2.62E+00
150.00	0.996	2.49	40.60	43.08	3.74E+00
200.00	0.998	1.89	37.43	39.32	4.95E+00
300.00	1.000	1.46	30.60	32.06	7.77E+00
400.00	1.000	1.07	25.59	26.66	1.12E+01
500.00	1.000	0.80	22.53	23.34	1.52E+01
600.00	1.000	0.82	20.51	21.33	1.97E+01
700.00	1.000	0.70	18.84	19.54	2.46E+01
800.00	1.000	0.61	17.68	18.28	2.99E+01
900.00	1.000	0.54	16.65	17.19	3.56E+01
1000.00	1.000	0.52	15.71	16.23	4.16E+01
1200.00	1.000	0.44	14.18	14.62	5.46E+01
1500.00	1.000	0.35	12.41	12.77	7.66E+01
1700.00	1.000	0.32	11.47	11.79	9.29E+01
2000.00	1.000	0.00	10.61	10.61	1.20E+02
2500.00	1.000	0.00	9.13	9.13	1.71E+02
3000.00	1.000	0.00	8.04	8.04	2.29E+02
3500.00	1.000	0.00	7.21	7.21	2.95E+02
4000.00	1.000	0.00	6.55	6.55	3.68E+02
4500.00	1.000	0.00	6.01	6.01	4.48E+02
5000.00	1.000	0.00	5.56	5.56	5.34E+02
5500.00	1.000	0.00	5.18	5.18	6.27E+02
6000.00	1.000	0.00	4.85	4.85	7.27E+02
6500.00	1.000	0.00	4.57	4.57	8.33E+02

ABSORBER.....CALCIUM

ION.....DEUTERONS

ENERGY E	Z <sub>EFF</sub>	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.056	35.85	1.06	36.91	3.82E-03
0.15	0.069	38.82	1.30	40.12	5.12E-03
0.20	0.079	40.64	1.50	42.14	6.33E-03
0.30	0.097	42.49	1.84	44.33	8.63E-03
0.50	0.125	44.59	2.38	46.97	1.30E-02
0.70	0.147	43.84	2.81	46.65	1.73E-02
1.00	0.175	42.79	3.36	46.15	2.37E-02
1.50	0.214	40.28	4.12	44.40	3.47E-02
2.00	0.246	37.86	4.76	42.61	4.62E-02
3.00	0.298	33.99	5.83	39.82	7.06E-02
5.00	0.377	27.76	7.52	35.28	1.24E-01
7.00	0.437	23.86	8.90	32.75	1.83E-01
10.00	0.508	19.93	10.64	30.56	2.79E-01
15.00	0.596	15.85	13.03	28.88	4.48E-01
20.00	0.660	13.19	15.04	28.23	6.23E-01
30.00	0.749	10.51	18.42	28.93	9.78E-01
50.00	0.849	6.63	23.78	30.41	1.65E+00
70.00	0.902	5.65	28.14	33.79	2.28E+00
100.00	0.944	4.31	33.63	37.95	3.11E+00
150.00	0.974	3.20	41.44	44.64	4.32E+00
200.00	0.987	2.45	43.55	46.00	5.41E+00
300.00	0.996	1.88	41.19	43.08	7.64E+00
400.00	0.998	1.39	37.93	39.31	1.01E+01
500.00	0.999	1.04	34.52	35.57	1.27E+01
600.00	1.000	1.05	30.99	32.04	1.57E+01
700.00	1.000	0.90	28.19	29.09	1.90E+01
800.00	1.000	0.78	25.86	26.64	2.26E+01
900.00	1.000	0.69	24.03	24.72	2.65E+01
1000.00	1.000	0.67	22.65	23.32	3.06E+01
1200.00	1.000	0.57	20.75	21.32	3.96E+01
1500.00	1.000	0.46	18.42	18.88	5.47E+01
1700.00	1.000	0.41	17.30	17.71	6.56E+01
2000.00	1.000	0.00	16.22	16.22	8.33E+01
2500.00	1.000	0.00	14.26	14.26	1.16E+02

ABSORBER.....CALCIUM

ION.....ALPHA-PARTICLES

ENERGY E	Z <sub>EFF</sub>	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV		(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	0.040	33.85	1.53	35.38	4.25E-03
0.15	0.049	37.03	1.87	38.90	5.60E-03
0.20	0.056	39.74	2.16	41.90	6.83E-03
0.30	0.069	42.99	2.65	45.64	9.11E-03
0.50	0.089	46.68	3.42	50.10	1.33E-02
0.70	0.105	48.16	4.05	52.20	1.72E-02
1.00	0.126	49.87	4.84	54.70	2.28E-02
1.50	0.154	49.26	5.92	55.19	3.19E-02
2.00	0.177	48.62	6.84	55.46	4.09E-02
3.00	0.217	45.92	8.38	54.30	5.91E-02
5.00	0.279	41.01	10.82	51.82	9.68E-02
7.00	0.330	37.26	12.80	50.06	1.36E-01
10.00	0.393	32.35	15.30	47.65	1.98E-01
15.00	0.478	26.97	18.74	45.70	3.05E-01
20.00	0.548	23.00	21.63	44.64	4.16E-01
30.00	0.663	18.69	26.50	45.19	6.39E-01
50.00	0.835	13.33	34.21	47.54	1.07E+00
70.00	0.965	11.16	40.47	51.64	1.48E+00
100.00	1.115	8.06	48.38	56.44	2.03E+00
150.00	1.294	6.41	59.25	65.66	2.85E+00
200.00	1.422	4.95	68.41	73.37	3.57E+00
300.00	1.593	3.62	83.79	87.41	4.81E+00
400.00	1.701	2.99	95.49	98.48	5.88E+00
500.00	1.773	2.35	102.13	104.49	6.87E+00
600.00	1.824	1.92	105.16	107.08	7.81E+00
700.00	1.861	1.97	106.03	108.00	8.74E+00
800.00	1.889	1.71	106.29	108.00	9.66E+00
900.00	1.910	1.49	105.52	107.01	1.06E+01
1000.00	1.926	1.30	104.21	105.51	1.15E+01
1200.00	1.949	1.03	101.98	103.01	1.35E+01
1500.00	1.970	1.03	97.12	98.14	1.64E+01
1700.00	1.978	0.90	93.31	94.21	1.85E+01
2000.00	1.986	0.76	88.26	89.02	2.18E+01
2500.00	1.993	0.66	80.72	81.38	2.77E+01
3000.00	1.996	0.55	74.41	74.96	3.41E+01
3500.00	1.998	0.48	68.90	69.38	4.10E+01
4000.00	1.999	0.45	64.13	64.58	4.85E+01
4500.00	1.999	0.00	60.42	60.42	5.65E+01
5000.00	1.999	0.00	56.80	56.80	6.50E+01
5500.00	2.000	0.00	53.63	53.63	7.41E+01
6000.00	2.000	0.00	50.82	50.82	8.37E+01
6500.00	2.000	0.00	48.32	48.32	9.38E+01
7000.00	2.000	0.00	46.08	46.08	1.04E+02
7500.00	2.000	0.00	44.06	44.06	1.15E+02

ABSORBER.....CALCIUM

ION.....C-12 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	26.68	2.45	29.13	5.38E-03
0.15	30.50	3.00	33.50	6.97E-03
0.20	33.44	3.46	36.90	8.39E-03
0.30	37.72	4.24	41.96	1.09E-02
0.50	42.99	5.47	48.46	1.53E-02
0.70	46.85	6.48	53.33	1.92E-02
1.00	50.48	7.74	58.22	2.46E-02
1.50	54.14	9.48	63.62	3.28E-02
2.00	56.61	10.95	67.56	4.04E-02
3.00	58.79	13.41	72.20	5.47E-02
5.00	59.52	17.31	76.83	8.12E-02
7.00	59.09	20.48	79.57	1.07E-01
10.00	56.85	24.48	81.32	1.44E-01
15.00	52.69	29.98	82.67	2.05E-01
20.00	49.05	34.61	83.67	2.65E-01
30.00	43.36	42.39	85.76	3.83E-01
50.00	35.17	54.73	89.90	6.12E-01
70.00	29.35	64.76	94.10	8.29E-01
100.00	24.47	77.40	101.87	1.14E+00
150.00	19.31	94.79	114.11	1.60E+00
200.00	15.69	109.46	125.15	2.02E+00
300.00	12.38	134.06	146.44	2.75E+00
400.00	9.42	154.80	164.22	3.40E+00
500.00	8.79	173.07	181.86	3.98E+00
600.00	7.52	189.59	197.11	4.50E+00
700.00	6.53	204.78	211.31	4.99E+00
800.00	6.08	218.92	225.00	5.45E+00
900.00	5.51	232.20	237.71	5.88E+00
1000.00	5.02	244.76	249.78	6.29E+00
1200.00	4.24	268.12	272.36	7.06E+00
1500.00	3.72	299.77	303.48	8.10E+00

ABSORBER.....CALCIUM

ION.....N-14 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	32.88	2.58	35.46	4.41E-03
0.15	38.01	3.16	41.17	5.71E-03
0.20	41.57	3.65	45.22	6.87E-03
0.30	46.91	4.47	51.38	8.93E-03
0.50	55.08	5.77	60.85	1.25E-02
0.70	59.08	6.83	65.91	1.56E-02
1.00	64.16	8.16	72.32	2.00E-02
1.50	69.58	10.00	79.57	2.65E-02
2.00	72.88	11.54	84.43	3.26E-02
3.00	76.30	14.14	90.44	4.40E-02
5.00	80.25	18.25	98.50	6.51E-02
7.00	79.06	21.60	100.66	8.51E-02
10.00	77.38	25.81	103.20	1.14E-01
15.00	73.05	31.62	104.67	1.62E-01
20.00	68.78	36.51	105.28	2.10E-01
30.00	61.91	44.71	106.62	3.05E-01
50.00	50.79	57.72	108.52	4.91E-01
70.00	43.76	68.30	112.06	6.72E-01
100.00	36.56	81.63	118.19	9.33E-01
150.00	29.14	99.98	129.12	1.34E+00
200.00	24.33	115.44	139.77	1.71E+00
300.00	19.40	141.39	160.79	2.38E+00
400.00	15.33	163.26	178.59	2.97E+00
500.00	12.34	182.53	194.87	3.50E+00
600.00	11.93	199.96	211.88	4.00E+00
700.00	10.49	215.98	226.46	4.45E+00
800.00	9.29	230.89	240.18	4.88E+00
900.00	8.35	244.89	253.24	5.29E+00
1000.00	7.98	258.14	266.13	5.67E+00
1200.00	6.83	282.78	289.61	6.39E+00

ABSORBER.....CALCIUM

ION.....0-16 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON)/(GRAM/CCM)			MICRON*GRAM/CCM
0.10	60.11	2.70	62.81	2.48E-03
0.15	69.43	3.30	72.74	3.22E-03
0.20	76.66	3.81	80.47	3.87E-03
0.30	86.99	4.67	91.66	5.03E-03
0.50	101.48	6.03	107.51	7.04E-03
0.70	109.76	7.13	116.90	8.80E-03
1.00	120.33	8.53	128.85	1.12E-02
1.50	131.13	10.44	141.57	1.49E-02
2.00	138.11	12.06	150.17	1.84E-02
3.00	146.95	14.77	161.72	2.48E-02
5.00	154.20	19.07	173.26	3.67E-02
7.00	154.21	22.56	176.77	4.80E-02
10.00	153.40	26.97	180.37	6.48E-02
15.00	147.07	33.03	180.09	9.25E-02
20.00	139.65	38.14	177.78	1.20E-01
30.00	126.69	46.71	173.40	1.77E-01
50.00	107.32	60.30	167.62	2.95E-01
70.00	93.69	71.34	165.03	4.16E-01
100.00	77.63	85.27	162.90	5.99E-01
150.00	62.96	104.44	167.40	9.02E-01
200.00	53.33	120.60	173.93	1.20E+00
300.00	40.27	147.70	187.97	1.75E+00
400.00	35.02	170.55	205.56	2.26E+00
500.00	28.84	190.68	219.52	2.73E+00
600.00	24.11	208.88	232.99	3.17E+00
700.00	23.81	225.61	249.43	3.59E+00
800.00	21.38	241.19	262.57	3.98E+00
900.00	19.27	255.82	275.09	4.35E+00
1000.00	17.49	269.66	287.15	4.70E+00

ABSORBER.....CALCIUM

ION.....F-19 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	61.06	2.72	63.78	2.43E-03
0.15	70.63	3.33	73.96	3.16E-03
0.20	78.33	3.85	82.18	3.80E-03
0.30	89.16	4.71	93.87	4.93E-03
0.50	104.04	6.08	110.13	6.88E-03
0.70	115.64	7.20	122.83	8.60E-03
1.00	124.84	8.60	133.45	1.09E-02
1.50	137.11	10.54	147.64	1.45E-02
2.00	145.29	12.17	157.45	1.77E-02
3.00	155.40	14.90	170.30	2.38E-02
5.00	164.44	19.24	183.68	3.51E-02
7.00	169.77	22.76	192.53	4.57E-02
10.00	167.63	27.21	194.84	6.11E-02
15.00	163.47	33.32	196.79	8.66E-02
20.00	157.10	38.48	195.58	1.12E-01
30.00	144.55	47.12	191.67	1.64E-01
50.00	125.20	60.83	186.03	2.70E-01
70.00	109.29	71.98	181.27	3.79E-01
100.00	93.40	86.03	179.43	5.45E-01
150.00	76.00	105.37	181.37	8.24E-01
200.00	64.84	121.67	186.51	1.10E+00
300.00	50.27	149.01	199.29	1.62E+00
400.00	40.43	172.07	212.50	2.10E+00
500.00	36.91	192.38	229.28	2.55E+00
600.00	31.42	210.74	242.16	2.98E+00
700.00	27.02	227.62	254.64	3.38E+00
800.00	23.71	243.34	267.04	3.76E+00
900.00	24.56	258.10	282.66	4.13E+00



ABSORBER.....CALCIUM

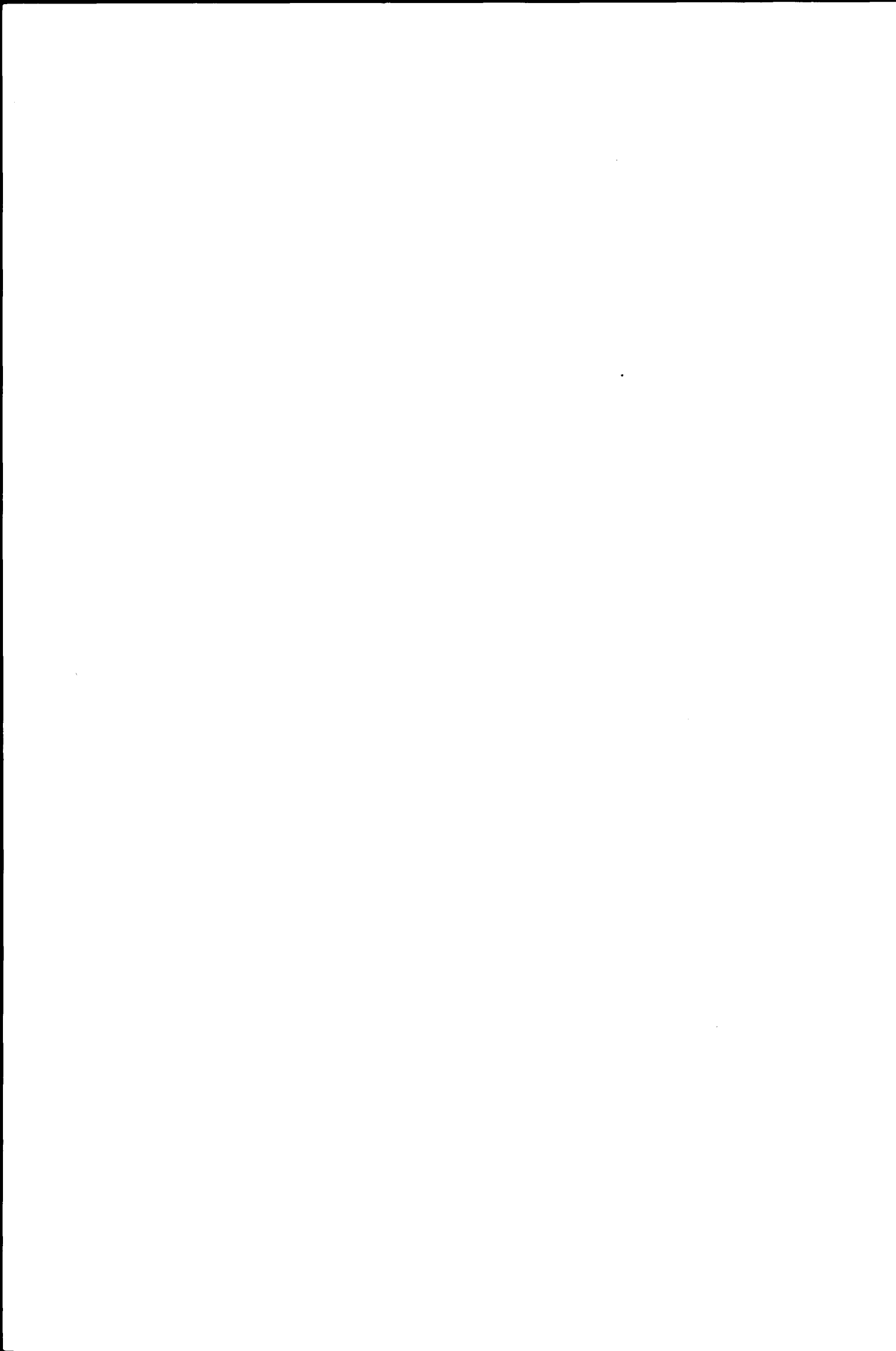
ION.....S-32 RECOILS

ENERGY E	SN(E)	SE(E)	ST(E)	PATHLENGTH
KEV	(KEV/MICRON) / (GRAM/CCM)			MICRON*GRAM/CCM
0.10	65.66	3.23	68.89	2.25E-03
0.15	76.38	3.96	80.34	2.92E-03
0.20	83.67	4.57	88.24	3.51E-03
0.30	97.09	5.59	102.69	4.55E-03
0.50	116.29	7.22	123.51	6.32E-03
0.70	129.25	8.55	137.80	7.85E-03
1.00	143.59	10.21	153.81	9.89E-03
1.50	163.37	12.51	175.88	1.29E-02
2.00	173.92	14.45	188.37	1.56E-02
3.00	192.89	17.69	210.58	2.06E-02
5.00	213.54	22.84	236.38	2.96E-02
7.00	225.52	27.03	252.55	3.77E-02
10.00	234.46	32.30	266.76	4.92E-02
15.00	244.93	39.56	284.49	6.73E-02
20.00	243.63	45.68	289.31	8.46E-02
30.00	241.57	55.95	297.52	1.19E-01
50.00	225.78	72.23	298.01	1.86E-01
70.00	210.34	85.46	295.80	2.53E-01
100.00	191.83	102.15	293.98	3.55E-01
150.00	165.32	125.11	290.42	5.26E-01
200.00	147.19	144.46	291.65	6.99E-01
300.00	118.57	176.93	295.49	1.04E+00
400.00	102.82	204.30	307.12	1.37E+00
500.00	90.81	228.41	319.22	1.69E+00
600.00	81.41	250.21	331.62	2.00E+00

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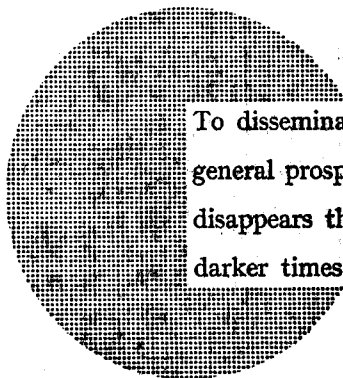
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