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**Westinghouse
Astronuclear
Laboratory**



WANL-PR-(LL)-034

AUGUST 1970

FINAL PROGRESS REPORT

Contract No. NAS-8-24919

Control No. DCN 1 - X - 80 - 00056

**NUCLEAR ROCKET SHIELDING METHODS , MODIFICATION ,
UPDATING , AND INPUT DATA PREPARATION**

VOLUME 2

COMPILATION OF NEUTRON AND PHOTON CROSS SECTION DATA

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COMPILATION OF NEUTRON AND PHOTON CROSS SECTION DATA

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The writers wish to acknowledge the technical guidance provided by Mr. Henry E. Stem, Deputy Manager of the Nuclear and Plasma Physics Division of the Space Sciences Laboratory, George C. Marshall Space Flight Center, the technical monitor of this contract.

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FOREWORD

This report is Volume 2 of six volumes of the final report on "Nuclear Rocket Shielding Methods, Modification, Updating, and Input Data Preparation." This work was performed for the George C. Marshall Space Flight Center (MSFC), Huntsville, Alabama, under Contract No. NAS-8-24919, Control No. DCN 1-X-80-00056. The technical monitor of this contract was Mr. Henry E. Stern, Deputy Manager of the Nuclear and Plasma Physics Division of the Space Sciences Laboratory, MSFC. A description of the compilation of neutron and photon, cross section library data is presented in this volume.

In summary, the six volumes of the final report are as follows:

- Volume 1: "Synopsis of Methods and Results of Analyses" - A summary of the work performed under this contract,
- Volume 2: "Compilation of Neutron and Photon Cross Section Data" - A description of the six Master Libraries of neutron and photon, cross section data,
- Volume 3: "Cross Section Generation and Data Processing Techniques" - A description of the GAMLEG-W, APPROPOS, NAGS, and SATURN codes,
- Volume 4: "One-Dimensional, Discrete Ordinates Transport Technique" - A description of the ANISN-W code,
- Volume 5: "Two-Dimensional, Discrete Ordinates Transport Techniques" - A description of DOT-IIW, DOQ, ADOQ, and MAP codes, and
- Volume 6: "Point Kernel Techniques" - A description of the KAP-VI and SCAP codes.

ABSTRACT

This report is Volume 2 of six volumes of the final report on "Nuclear Rocket Shielding Methods, Modifications, Updating, and Input Data Preparation". This volume describes the compilation of neutron and photon cross section data.

The compilation and preparation of neutron and photon cross section data are subdivided into the following categories:

- 1) Neutron cross sections for the ANISN-W and DOT-IIW discrete ordinates transport codes and their auxiliary codes;
- 2) Photon cross sections for the ANISN-W and DOT-IIW discrete ordinates transport codes, the KAP-VI point kernel code, and the SCAP single- and albedo-scatter code;
- 3) Preparation of multigroup cross section sets (with upscatter removed, if desired), using the WANL modified version of the ANISN code or the APPROPOS cross section preparation code;
- 4) Basic, nuclear data for nuclear and radiation analysis of a nuclear system.

The multigroup cross sections described in this volume are applicable for the analysis of graphite-moderated, nuclear reactor, rocket systems.

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1.0 INTRODUCTION

This is Volume 2 of six volumes of the final report on "Nuclear Rocket Shielding Methods, Modification, Updating, and Input Data Preparation". This volume describes the compilation of neutron and photon cross section data.

The neutron and photon cross section libraries are an integral part of both the preliminary or parametric and the detailed design radiation analysis methods provided to MSFC under this contract and the previous contractual work (NAS-8-20414). A schematic diagram of each method is shown in Figures 1-1 and 1-2. Both methods are described in Volume 1 of this report.

In the preliminary or parametric design method (Figure 1-1), the APPROPOS code (Volume 3) is used to prepare neutron and photon cross sections and other basic data for use in the transport and data processing codes. The cross sections are input to the ANISN-W code (Volume 4). The ANISN-W code computes one-dimensional neutron and photon fluxes in the reactor geometry. From the neutron fluxes, neutron and photon energy sources and distributions are obtained using the NAGS data processing code (Volume 3). The sources and distributions are used as input to the KAP-VI point kernel code (Volume 6). The KAP-VI code provides gamma ray and fast neutron radiation levels at locations external to the reactor. Radiation sources, heat generation rates, and radiation environment, both internal and external to the reactor as well as shield effectiveness, can be computed using the preliminary or parametric design method.

In the detailed design method (Figure 1-2), the neutron and photon cross sections prepared by the APPROPOS code (Volume 3) are used as input data to the DOT-IIW, two-dimensional, discrete ordinates transport code. The DOT-IIW code (Volume 5) computes the two-dimensional neutron and photon fluxes throughout the reactor geometry. The NAGS data processing code (Volume 3) processes these fluxes and calculates neutron and photon energy deposition and neutron and photon energy sources and distributions within the reactor system. These sources and distributions are used as input to the KAP-VI point kernel code (Volume 6). In addition, the surface leakage fluxes from the DOT-IIW problem geometry

are used as input to the MAP radiation transport code (Volume 5). The MAP code computes the radiation environment at selected surfaces or points external to the DOT-IIW geometry and includes provision for last-flight transport using optional, point kernel techniques. The SCAP single- or albedo-scatter code (Volume 6) is used to compute external radiation environment using, as source input data, the output from either the KAP-VI or the MAP codes. Radiation sources, heat generation rates, and radiation environment, both internal and external to the reactor as well as shield effectiveness can be computed using the detailed design method.

The SATURN (Volume 3), DOQ and ADOQ (Volume 5) codes are additional data preparation and handling codes. These codes are provided as convenient tools for manipulating large quantities of data or for providing selected input data.

Section 2.0 summarizes the neutron and photon cross section data compiled for the Marshall Space Flight Center (MSFC). A brief description of each of the five MSFC Master Library Tapes is included.

Section 3.0 describes the basic neutron, cross section libraries provided under this Contract and the method of computation.

Section 4.0 describes the basic photon cross section libraries provided under this Contract. A brief description of how these data are used in the respective codes is provided.

Section 5.0 describes two techniques for the preparation of few group cross section data using the Master Libraries described in this volume.

Section 6.0 describes the basic, nuclear data provided under this Contract and the method of computation.

A tabulation of pair-production, photo-electric, and Compton absorption as well as Compton scatter and the total gamma ray cross section by element is listed in the APPENDIX. These data are provided from 0.01 to 20.0 MeV.

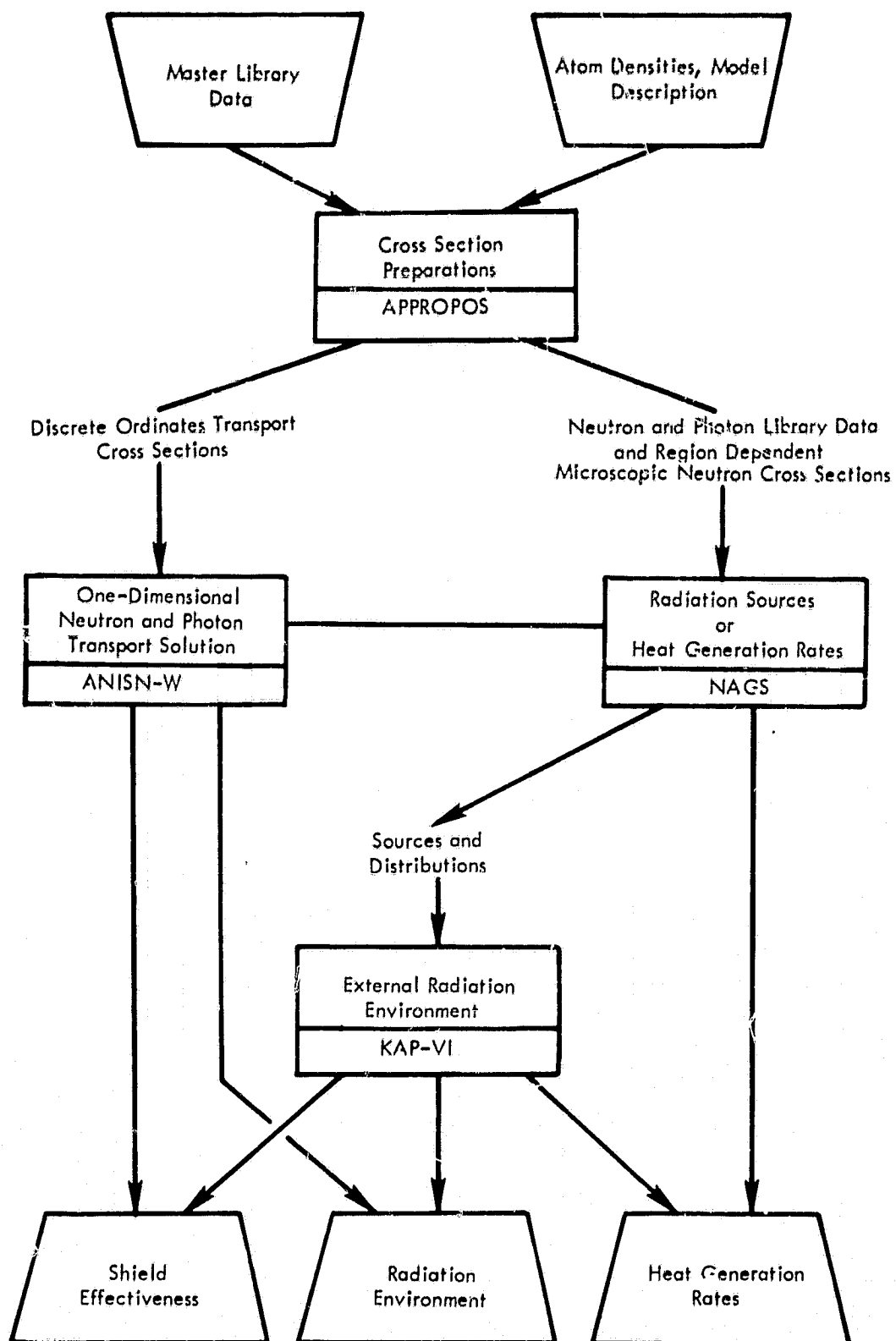


Figure 1-1. Flow Chrt for Preliminary or Parametric Radiation Analysis

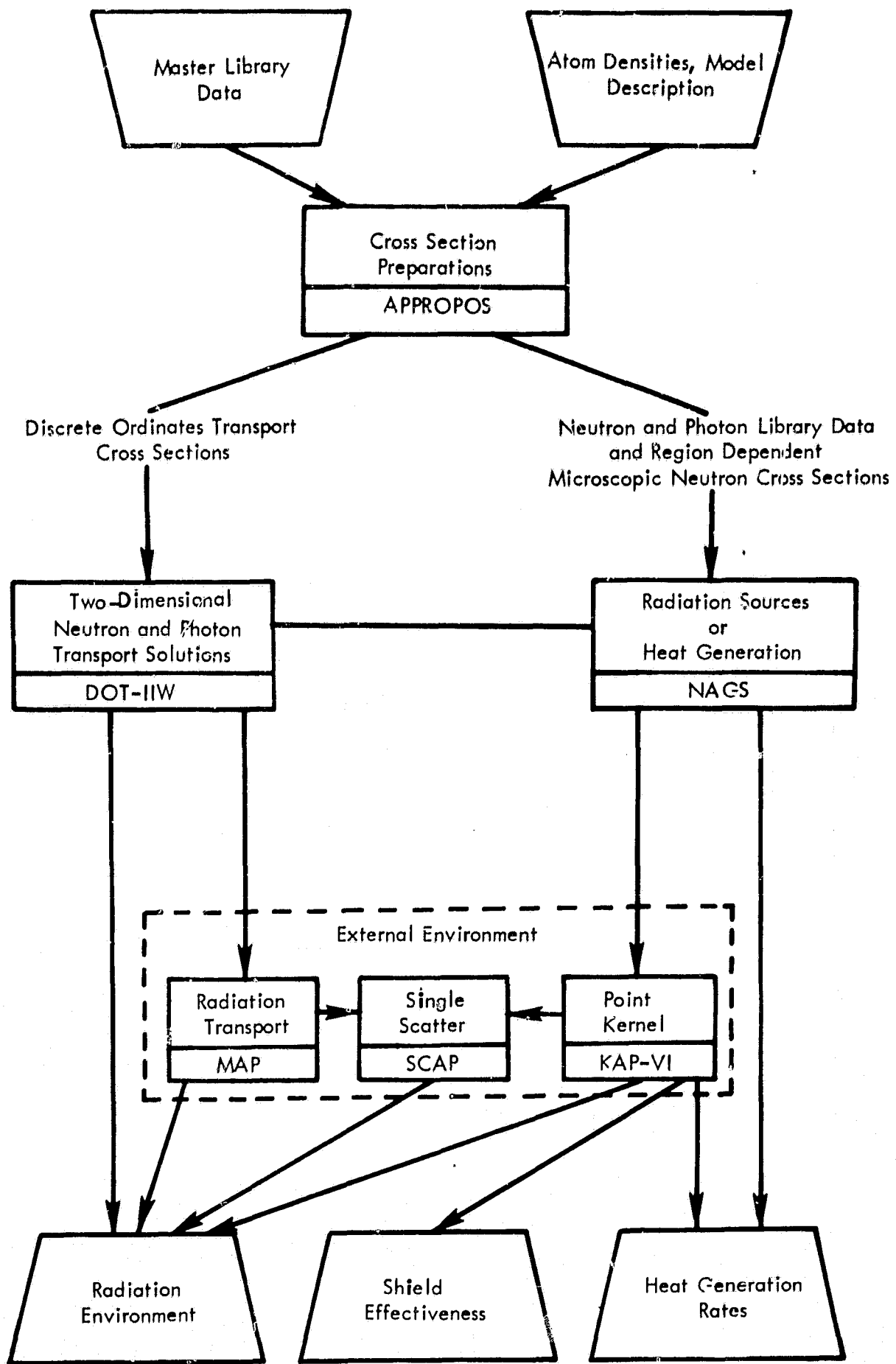


Figure 1-2. Flow Chart for Detailed Radiation Analysis

2.0 SUMMARY AND CONCLUSIONS

The compilation of neutron and photon cross section data for MSFC has generated five Master Library Tapes and a deck of basic nuclear data. (See Table 2-1.)

Master Library Tape No. 1 contains 135 microscopic, transport corrected, neutron cross sections sets for 36 elements for use in the ANISN-W, DOT-IIW, and APPROPOS codes. These data are in a 52 energy group structure. Master Library Tape No. 2 contains 413 microscopic, P_ℓ ($\ell \leq 3$) neutron cross section sets for 36 elements for use in the ANISN-W, DOT-IIW, and APPROPOS codes. These data are also in a 52 energy group structure. Master Library Tape No. 3 contains 134 sets of reaction rate cross section data for use in the APPROPOS code. The data on Master Library Tapes No. 1, 2, and 3 are averaged over four representative, spatially dependent, neutron spectra obtained from current R-1 nuclear subsystem design work. These first three tapes are obtained in a manner consistent with each other and with the nuclear and radiation analysis procedures used in the radiation analysis of reactors at the Westinghouse Astronuclear Laboratory (WANL).

Master Library Tape No. 4 contains 510 microscopic, P_ℓ , gamma ray cross section sets for 51 elements for use in the ANISN-W, DOT-IIW, and APPROPOS codes. These data, which are in a 13 energy group structure, are averaged over a source spectrum of prompt gamma ray energy emitted from the fission of ^{235}U . Master Library Tape No. 5 contains the pair-production and photo-electric gamma ray cross section data used in the KAP-VI, SCAP, MAP, and GAMLEG-W codes. Again, the data on Tapes 4 and 5 are obtained in a manner consistent with each other and with the radiation analysis procedures used in the radiation analysis of reactors at WANL.

Finally, a basic set of nuclear data is generated for use in the complete package of codes.

TABLE 2-1
SUMMARY OF MASTER LIBRARIES

<u>MSFC Master Library Number</u>	DESCRIPTION
1	Microscopic, 52 Group, Transport Corrected, Neutron Cross Section Sets for Use in the ANISN-W, DOT-IIW, and APPROPOS Codes
2	Microscopic, 52 Group, P_0 , Neutron Cross Section Sets for Use in the ANISN-W, DOT-IIW, and APPROPOS Codes
3	Microscopic, 52 Group, Reaction Rate Cross Section Sets for Use in the APPROPOS Code
4	Microscopic, 13 Group, P_0 , Gamma Ray Cross Section Sets for Use in the ANISN-W, DOT-IIW, and APPROPOS Codes
5	Pair-Production and Photo-Electric Gamma Ray Cross Sections for Use in the KAP-VI, SCAP, MAP, and GAMLEG-W Codes
6*	Gamma Ray Production Data Due to Thermal Neutron Capture and Inelastic Scatter, Selected Nuclear Parameters, and Other Related Data.

* On Cards

3.0 NEUTRON CROSS SECTIONS

A multigroup, microscopic library of neutron cross sections has been prepared for use in the discrete ordinates transport codes, DOT-IIW and ANISN-W. Table 3-1 lists the 35 elements (or isotopes) for which cross section sets have been supplied. Transport corrected* and full P_1 scattering-approximation cross sections were generated for the elements (or isotopes) noted in the Table. Each microscopic cross section set was spectrally weighted over four representative flux and current spectra. These spectra, as shown in Table 3-2, are selected from the NERVA project analyses of the current R-1 nuclear subsystem design and represent the spatially dependent neutron spectra in the R-1 reactor system. Full P_3 scattering-approximation cross sections for neutron energies greater than 1.86 eV are supplied for 16 elements, as specified in Table 3-1. These data are weighted over a $1/E$ spectrum. In addition, a vane prescription cross section set weighted over the R-1 reflector spectrum is included to represent the NERVA reactor peripheral control drums containing $^{10}\text{Boron}$. In one-dimensional (ANISN-W) or r, z two-dimensional (DOT-IIW) calculations, an annular ring containing the vane prescription cross section set is employed to represent the control drums.

All neutron cross sections are obtained in a manner consistent with the nuclear and radiation analysis procedures used in the radiation analysis of reactors at WANL. This cross section library is most applicable for radiation analyses of nuclear rocket reactors; however, the 52 energy group data are considered to be adequate for parametric survey calculations of other nuclear systems, as well.

3.1 BASIC LIBRARY DATA

The multigroup structure of the microscopic neutron library is shown in Table 3-3. These 52 energy groups consist of 32 groups in the fast energy range (from 1.86 eV to

* The transport correction made in neutron cross sections involves the flux weighted P_0 cross sections, and the diagonal transport approximation using the current weighted P_1 cross section, $\sum_{g=1}^G \sigma_{gg}^{P_1}$, to obtain the correction term, $1/3 \sum_{g=1}^G \sigma_{gg}^{P_1}$, where G is the total number of neutron groups. The term is subtracted from the total cross section and the within group scattering cross section σ_{gg} .

1.0×10^7 eV) and 20 groups in the thermal energy range (from 0.0 eV to 1.86 eV). The probability of neutron upscatter or downscatter is included in the thermal range data up to the upper limit of 1.86 eV; the probability of downscatter is included in the fast range data from 1.86 eV to 10.0 MeV. The group structure shown in Table 3-3 is chosen for the following reasons:

- 1) Adequate high-energy group structure to provide reaction rates for heating calculations, comparisons with activation measurements, and representation of anisotropic scattering,
- 2) Adequate epithermal energy group structure to define the ^{235}U Uranium cross section in the resonance range (lethargy greater than 12),
- 3) Computer code storage limits,
- 4) Multigroup cross sections collapsible directly to few-group cross sections. This means that every few-group break point must fall at a multigroup break point. The motivation for this criterion is that ANISN-W or APPROPOS can be used to perform the group collapse,
- 5) Sufficient thermal energy range group structure to adequately define the downscatter-upscatter cross sections,
- 6) Adequate thermal energy range group structure to equalize the relative influence of each thermal group in transport calculations, and
- 7) Reasonable computer running time.

Using this 52 energy group structure, 548 neutron cross section sets and 134 reaction rate sets are generated at room temperature (except where noted) for use in the ANISN-W and DOT-IIW discrete ordinates transport codes. Each neutron cross section set consists of 52 groups and 34 cross section types for a total array size of 1768.

Each energy group contains 34 different types of cross sections as follows:

- 1) σ_g^a , in position 1, the total absorption cross section, i. e., radiative capture, $(n;2n)^*$, fission, $(n;p)$ (n,γ) , etc. For most elements, this cross section is the radiative capture cross section.
- 2) $\nu \sigma_g^f$, in position 2, the product of the fission cross section and the average number of neutrons released per fission event.

* The $(n, 2n)$ reaction is treated as a negative absorption cross section

3) σ_g^t , in position 3, the total collision cross section. When transport corrected cross sections are used, this table position contains the total collision cross section corrected by the diagonal transport approximation term. This correction term for anisotropic scattering has been computed by the diagonal transport approximation using the current weighted total P_1 scatter cross section, $\sum_{g=1}^G \sigma_{g' \rightarrow g}^{P_1}$, to obtain the correction term $1/3 \sum_{g=1}^G \sigma_{g' \rightarrow g}^{P_1}$. This correction term has been subtracted from the total collision cross section and the within-group scattering cross section, σ_{gg} , for the transport corrected data set.

4 to 13) $\sigma_{g',g}$ for $g' > g$, in positions 4 to 13, inclusive, the upscatter transfer cross section (always considered to be transfer into a group). The 13th position cross section in group 1 would represent transfer from group 2 into group 1, for example. These transfer cross sections are the sum of the elastic, inelastic, and where applicable ($n;2n$) reaction cross sections.

14) $\sigma_{g',g}$ for $g' = g$, or simply, σ_{gg} , in position 14, the within-group transfer cross section defined as:

$$\sigma_{gg} = \sigma_g^t - \sigma_g^a - \sum_{g=1}^G \sigma_{g',g} \text{ for } g' \neq g$$

15 to 34) $\sigma_{g',g}$ for $g' < g$, in positions 15 to 34, inclusive, the downscatter transfer cross section (always considered to be transfer into a group). For example, the 15th position in group 2 would represent transfer from group 1 into group 2. These transfer cross sections are the sum of the elastic, inelastic, and where applicable, ($n;2n$) reaction cross sections.

Impossible transfer elements, such as upscatter into group 52, are entered as a zero. The vane prescription data set and each neutron cross section set are given a unique four-digit identification number. The first two digits of the identification number denote the particular element or isotope of the cross section library, the third digit denotes the spectrum over which the cross section data is averaged, and the fourth digit denotes the cross section type (P_1 , P_2 , P_3 , etc.). Table 3-4 specifies the element or isotope identification number, Table 3-2 specifies the spectrum, and Table 3-5 specifies the cross section type.

The neutron cross section sets are contained on two library tapes; the first tape contains only transport corrected cross-section data; the second tape contains the P_0 cross section data. Table 3-6 lists the cross section sets on the transport corrected data tape. This table lists the element or isotope and its identification number, the spectrum over which it is averaged, and the sequence with which it is placed on tape. Table 3-7 lists the cross section sets on the P_0 data tape. This table lists the element or isotope and its identification number, the spectrum over which it is averaged, the P_0 order, and the sequence with which it is placed on tape. The P_2 and P_3 cross section sets for hydrogen are assumed independent of temperature or the type of hydrogen so that all the P_2 data for hydrogen are identical to one another as are the P_3 data. The same assumption is used for the P_2 or P_3 data for any given element that appears more than once. By repeating the element in the proper sequence, continuity of tape ID numbers and user convenience are achieved.

The 52 group, ring vane prescription is contained on both library tapes. The microscopic cross section data on these two magnetic tapes are in a format consistent with the input requirements of the ANISN-W and DOT-IIW discrete ordinates transport codes and of the APPROPOS cross section preparation code.

Fifty-two neutron energy group, microscopic, reaction rate cross section data are also generated for 35 elements or isotopes, averaged over the same four representative R-1 spectra. These microscopic reaction rate cross sections contained on Master Library Tape No. 3 are:

- 1) σ_g^c , the capture cross section which includes $\sigma(n, \gamma)$, $\sigma(n; p, \gamma)$, and $\sigma(n; \alpha, \gamma)$ reactions,
- 2) σ_g^f , the fission cross section for fissionable isotopes; non-fissionable elements or isotopes contain zeros for this cross section,
- 3) $\sigma_g^{el, eff}$ the "effective" energy deposition cross section which was computed by

$$\sigma_g^{el, eff} = \frac{\Delta E_g}{\Delta U_g} \times \frac{2A}{(A+1)^2} \times (1 - \mu_g^{cm}) \times \sigma_g^{el}$$

where:

$\frac{\Delta E_g}{\Delta U_g}$ is the average energy of group g ,

$\frac{2A}{(A+1)^2}$ is the average energy loss per collision,

$(1 - \mu_g^{cm})$ is the correction term for anisotropic scattering,

ΔE_g is the energy width of group g ,

ΔU_g is the lethargy width of group g ,

A is the atomic mass of the scattering nucleus,

μ_g^{cm} is the average cosine of the scattering angle in the center-of-mass coordinate system for group g , and

σ_g^{el} is the total microscopic elastic scattering cross section for group g ,

4) $\sigma_g^{n, n'}$, the total inelastic scattering cross section for group g .

The use of an effective energy deposition cross section facilitates rapid computations of the direct neutron kinetic energy deposition due to neutron elastic scattering. The effective energy deposition cross section is calculated in a consistent manner with the data on Master Library Tapes No. 1 and 2.

The capture cross section is used in the calculation of the secondary gamma ray source due to (n, γ) , $(n; p, \gamma)$, and $(n; \alpha, \gamma)$ reactions. The fission cross section is used in the calculation of prompt and delayed gamma ray source due to the (n, f) reaction. The effective energy deposition cross section is used in the calculation of neutron kinetic energy deposition due to neutron elastic scattering. The inelastic scattering cross section is used in the calculation of the secondary gamma ray source due to the $(n; n', \gamma)$ reaction.

Table 3-8 lists the reaction rate microscopic cross sections contained on Master Library Tape No. 3, the identification number, the spectrum over which the data are averaged, and the order in which they are placed on tape. These data are used primarily by the APPROPOS code.

3.2 METHOD OF COMPUTATION

A consistent, microscopic neutron transport library of cross sections in 52 energy groups is generated for the Marshall Space Flight Center. These cross sections are obtained in a manner consistent with the nuclear and radiation analysis procedures used in the radiation analysis of reactors at WANL.

The GAMBIT^(3.1 - 3.4) code is used to generate the larger portion of the library. This code provides group averaged, flux and current weighted, neutron cross sections based on a thermal cross section Master Library consisting of 99 fine groups (0 - 2.38 eV), a fast neutron cross section Master Library consisting of 68 fine groups (0.414 eV - 10 MeV, 1/4 lethargy intervals), and a detailed set of element resonance parameters for the 68 fine groups.

The generation of basic neutron cross section data for the Master Libraries has been carried out in recent years by the Reactor Physics and Mathematics Department of WANL. Considerable effort is expended in preparing and evaluating basic neutron cross section data (i. e., smooth cross sections, resonance parameters, scattering kernels, inelastic matrices, etc.) for use in the GAMBIT code. The Master Libraries for GAMBIT are based on the GAM-I and TNS libraries^(3.5) and recent evaluations of neutron cross section data.^(3.6 - 3.13) The references for the changes and additions to these libraries, based on new measurements, analytical models, and evaluations, is shown in Table 3-9 for the elements in the MSFC library. These references detail the method of cross section evaluation and the basic data source.

P_2 and P_3 multigroup scattering matrices for 16 elements were generated using the TRANSFER^(3.14) code. These cross sections are weighted over a $1/E$ spectrum and are generated only for the 32 fast groups ($E > 1.86$ eV) as anisotropic scattering effects are most significant for high neutron energies. Input to the TRANSFER code consists of the pointwise total scattering cross section and the coefficients, $f_\ell(E)$, in the Legendre expansion of the differential elastic scattering cross section $\sigma_{n,n}(E, \theta)$:

$$\sigma_{n,n}(E, \theta) = \frac{\sigma_{n,n}(E)}{4\pi} \sum_{\ell=0}^{\infty} (2\ell + 1) f_\ell(E) P_\ell(\cos \theta)$$

where $f_0(E) = 1$

The required input data are obtained from References 3.15 to 3.24. The punched output from the TRANSFER code is input to an auxiliary code to (1) repunch the cards in a format acceptable to the ANISN-W, DOT-IIW, and APPROPOS codes, and (2) perform specific error checks. These checks^(3.25) tested for the integral conditions that the P_0 , P_1 , P_2 , and P_3 transfer matrices must satisfy. These conditions are:

1) The sum $\sum_g \sigma_{g'g}^{P_0}$, for $g \leq g'$ should equal the average ($1/E$ weighting) of the elastic scattering cross section over group g ,

2) The ratio $\sum_g \sigma_{g'g}^{P_1} / \sum_g \sigma_{g'g}^{P_0} = 2/A$, for $g \leq g'$,

3) The ratio $\sum_g \sigma_{g'g}^{P_2} / \sum_g \sigma_{g'g}^{P_0} = 1.25$ for $A = 1$, or

$$= 1/A^2 \left[1 + \sum_{n=1}^{\infty} \left(\frac{1}{(2n-1) \cdot 7A^{2n}} \right) \right] \text{ for } A > 1$$

4) The sum $\sum_g \sigma_{g'g}^{P_3} = 0$

where A is the mass number of the scattering nucleus.

The above conditions are based on the assumption that:

- 1) The elastic scattering is isotropic in the center-of-mass coordinate system, and
- 2) The elastic scattering cross sections are averaged over a $1/E$ spectrum.

The cross sections were then placed on Library Tape No. 2 for use in the ANISN-W, DOT-IIW, and APPROPOS codes.

TABLE 3-1

COMPILATION OF NEUTRON CROSS SECTION DATA BY ELEMENT OR ISOTOPE

Number	Element or Isotope	Cross Section Scattering Approximation*		
		Transport Corrected	P0/P1	P2/P3
1	Hydrogen (20.4°K, Para)	x	x	x
2	Hydrogen (20.4°K, Ortho)	x	x	x
3	Hydrogen (300°K, Para)	x	x	x
4	Hydrogen (300°K, Ortho)	x	x	x
5	Hydrogen (2500°K, Gas Kernel)	x	x	x
6	Carbon (296°K)	x	x	x
7	Beryllium (296°K)	x	x	x
8	Boron	x	x	x
9	¹⁰ Boron	x	x	---
10	Aluminum	x	x	x
11	Titanium	x	x	x
12	Chromium	x	x	x
13	Iron	x	x	x
14	Copper	x	x	x
15	Niobium	x	x	x
16	Molybdenum	x	x	x
17	²³⁵ Uranium	x	x	x
18	²³⁸ Uranium	x	x	x
19	Nickel	x	x	x
20	Manganese	x	x	x
21	Tantalum	x	x	---
22	Gadolinium	x	x	---
23	Tungsten	x	x	x
24	Silicon	x	x	---
25	Oxygen	x	x	---
26	Magnesium	x	x	---
27	Zirconium	x	x	---
28	Lead	x	x	---
29	⁶ Lithium	x	x	---
30	⁷ Lithium	x	x	---
31	Lithium	x	x	---
32	Indium	x	x	---
33	Gold	x	x	---
34	Cadmium	x	x	---
35	Nitrogen	x	x	---
36	Cobalt	x	x	---

* x indicates the data have been included; --- indicates the data have not been included.

TABLE 3-2

SPECTRUM IDENTIFICATION NUMBER

- 1 - Core Center Spectrum
- 2 - Core Edge Spectrum
- 3 - Reflector Spectrum
- 4 - Shield Spectrum

TABLE 3-3

FIFTY-TWO NEUTRON ENERGY GROUP STRUCTURE (FINE GROUP)

Multi-Group Number	E (lower) (eV.)	U (lower)	ΔU	Multi-Group Number	E (lower) (eV.)	U (lower)	ΔU
1*	7.79×10^6	0.25	0.25	27	6.48	14.25	0.25
2	6.07×10^6	0.50	0.25	28	5.04	14.25	0.25
3	4.72×10^6	0.75	0.25	29	3.39	14.75	0.25
4	3.68×10^6	1.00	0.25	30	3.06	15.00	0.25
5	2.87×10^6	1.25	0.25	31	2.38	15.25	0.25
6	2.23×10^6	1.50	0.25	32	1.86	15.50	0.15
7	1.35×10^6	2.00	0.50	33	1.6	15.65	0.17
8	8.21×10^5	2.50	0.50	34	1.35	15.82	0.07
9	3.88×10^5	3.25	0.75	35	1.25	15.89	0.25
10	1.11×10^5	4.50	1.25	36	0.975	16.14	0.33
11	4.09×10^4	5.50	1.00	37	0.70	16.47	0.56
12	1.50×10^4	6.50	1.00	38	0.40	17.03	0.29
13	5.53×10^3	7.50	1.00	39	0.30	17.32	0.15
14	2.04×10^3	8.50	1.00	40	0.26	17.47	0.26
15	583	9.75	1.25	41	0.20	17.73	0.22
16	167	11.00	1.25	42	0.16	17.95	0.29
17	78.9	11.75	0.75	43	0.12	18.24	0.18
18	61.4	12.00	0.25	44	0.10	18.42	0.22
19	47.9	12.25	0.25	45	0.08	18.64	0.29
20	37.3	12.50	0.25	46	0.06	18.93	0.41
21	29.0	12.75	0.25	47	0.04	19.34	0.28
22	22.6	13.0	0.25	48	0.03	19.62	0.41
23	17.6	13.25	0.25	49	0.02	20.03	0.80
24	13.7	13.50	0.25	50	0.009	20.83	0.59
25	10.68	13.75	0.25	51	0.005	21.42	
26	8.32	14.00	0.25	52	0.0	---	

* The upper energy of Multigroup Number 1 is 1.0×10^7 eV.

TABLE 3-4

ELEMENT OR ISOTOPE IDENTIFICATION NUMBER

01 - Aluminum	20 - Lithium
02 - Beryllium 296°K	21 - ⁶ Lithium
03 - Boron	22 - ⁷ Lithium
04 - ¹⁰ Boron	23 - Magnesium
05 - Cadmium	24 - Manganese
06 - Carbon 296°K	25 - Molybdenum
07 - Chromium	26 - Nickel
08 - Cobalt	27 - Niobium
09 - Copper	28 - Nitrogen
10 - Gadolinium	29 - Oxygen
11 - Gold	30 - Silicon
12 - Hydrogen, para, 20.4°K	32 - Tantalum
13 - Hydrogen, ortho, 20.4°K	33 - Titanium
14 - Hydrogen, para, 300°K	34 - Tungsten
15 - Hydrogen, ortho, 300°K	35 - ²³⁵ Uranium
16 - Hydrogen, gas kernel, 2500°K	36 - ²³⁸ Uranium
17 - ¹¹⁵ Indium	37 - Zirconium
18 - Iron	38 - Ring "Vane Prescription"
19 - Lead	

TABLE 3-5

CROSS SECTION TYPE IDENTIFICATION NUMBER

0 - P_0 Cross Section Set

1 - P_1 Cross Section Set

2 - P_2 Cross Section Set

3 - P_3 Cross Section Set

9 - Transport Corrected Cross Section Set

TABLE 3-6

TRANSPORT CORRECTED CROSS SECTION SETS ON TAPE NO. ONE

IDENTIFICATION NUMBER	MATERIAL	SPECTRUM*
0119	ALUMINUM	CC
0129	ALUMINUM	CE
0139	ALUMINUM	R
0149	ALUMINUM	S
0219	BERYLLIUM, 296 DEG. K.	CC
0220	BERYLLIUM, 297 DEG. K.	CE
0239	BERYLLIUM, 296 DEG. K.	R
0249	BERYLLIUM, 296 DEG. K.	S
0319	BORON	CC
0329	BORON	CE
0339	BORON	R
0349	BORON	S
0419	BORON-10	CC
0429	BORON-10	CE
0439	BORON-10	R
0449	BORON-10	S
0519	CADMIUM	CC
0529	CADMIUM	CE
0539	CADMIUM	R
0549	CADMIUM	S
0619	CARBON, 296 DEG. K.	CC
0629	CARBON, 296 DEG. K.	CE
0639	CARBON, 296 DEG. K.	R
0649	CARBON, 296 DEG. K.	S
0719	CHROMIUM	CC
0729	CHROMIUM	CE
0739	CHROMIUM	R
0749	CHROMIUM	S
0819	COBALT	CC
0829	COBALT	CE
0839	COBALT	R
0849	COBALT	S
0919	COPPER	CC
0929	COPPER	CE
0939	COPPER	R
0949	COPPER	S
1019	GADOLINIUM	CC
1029	GADOLINIUM	CE
1039	GADOLINIUM	R
1049	GADOLINIUM	S
1119	GOLD	CC
1129	GOLD	CE
1139	GOLD	R

*KFY. CC-CORE CENTER, CE-CORE EDGE, R-REFLECTOR, S-SHIELD.

TABLE 3-6 (CONTINUED)

IDENTIFICATION NUMBER	MATERIAL	SPECTRUM
1149	GOLD	S
1219	HYDROGEN, PARA, 20.4 DEG. K.	CC
1229	HYDROGEN, PARA, 20.4 DEG. K.	CE
1239	HYDROGEN, PARA, 20.4 DEG. K.	R
1249	HYDROGEN, PARA, 20.4 DEG. K.	S
1319	HYDROGEN, ORTHO, 20.4 DEG. K.	CC
1329	HYDROGEN, ORTHO, 20.4 DEG. K.	CE
1339	HYDROGEN, ORTHO, 20.4 DEG. K.	R
1349	HYDROGEN, ORTHO, 20.4 DEG. K.	S
1419	HYDROGEN, PARA, 300 DEG. K.	CC
1429	HYDROGEN, PARA, 300 DEG. K.	CE
1439	HYDROGEN, PARA, 300 DEG. K.	R
1449	HYDROGEN, PARA, 300 DEG. K.	S
1519	HYDROGEN, ORTHO, 300 DEG. K.	CC
1529	HYDROGEN, ORTHO, 300 DEG. K.	CE
1539	HYDROGEN, ORTHO, 300 DEG. K.	R
1549	HYDROGEN, ORTHO, 300 DEG. K.	S
1619	HYDROGEN, GAS, 2500 DEG. K.	CC
1629	HYDROGEN, GAS, 2500 DEG. K.	CE
1639	HYDROGEN, GAS, 2500 DEG. K.	R
1649	HYDROGEN, GAS, 2500 DEG. K.	S
1719	INDIUM-115	CC
1729	INDIUM-115	CE
1739	INDIUM-115	R
1749	INDIUM-115	S
1819	IRON	CC
1829	IRON	CE
1839	IRON	R
1849	IRON	S
1919	LEAD	CC
1929	LEAD	CE
1939	LEAD	R
1949	LEAD	S
2019	LITHIUM	CC
2029	LITHIUM	CE
2039	LITHIUM	R
2049	LITHIUM	S
2119	LITHIUM-6	CC
2129	LITHIUM-6	CE
2139	LITHIUM-6	R
2149	LITHIUM-6	S
2219	LITHIUM-7	CC
2229	LITHIUM-7	CE
2239	LITHIUM-7	R
2249	LITHIUM-7	S
2319	MAGNESIUM	CC
2329	MAGNESIUM	CE
2339	MAGNESIUM	R
2349	MAGNESIUM	S

TABLE 3-6 (CONTINUED)

IDENTIFICATION NUMBER -----	MATERIAL -----	SPECTRUM -----
2419	MANGANESE	CC
2429	MANGANESE	CE
2449	MANGANESE	S
2519	MOLYBDENUM	CC
2529	MOLYBDENUM	CE
2539	MOLYBDENUM	R
2549	MOLYBDENUM	S
2619	NICKEL	CC
2629	NICKEL	CE
2639	NICKEL	R
2649	NICKEL	S
2719	NIOBIUM	CC
2729	NIOBIUM	CE
2739	NIOBIUM	R
2749	NIOBIUM	S
2819	NITROGEN	CC
2829	NITROGEN	CE
2839	NITROGEN	R
2849	NITROGEN	S
2919	OXYGEN	CC
2929	OXYGEN	CE
2939	OXYGEN	R
2949	OXYGEN	S
3019	SILICON	CC
3029	SILICON	CE
3039	SILICON	R
3049	SILICON	S
3219	TANTALUM	CC
3229	TANTALUM	CE
3319	TITANIUM	CC
3329	TITANIUM	CE
3339	TITANIUM	R
3349	TITANIUM	S
3449	TUNGSTEN	S
3519	URANIUM-235	CC
3529	URANIUM-235	CE
3619	URANIUM-238	CC
3629	URANIUM-238	CE
3719	ZIRCONIUM	CC
3729	ZIRCONIUM	CE
3739	ZIRCONIUM	R
3749	ZIRCONIUM	S
3839	RING VANE PRESCRIPTION	R

TABLE 3-7

P₀ CROSS SECTION SETS ON TAPE NO. 2

I.D. NUMBER	MATERIAL	CROSS SECTION TYPE	SPECTRUM*
0110	ALUMINUM	P0	CC
0111	ALUMINUM	P1	CC
0112	ALUMINUM	P2	1/E
0113	ALUMINUM	P3	1/E
0120	ALUMINUM	P0	CE
0121	ALUMINUM	P1	CE
0122	ALUMINUM	P2	1/E
0123	ALUMINUM	P3	1/E
0130	ALUMINUM	P0	R
0131	ALUMINUM	P1	R
0132	ALUMINUM	P2	1/E
0133	ALUMINUM	P3	1/E
0140	ALUMINUM	P0	S
0141	ALUMINUM	P1	S
0142	ALUMINUM	P2	1/E
0143	ALUMINUM	P3	1/E
0210	BERYLLIUM, 296 DEG. K.	P0	CC
0211	BERYLLIUM, 296 DEG. K.	P1	CC
0212	BERYLLIUM	P2	1/E
0213	BERYLLIUM	P3	1/E
0220	BERYLLIUM, 296 DEG. K.	P0	CE
0221	BERYLLIUM, 296 DEG. K.	P1	CE
0222	BERYLLIUM	P2	1/E
0223	BERYLLIUM	P3	1/E
0230	BERYLLIUM, 296 DEG. K.	P0	R
0231	BERYLLIUM, 296 DEG. K.	P1	R
0232	BERYLLIUM	P2	1/E
0233	BERYLLIUM	P3	1/E
0240	BERYLLIUM, 296 DEG. K.	P0	S
0241	BERYLLIUM, 296 DEG. K.	P1	S
0242	BERYLLIUM	P2	1/E
0243	BERYLLIUM	P3	1/E
0310	BORON	P0	CC
0311	BORON	P1	CC
0312	BORON	P2	1/E

*KEY. CC-CORE CENTER, CE-CORE EDGE, R-REFLECTOR, S-SHIELD, 1/E-1/E SPECTRUM.
P0-P(0) CROSS SECTION SET, P1-P(1) CROSS SECTION SET.
P2-P(2) CROSS SECTION SET, P3-P(3) CROSS SECTION SET.
TRC-TRANSPORT CORRECTED CROSS SECTION SET.

NOTE. THE P(2) AND P(3) CROSS SECTION SETS ARE NOT DEPENDENT ON TEMPERATURE OR HYDROGEN TYPE (I.P., PARA, ORTHO, GAS KERNEL). THEREFORE, ALL THE P(2) HYDROGEN CROSS SECTION SETS ARE IDENTICAL TO ONE ANOTHER, AS ARE ALL THE P(3) HYDROGEN CROSS SECTION SETS.

TABLE 3-7 (CONTINUED)

I.D. NUMBER	MATERIAL	CROSS SECTION TYPE	SPECTRUM
0313	BORON	P3	1/E
0320	BORON	P0	CE
0321	BORON	P1	CE
0322	BORON	P2	1/E
0323	BORON	P3	1/E
0330	BORON	P0	R
0331	BORON	P1	R
0332	BORON	P2	1/E
0333	BORON	P3	1/E
0340	BORON	P0	S
0341	BORON	P1	S
0342	BORON	P2	1/E
0343	BORON	P3	1/E
0410	BORON-10	P0	CC
0411	BORON-10	P1	CC
0420	BORON-10	P0	CE
0421	BORON-10	P1	CE
0430	BORON-10	P0	R
0431	BORON-10	P1	R
0440	BORON-10	P0	S
0441	BORON-10	P1	S
0510	CADMIUM	P0	CC
0511	CADMIUM	P1	CC
0520	CADMIUM	P0	CE
0521	CADMIUM	P1	CE
0530	CADMIUM	P0	R
0531	CADMIUM	P1	R
0540	CADMIUM	P0	S
0541	CADMIUM	P1	S
0610	CARBON, 296 DEG. K.	P0	CC
0611	CARBON, 296 DEG. K.	P1	CC
0612	CARBON	P2	1/E
0613	CARBON	P3	1/E
0620	CARBON, 296 DEG. K.	P0	CE
0621	CARBON, 296 DEG. K.	P1	CE
0622	CARBON	P2	1/E
0623	CARBON	P3	1/E
0630	CARBON, 296 DEG. K.	P0	R
0631	CARBON, 296 DEG. K.	P1	R
0632	CARBON	P2	1/E
0633	CARBON	P3	1/E
0640	CARBON, 296 DEG. K.	P0	S
0641	CARBON, 296 DEG. K.	P1	S
0642	CARBON	P2	1/E
0643	CARBON	P3	1/E
0710	CHROMIUM	P0	CC
0711	CHROMIUM	P1	CC
0712	CHROMIUM	P2	1/E
0713	CHROMIUM	P3	1/E

TABLE 3-7 (CONTINUED)

I.D. NUMBER	MATERIAL	CROSS SECTION TYPE	SPECTRUM
0720	CHROMIUM	P0	CE
0721	CHROMIUM	P1	CE
0722	CHROMIUM	P2	1/E
0723	CHROMIUM	P3	1/E
0730	CHROMIUM	P0	R
0731	CHROMIUM	P1	R
0732	CHROMIUM	P2	1/E
0733	CHROMIUM	P3	1/E
0740	CHROMIUM	P0	S
0741	CHROMIUM	P1	S
0742	CHROMIUM	P2	1/E
0743	CHROMIUM	P3	1/E
0810	COBALT	P0	CC
0811	COBALT	P1	CC
0820	COBALT	P0	CE
0821	COBALT	P1	CE
0830	COBALT	P0	R
0831	COBALT	P1	R
0840	COBALT	P0	S
0841	COBALT	P1	S
0910	COPPER	P0	CC
0911	COPPER	P1	CC
0912	COPPER	P2	1/E
0913	COPPER	P3	1/E
0920	COPPER	P0	CE
0921	COPPER	P1	CE
0922	COPPER	P2	1/E
0923	COPPER	P3	1/E
0930	COPPER	P0	R
0931	COPPER	P1	R
0932	COPPER	P2	1/E
0933	COPPER	P3	1/E
0940	COPPER	P0	S
0941	COPPER	P1	S
0942	COPPER	P2	1/E
0943	COPPER	P3	1/E
1010	GADOLINIUM	P0	CC
1011	GADOLINIUM	P1	CC
1020	GADOLINIUM	P0	CE
1021	GADOLINIUM	P1	CE
1030	GADOLINIUM	P0	R
1031	GADOLINIUM	P1	R
1040	GADOLINIUM	P0	S
1041	GADOLINIUM	P1	S
1110	GOLD	P0	CC
1111	GOLD	P1	CC
1120	GOLD	P0	CE
1121	GOLD	P1	CE
1130	GOLD	P0	R

TABLE 3-7 (CONTINUED)

I.D. NUMBER	MATERIAL	CROSS SECTION TYPE	SPECTRUM
1131	GOLD	P1	R
1140	GOLD	P0	S
1141	GOLD	P1	S
1210	HYDROGEN, PARA, 20.4 DEG. K.	P0	CC
1211	HYDROGEN, PARA, 20.4 DEG. K.	P1	CC
1212	HYDROGEN	P2	1/E
1213	HYDROGEN	P3	1/E
1220	HYDROGEN, PARA, 20.4 DEG. K.	P0	CE
1221	HYDROGEN, PARA, 20.4 DEG. K.	P1	CE
1222	HYDROGEN	P2	1/E
1223	HYDROGEN	P3	1/E
1230	HYDROGEN, PARA, 20.4 DEG. K.	P0	R
1231	HYDROGEN, PARA, 20.4 DEG. K.	P1	R
1232	HYDROGEN	P2	1/E
1233	HYDROGEN	P3	1/E
1240	HYDROGEN, PARA, 20.4 DEG. K.	P0	S
1241	HYDROGEN, PARA, 20.4 DEG. K.	P1	S
1242	HYDROGEN	P2	1/E
1243	HYDROGEN	P3	1/E
1310	HYDROGEN, ORTHO, 20.4 DEG. K.	P0	CC
1311	HYDROGEN, ORTHO, 20.4 DEG. K.	P1	CC
1312	HYDROGEN	P2	1/E
1313	HYDROGEN	P3	1/E
1320	HYDROGEN, ORTHO, 20.4 DEG. K.	P0	CE
1321	HYDROGEN, ORTHO, 20.4 DEG. K.	P1	CE
1322	HYDROGEN	P2	1/E
1323	HYDROGEN	P3	1/E
1330	HYDROGEN, ORTHO, 20.4 DEG. K.	P0	R
1331	HYDROGEN, ORTHO, 20.4 DEG. K.	P1	R
1332	HYDROGEN	P2	1/E
1333	HYDROGEN	P3	1/E
1340	HYDROGEN, ORTHO, 20.4 DEG. K.	P0	S
1341	HYDROGEN, ORTHO, 20.4 DEG. K.	P1	S
1342	HYDROGEN	P2	1/E
1343	HYDROGEN	P3	1/E
1410	HYDROGEN, PARA, 300 DEG. K.	P0	CC
1411	HYDROGEN, PARA, 300 DEG. K.	P1	CC
1412	HYDROGEN	P2	1/E
1413	HYDROGEN	P3	1/E
1420	HYDROGEN, PARA, 300 DEG. K.	P0	CE
1421	HYDROGEN, PARA, 300 DEG. K.	P1	CE
1422	HYDROGEN	P2	1/E
1423	HYDROGEN	P3	1/E
1430	HYDROGEN, PARA, 300 DEG. K.	P0	R
1431	HYDROGEN, PARA, 300 DEG. K.	P1	R
1432	HYDROGEN	P2	1/E
1433	HYDROGEN	P3	1/E
1440	HYDROGEN, PARA, 300 DEG. K.	P0	S
1441	HYDROGEN, PARA, 300 DEG. K.	P1	S

TABLE 3-7 (CONTINUED)

I.D. NUMBER	MATERIAL	CROSS SECTION TYPE	SPECTRUM
1442	HYDROGEN	P2	1/E
1443	HYDROGEN	P3	1/E
1510	HYDROGEN, ORTHO, 300 DEG. K.	P0	CC
1511	HYDROGEN, ORTHO, 300 DEG. K.	P1	CC
1512	HYDROGEN	P2	1/E
1513	HYDROGEN	P3	1/E
1520	HYDROGEN, ORTHO, 300 DEG. K.	P0	CE
1521	HYDROGEN, ORTHO, 300 DEG. K.	P1	CE
1522	HYDROGEN	P2	1/E
1523	HYDROGEN	P3	1/E
1530	HYDROGEN, ORTHO, 300 DEG. K.	P0	R
1531	HYDROGEN, ORTHO, 300 DEG. K.	P1	R
1532	HYDROGEN	P2	1/E
1533	HYDROGEN	P3	1/E
1540	HYDROGEN, ORTHO, 300 DEG. K.	P0	S
1541	HYDROGEN, ORTHO, 300 DEG. K.	P1	S
1542	HYDROGEN	P2	1/E
1543	HYDROGEN	P3	1/E
1610	HYDROGEN, GAS, 2500 DEG. K.	P0	CC
1611	HYDROGEN, GAS, 2500 DEG. K.	P1	CC
1612	HYDROGEN	P2	1/E
1613	HYDROGEN	P3	1/E
1620	HYDROGEN, GAS, 2500 DEG. K.	P0	CE
1621	HYDROGEN, GAS, 2500 DEG. K.	P1	CE
1622	HYDROGEN	P2	1/E
1623	HYDROGEN	P3	1/E
1630	HYDROGEN, GAS, 2500 DEG. K.	P0	R
1631	HYDROGEN, GAS, 2500 DEG. K.	P1	R
1632	HYDROGEN	P2	1/E
1633	HYDROGEN	P3	1/E
1640	HYDROGEN, GAS, 2500 DEG. K.	P0	S
1641	HYDROGEN, GAS, 2500 DEG. K.	P1	S
1642	HYDROGEN	P2	1/E
1643	HYDROGEN	P3	1/E
1710	INDIUM-115	P0	CC
1711	INDIUM-115	P1	CC
1720	INDIUM-115	P0	CE
1721	INDIUM-115	P1	CE
1730	INDIUM-115	P0	R
1731	INDIUM-115	P1	R
1740	INDIUM-115	P0	S
1741	INDIUM-115	P1	S
1810	IRON	P0	CC
1811	IRON	P1	CC
1812	IRON	P2	1/E
1813	IRON	P3	1/E
1820	IRON	P0	CE
1821	IRON	P1	CE
1822	IRON	P2	1/E

TABLE 3-7 (CONTINUED)

I.D. NUMBER	MATERIAL	CROSS SECTION TYPE	SPECTRUM
2410	MANGANESE	P0	CC
2411	MANGANESE	P1	CC
2412	MANGANESE	P2	1/E
2413	MANGANESE	P3	1/E
2420	MANGANESE	P0	CE
2421	MANGANESE	P1	CE
2422	MANGANESE	P2	1/E
2423	MANGANESE	P3	1/E
2440	MANGANESE	P0	S
2441	MANGANESE	P1	S
2442	MANGANESE	P2	1/E
2443	MANGANESE	P3	1/E
2510	MOLYBDENUM	P0	CC
2511	MOLYBDENUM	P1	CC
2512	MOLYBDENUM	P2	1/E
2513	MOLYBDENUM	P3	1/E
2520	MOLYBDENUM	P0	CE
2521	MOLYBDENUM	P1	CE
2522	MOLYBDENUM	P2	1/E
2523	MOLYBDENUM	P3	1/E
2530	MOLYBDENUM	P0	R
2531	MOLYBDENUM	P1	R
2532	MOLYBDENUM	P2	1/E
2533	MOLYBDENUM	P3	1/E
2540	MOLYBDENUM	P0	S
2541	MOLYBDENUM	P1	S
2542	MOLYBDENUM	P2	1/E
2543	MOLYBDENUM	P3	1/E
2610	NICKEL	P0	CC
2611	NICKEL	P1	CC
2612	NICKEL	P2	1/E
2613	NICKEL	P3	1/E
2620	NICKEL	P0	CE
2621	NICKEL	P1	CE
2622	NICKEL	P2	1/E
2623	NICKEL	P3	1/E
2630	NICKEL	P0	R
2631	NICKEL	P1	R
2632	NICKEL	P2	1/E
2633	NICKEL	P3	1/E
2640	NICKEL	P0	S
2641	NICKEL	P1	S
2642	NICKEL	P2	1/E
2643	NICKEL	P3	1/E
2710	NIOBIUM	P0	CC
2711	NIOBIUM	P1	CC
2712	NIOBIUM	P2	1/E
2713	NIOBIUM	P3	1/E
2720	NIOBIUM	P0	CE

TABLE 3-7 (CONTINUED)

I.D. NUMBER	MATERIAL	CROSS SECTION TYPE	SPECTRUM
1823	IRON	P3	1/E
1830	IRON	P0	R
1831	IRON	P1	R
1832	IRON	P2	1/E
1833	IRON	P3	1/E
1840	IRON	P0	S
1841	IRON	P1	S
1842	IRON	P2	1/E
1843	IRON	P3	1/E
1910	LEAD	P0	CC
1911	LEAD	P1	CC
1920	LEAD	P0	CE
1921	LEAD	P1	CE
1930	LEAD	P0	R
1931	LEAD	P1	R
1940	LEAD	P0	S
1941	LEAD	P1	S
2010	LITHIUM	P0	CC
2011	LITHIUM	P1	CC
2020	LITHIUM	P0	CE
2021	LITHIUM	P1	CE
2030	LITHIUM	P0	R
2031	LITHIUM	P1	R
2040	LITHIUM	P0	S
2041	LITHIUM	P1	S
2110	LITHIUM-6	P0	CC
2111	LITHIUM-6	P1	CC
2120	LITHIUM-6	P0	CE
2121	LITHIUM-6	P1	CE
2130	LITHIUM-6	P0	R
2131	LITHIUM-6	P1	R
2140	LITHIUM-6	P0	S
2141	LITHIUM-6	P1	S
2210	LITHIUM-7	P0	CC
2211	LITHIUM-7	P1	CC
2220	LITHIUM-7	P0	CE
2221	LITHIUM-7	P1	CE
2230	LITHIUM-7	P0	R
2231	LITHIUM-7	P1	R
2240	LITHIUM-7	P0	S
2241	LITHIUM-7	P1	S
2310	MAGNESIUM	P0	CC
2311	MAGNESIUM	P1	CC
2320	MAGNESIUM	P0	CE
2321	MAGNESIUM	P1	CE
2330	MAGNESIUM	P0	R
2331	MAGNESIUM	P1	R
2340	MAGNESIUM	P0	S
2341	MAGNESIUM	P1	S



TABLE 3-7 (CONTINUED)

I.D. NUMBER	MATERIAL	CROSS SECTION TYPE	SPECTRUM
2721	NIOBIUM	P1	CE
2722	NIOBIUM	P2	1/E
2723	NIOBIUM	P3	1/E
2730	NIOBIUM	P0	R
2731	NIOBIUM	P1	R
2732	NIOBIUM	P2	1/E
2733	NIOBIUM	P3	1/E
2740	NIOBIUM	P0	S
2741	NIOBIUM	P1	S
2742	NIOBIUM	P2	1/E
2743	NIOBIUM	P3	1/E
2810	NITROGEN	P0	CC
2811	NITROGEN	P1	CC
2820	NITROGEN	P0	CE
2821	NITROGEN	P1	CE
2830	NITROGEN	P0	R
2831	NITROGEN	P1	R
2840	NITROGEN	P0	S
2841	NITROGEN	P1	S
2910	OXYGEN	P0	CC
2911	OXYGEN	P1	CC
2920	OXYGEN	P0	CE
2921	OXYGEN	P1	CE
2930	OXYGEN	P0	R
2931	OXYGEN	P1	R
2940	OXYGEN	P0	S
2941	OXYGEN	P1	S
3010	SILICON	P0	CC
3011	SILICON	P1	CC
3020	SILICON	P0	CE
3021	SILICON	P1	CE
3030	SILICON	P0	R
3031	SILICON	P1	R
3040	SILICON	P0	S
3041	SILICON	P1	S
3210	TANTALUM	P0	CC
3211	TANTALUM	P1	CC
3220	TANTALUM	P0	CE
3221	TANTALUM	P1	CE
3310	TITANIUM	P0	CC
3311	TITANIUM	P1	CC
3312	TITANIUM	P2	1/E
3313	TITANIUM	P3	1/E
3320	TITANIUM	P0	CE
3321	TITANIUM	P1	CE
3322	TITANIUM	P2	1/E
3323	TITANIUM	P3	1/E
3330	TITANIUM	P0	R
3331	TITANIUM	P1	R

TABLE 3-7 (CONTINUED)

I.D. NUMBER	MATERIAL	CROSS SECTION TYPE	SPECTRUM
3332	TITANIUM	P2	1/E
3333	TITANIUM	P3	1/E
3340	TITANIUM	P0	S
3341	TITANIUM	P1	S
3342	TITANIUM	P2	1/E
3343	TITANIUM	P3	1/E
3440	TUNGSTEN	P0	S
3441	TUNGSTEN	P1	S
3442	TUNGSTEN	P2	1/E
3443	TUNGSTEN	P3	1/E
3510	URANIUM-235	P0	CC
3511	URANIUM-235	P1	CC
3512	URANIUM-235	P2	1/E
3513	URANIUM-235	P3	1/E
3520	URANIUM-235	P0	CE
3521	URANIUM-235	P1	CE
3522	URANIUM-235	P2	1/E
3523	URANIUM-235	P3	1/E
3610	URANIUM-238	P0	CC
3611	URANIUM-238	P1	CC
3612	URANIUM-238	P2	1/E
3613	URANIUM-238	P3	1/E
3620	URANIUM-238	P0	CE
3621	URANIUM-238	P1	CE
3622	URANIUM-238	P2	1/E
3623	URANIUM-238	P3	1/E
3710	ZIRCONIUM	P0	CC
3711	ZIRCONIUM	P1	CC
3720	ZIRCONIUM	P0	CE
3721	ZIRCONIUM	P1	CE
3730	ZIRCONIUM	P0	R
3731	ZIRCONIUM	P1	R
3740	ZIRCONIUM	P0	S
3741	ZIRCONIUM	P1	S
3839	RING VANE PRESCRIPTION	TRC	R

TABLE 3-8

MICROSCOPIC REACTION RATE CROSS SECTIONS ON TAPE NO. 3

IDENTIFICATION NUMBER	MATERIAL	SPECTRUM*
0119	ALUMINUM	CC
0129	ALUMINUM	CE
0139	ALUMINUM	R
0149	ALUMINUM	S
0219	BERYLLIUM, 296 DEG. K.	CC
0229	BERYLLIUM, 296 DEG. K.	CE
0239	BERYLLIUM, 296 DEG. K.	R
0249	BERYLLIUM, 296 DEG. K.	S
0319	BORON	CC
0329	BORON	CE
0339	BORON	R
0349	BORON	S
0419	BORON-10	CC
0429	BORON-10	CE
0439	BORON-10	R
0449	BORON-10	S
0519	CADMIUM	CC
0529	CADMIUM	CE
0539	CADMIUM	R
0549	CADMIUM	S
0619	CARBON, 296 DEG. K.	CC
0629	CARBON, 296 DEG. K.	CE
0639	CARBON, 296 DEG. K.	R
0649	CARBON, 296 DEG. K.	S
0719	CHROMIUM	CC
0729	CHROMIUM	CE
0739	CHROMIUM	R
0749	CHROMIUM	S
0819	COBALT	CC
0829	COBALT	CE
0839	COBALT	R
0849	COBALT	S
0919	COPPER	CC
0929	COPPER	CE
0939	COPPER	R
0949	COPPER	S
1019	GADOLINIUM	CC
1029	GADOLINIUM	CE
1039	GADOLINIUM	R
1049	GADOLINIUM	S
1119	GOLD	CC
1129	GOLD	CE
1139	GOLD	R

*KEY. CC-CORE CENTER, CE-CORE EDGE, R-REFLECTOR, S-SHIELD.

TABLE 3-8 (CONTINUED)

IDENTIFICATION NUMBER	MATERIAL	SPECTRUM
1149	GOLD	S
1219	HYDROGEN, PARA, 20.4 DEG. K.	CC
1229	HYDROGEN, PARA, 20.4 DEG. K.	CE
1239	HYDROGEN, PARA, 20.4 DEG. K.	R
1249	HYDROGEN, PARA, 20.4 DEG. K.	S
1319	HYDROGEN, ORTHO, 20.4 DEG. K.	CC
1329	HYDROGEN, ORTHO, 20.4 DEG. K.	CE
1339	HYDROGEN, ORTHO, 20.4 DEG. K.	R
1349	HYDROGEN, ORTHO, 20.4 DEG. K.	S
1419	HYDROGEN, PARA, 300 DEG. K.	CC
1429	HYDROGEN, PARA, 300 DEG. K.	CE
1439	HYDROGEN, PARA, 300 DEG. K.	R
1449	HYDROGEN, PARA, 300 DEG. K.	S
1519	HYDROGEN, ORTHO, 300 DEG. K.	CC
1529	HYDROGEN, ORTHO, 300 DEG. K.	CE
1539	HYDROGEN, ORTHO, 300 DEG. K.	R
1549	HYDROGEN, ORTHO, 300 DEG. K.	S
1619	HYDROGEN, GAS, 200 DEG. K.	CC
1629	HYDROGEN, GAS, 2500 DEG. K.	CE
1639	HYDROGEN, GAS, 2500 DEG. K.	R
1649	HYDROGEN, GAS, 2500 DEG. K.	S
1719	INDIUM-115	CC
1729	INDIUM-115	CE
1739	INDIUM-115	R
1749	INDIUM-115	S
1819	IRON	CC
1829	IRON	CE
1839	IRON	R
1849	IRON	S
1919	LEAD	CC
1929	LEAD	CE
1939	LEAD	R
1949	LEAD	S
2019	LITHIUM	CC
2029	LITHIUM	CE
2039	LITHIUM	R
2049	LITHIUM	S
2119	LITHIUM-6	CC
2129	LITHIUM-6	CE
2139	LITHIUM-6	R
2149	LITHIUM-6	S
2219	LITHIUM-7	CC
2229	LITHIUM-7	CE
2239	LITHIUM-7	R
2249	LITHIUM-7	S
2319	MAGNESIUM	CC
2329	MAGNESIUM	CE
2339	MAGNESIUM	R
2349	MAGNESIUM	S

TABLE 3-8 (CONTINUED)

IDENTIFICATION NUMBER	MATERIAL	SPECTRUM
2419	MANGANESE	CC
2429	MANGANESE	CE
2449	MANGANESE	S
2519	MOLYBDENUM	CC
2529	MOLYBDENUM	CE
2539	MOLYBDENUM	R
2549	MOLYBDENUM	S
2619	NICKEL	CC
2629	NICKEL	CE
2639	NICKEL	R
2649	NICKEL	S
2719	NIOBIUM	CC
2729	NIOBIUM	CE
2739	NIOBIUM	R
2749	NIOBIUM	S
2819	NITROGEN	CC
2829	NITROGEN	CE
2839	NITROGEN	R
2849	NITROGEN	S
2919	OXYGEN	CC
2929	OXYGEN	CE
2939	OXYGEN	R
2949	OXYGEN	S
3019	SILICON	CC
3029	SILICON	CE
3039	SILICON	R
3049	SILICON	S
3219	TANTALUM	CC
3229	TANTALUM	CE
3319	TITANIUM	CC
3329	TITANIUM	CE
3339	TITANIUM	R
3349	TITANIUM	S
3449	TUNGSTEN	S
3519	URANIUM-235	CC
3529	URANIUM-235	CE
3619	URANIUM-238	CC
3629	URANIUM-238	CE
3719	ZIRCONIUM	CC
3729	ZIRCONIUM	CE
3739	ZIRCONIUM	R
3749	ZIRCONIUM	S

TABLE 3-9

CHANGES AND ADDITIONS TO GAMBIT MASTER LIBRARY NEUTRON
CROSS SECTIONS

<u>Element or Isotope</u>	<u>Reference</u>	<u>Element or Isotope</u>	<u>Reference</u>
Hydrogen	3.6, 3.8, 3.13	Manganese	3.11
Carbon	3.12	Tantalum	3.5
Beryllium	3.9, 3.12	Gadolinium	3.5
Boron	3.9, 3.13	Tungsten	3.10
Aluminum	3.5	Silicon	3.13
Titanium	3.5	Oxygen	3.5
Chromium	3.5	Magnesium	3.13
Iron	3.5	Zirconium	3.11
Copper	3.13	Lead	3.11
Niobium	3.7, 3.11	Lithium	3.13
Molybdenum	3.5	Indium	3.11
²³⁵ Uranium	3.6, 3.8, 3.13	Gold	3.13
²³⁸ Uranium	3.6, 3.8	Cadmium	3.13
Nickel	3.5	Nitrogen	3.13
		Cobalt	3.13

4.0 PHOTON CROSS SECTIONS

The point kernel and discrete ordinates transport codes of the MSFC code package use the same basic, photon, cross section library data and techniques. A basic library of energy dependent, photo-electric and pair-production data is used in the KAP-VI point kernel code, the SCAP single- or albedo-scatter, point kernel code, the MAP radiation transport code, and the GAMLEG-W multigroup, cross section preparation code. These codes calculate Compton scattering cross sections from the Klein-Nishina equation^(4.1) and absorption cross sections from the basic library data to provide total cross section data. The numerical techniques used in the KAP-VI, SCAP, MAP, and GAMLEG-W codes are completely consistent; the final form of the data, however, is dependent on the code's individual requirements. A discussion of the basic library data is presented in Section 4.1; the generation of photon cross sections in each type of code is described in Sections 4.2 and 4.3.

4.1 BASIC LIBRARY DATA

The KAP-VI, SCAP, MAP, and GAMLEG-W codes in the MSFC code package accept the same basic pair-production and photo-electric cross section data. These data are punched on data cards for input to the GAMLEG-W^(4.2) code. The GAMLEG-W code generated Master Library Tape No. 5. This tape contains the cross sections to be used as input to each of the codes (including subsequent use in GAMLEG-W).

The basic, pair-production and photo-electric data are obtained from Reference 4.3. These data are compiled in tabular form for the 51 elements shown in Table 4-1. Pointwise data are provided at energy points in the range of 0.01 MeV to 20.0 MeV. The number of energy points for each element data is dependent on the number of points required to accurately describe the variations of the data with energy. For photo-electric absorption, the presence of a double valued function at the K, L, and M electron shell absorption edges is represented in the library by the use of continuous data, i. e., values of the cross section at two energy points, $E_K + \delta$ and $E_K - \delta$, as shown in Figure 4-1 (where δ was on the order of 0.001 MeV).

A description of the format of the pair-production and photo-electric cross section library tape is shown in Table 4-2. As indicated, each element requires that the data be in order of increasing photon energy. Five binary records describe each element on the magnetic tape. This magnetic tape contains a title record as the first record on tape. The specific energy points and cross section values are listed in Appendix A.

4.2 CROSS SECTIONS FOR USE IN POINT KERNEL CODES

The MSFC codes, which apply the point kernel technique, obtain photon cross sections in a consistent fashion. These codes are:

- 1) KAP-VI - a revised version of the KAP-V point kernel code,
- 2) SCAP - a single- or albedo-scatter, point kernel code of similar geometry capability to KAP-VI, and
- 3) MAP - a radiation transport code which includes point kernel techniques. The MAP code uses the surface angular fluxes from the DOT-IIW code as angular dependent source data.

Each of the above codes use the magnetic tape library data as input to a separate subroutine in each code. This subroutine calculates the absorption cross section, $\sigma_a(E_i)$, as the sum of the photo-electric absorption cross section, $\sigma_{pe}(E_i)$, and pair production absorption cross section, $\sigma_{pp}(E_i)$. The absorption cross section is then interpolated at specified energy point values, E_K . The interpolation technique employs a linear variation of the logarithm of the cross section values with the logarithm of the energy for the two energy points bounding the input specified energy value, E_K . Two special conditions of interpolation are included:

- 1) If either cross section value bounding the energy point is 0.0, then a linear variation of cross section value with energy is assumed, and
- 2) If the energy value is outside the energy range of the pointwise library data, then the value is set to the end point value and no extrapolation is performed.

Total cross section data are obtained using different techniques in the KAP-VI, MAP and SCAP codes. Each technique is described in the following paragraphs.

4.2.1 KAP-VI and MAP Total Photon Cross Sections

The calculation of the total cross section is identical in the KAP-VI and MAP codes. The two codes require total cross section data at input specified energy points only. The interpolated absorption data, $\sigma_a(E_K)$, described earlier are combined with the Compton scatter cross section, $\sigma_c(E_K)$, to provide the total cross section $\sigma_t(E_K)$. The Compton cross section in units of barns/electron is calculated from the Klein-Nishina equation for the inelastic scattering of a photon of energy, E_K , with a free electron as follows:

$$\sigma_c(E_K) = \left(\frac{3}{8}\right) (0.665) \frac{\ln(1+2E_K) \left[E_K - 2 - \frac{2}{E_K} \right] + 4 + \frac{2E_K^2 (1+E_K)}{(1+2E_K)^2}}{E_K^2}, \quad E_K \text{ is in units of electron rest masses.}$$

The total cross section, $\sigma_t(E_K)$, in barns, is then defined as,

$$\sigma_t(E_K) = \sigma_a(E_K) + Z_i \cdot \sigma_c(E_K)$$

where Z_i is the atomic number (electrons/atom) of the element. These data are converted into mass absorption data (cm^2/gm) for each element for use in the KAP-VI and MAP calculations. A description of each code's use of these data is presented in Volumes 3 and 4.

4.2.2 SCAP Total Cross Section Data

In the single- or albedo-scatter code, SCAP, the numerical techniques used to obtain the total cross section differ because cross section data for primary radiation of input specified energy, E'_K , and the single scattered energy, E''_K are required. For this reason, the SCAP code computes the absorption cross sections at input specified energy values, E_K , as described earlier. These data are then interpolated during a SCAP calculation to the required energy values, E'_K and E''_K . Interpolated values are combined with calculated values of the Compton cross section, $\sigma_c(E'_K)$ and $\sigma_c(E''_K)$ to provide total cross sections for the primary leg and single scattered leg attenuation calculations. The detailed use of cross section data in the SCAP code is described in Volume 4.

4.3 DISCRETE ORDINATES TRANSPORT CROSS SECTIONS

The same pair-production and photo-electric cross section tape that is used in the KAP-VI, SCAP, and MAP codes is also used in the GAMLEG-W multigroup, cross section preparation code. The GAMLEG-W code combines these data with the Compton absorption cross section to obtain the total absorption cross section. The Klein-Nishina equation is solved for the inelastic scattering of a photon with a free electron. The doubly differential scattering cross section is then approximated with a truncated Legendre polynomial expansion of the form:

$$\sigma_s(E' \rightarrow E, \vec{\Omega}' \cdot \vec{\Omega}) = \frac{1}{4\pi} \sum_{\ell=0}^{\infty} (2\ell + 1) P_{\ell}(\mu_0) \sigma_{s\ell}(E' \rightarrow E)$$

where $\mu_0 = \vec{\Omega}' \cdot \vec{\Omega}$

and P_{ℓ} is a Legendre polynomial.

A generalized Legendre polynomial expansion is included in the GAMLEG-W code so that any P_{ℓ} order may be generated.

A microscopic, multigroup, gamma ray transport cross section tape is generated in 13 energy groups using the GAMLEG-W code for the 51 elements shown in Table 4-1 using a P_9 Legendre polynomial expansion of the scattering cross section. These data are contained on Master Library Tape No. 4. The multigroup structure of this library tape is shown in Table 4-3. This tape format is compatible with the ANISN-W, DOT-IIW, and APPROPOS codes. The tape contains a lead title record of two words, followed by the P_0 data for each element, the P_1 data, etc. A 105 energy point, ²³⁵Uranium, prompt fission photon source spectrum is used for averaging these cross sections. This source spectrum is adequate for photon transport analyses of graphite-moderated, nuclear rocket reactors. When used in the DOT-IIW and ANISN-W discrete ordinates transport codes, these cross sections permit the calculation of energy fluxes in units of (MeV/cm²-sec) as opposed to particle fluxes in units of (photons/cm²-sec). Energy deposition calculations are more conveniently calculated using energy flux data.

Each gamma ray cross section set consists of 13 groups and 16 cross section types for a total array size of 208 pieces.

Each energy group contains 16 different types of cross sections as follows:

- 1) σ_g^a , in position 1, the total photon absorption cross section (the sum of the pair-production, photo-electric, and Compton-absorption cross sections).
- 2) $\nu_g \sigma_g^f$, in position 2, zero for all groups.
- 3) σ_g^t , in position 3, the total collision cross section, which is the sum of σ_g^a plus the total P_0 component of the Compton scatter cross section $\sigma_{g'g}^{P_0}$, calculated from

$$\sigma_{g'g}^{P_0} = \sum_G \sigma_{g'g}^{P_0} \quad \text{for } g' \leq g$$

- 4) $\sigma_{g'g}$, for $g' = g$, or simply σ_{gg} , in position 4, the within group scattering cross section defined as:

$$\sigma_{gg} = \sigma_g^t - \sigma_g^a - \sum_G \sigma_{g'g}^{P_0} \quad \text{for } g' \neq g$$

5 to 16) $\sigma_{g'g}$, for $g' < g$, in positions 5 to 16, inclusive, the downscatter cross section (always considered to be transfer into a group). For example, the fifth position in group two would represent transfer from group one into group two. These transfer cross sections represent the inelastic scattering of a photon with a free electron as computed by the Klein-Nishina equation.

For the P_0 data ($l > 0$), table positions 1, 2, and 3 are zero. Impossible transfer elements, such as downscatter into group 1, are entered as zero.

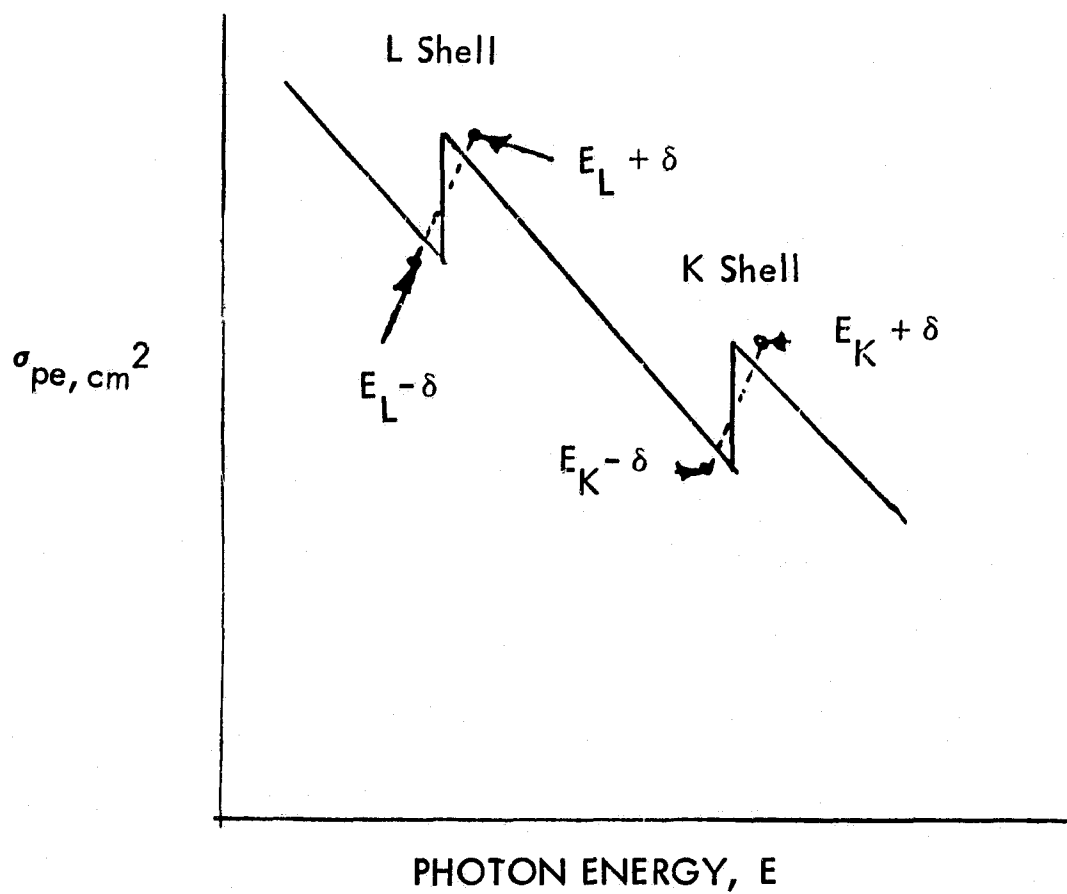


Figure 4-1. Representation of K, L, M Electron Shell Photoelectric Absorption Cross Sections in Basic Library

TABLE 4-1

GAMMA RAY CROSS SECTION LIBRARY DATA PLACED ON TAPE BY GAMLEG-W

Library Identification Number	Atomic Number	Element Name	Library Identification Number	Atomic Number	Element Name
1	1	Hydrogen	26	39	Yttrium
2	2	Helium	27	40	Zirconium
3	3	Lithium	28	41	Niobium
4	4	Beryllium	29	42	Molybdenum
5	5	Boron	30	47	Silver
6	6	Carbon	31	48	Cadmium
7	7	Nitrogen	32	49	Indium
8	8	Oxygen	33	50	Tin
9	11	Sodium	34	55	Cesium
10	12	Magnesium	35	56	Barium
11	13	Aluminum	36	62	Samarium
12	14	Silicon	37	64	Gadolinium
13	15	Phosphorus	38	66	Dysprosium
14	16	Sulfur	39	70	Ytterbium
15	19	Potassium	40	72	Hafnium
16	20	Calcium	41	73	Tantalum
17	22	Titanium	42	74	Tungsten
18	23	Vanadium	43	79	Gold
19	24	Chromium	44	80	Mercury
20	25	Manganese	45	82	Lead
21	26	Iron	46	84	Polonium
22	27	Cobalt	47	90	Thorium
23	28	Nickel	48	91	Protactinium
24	29	Copper	49	92	Uranium
25	30	Zinc	50	93	Nepthunium
			51	94	Plutonium

TABLE 4-2
 REQUIRED BASIC LIBRARY DATA FORMAT
 (Repeated for Each Element)

<u>Punch Card Type and FORTRAN Form</u>	<u>Magnetic Tape**</u>	<u>Required Data</u>
1 (2; 12A4)	Record 1	Name of Element
2 (13,2E12.5)	Record 2	IA, number of energy points Z, Atomic Number of element, electrons/atom AW, Atomic Weight of element atoms/gram-atom
3 (6E12.5)	Record 3	E_i , * IA point values of energy describing the cross section input, MeV
4 (6E12.5)	Record 4	$\sigma_{pe}(E_i)$, IA values of photo- electric absorption cross sections at energy points, (E_i), barns
5 (6E12.5)	Record 5	$\sigma_{pp}(E_i)$, IA values of pair- production cross sections at energy points, (E_i), barns

* Values of E_i must be in order of increasing energy.

** The lead record on the tape contains a title record. The MSFC tape contains
 (5 x 51) + 1 records.

TABLE 4-3
GAMMA RAY ENERGY GROUP STRUCTURE

<u>Group Number</u>	<u>Energy Bounds (MeV)</u>
1	7.50 - 9.50
2	7.00 - 7.50
3	6.00 - 7.00
4	5.00 - 6.00
5	4.00 - 5.00
6	3.00 - 4.00
7	2.60 - 3.00
8	2.20 - 2.60
9	1.80 - 2.20
10	1.35 - 1.80
11	0.90 - 1.35
12	0.40 - 0.90
13	0.10 - 0.40

5.0 PREPARATION OF MULTIGROUP CROSS SECTION DATA

A 52 energy group, microscopic library of neutron cross sections is prepared for use in the discrete ordinates transport codes DOT-IIW and ANISN-W. Frequently, however, the use does not require this much detail or does not have enough computer core storage available to use these data. For these reasons, the need to reduce the 52 energy group data into "few group" data is evident. In this section, two techniques for generating "few group" data with the MSFC code package and libraries are presented.

5.1 USE OF THE ANISN CODE TO PROVIDE GROUP-COLLAPSED DATA

The ANISN-W code (Volume 4) can be used to provide few group data by use of the cross section weighting option to average the 52 group cross section data over the appropriate energy group limits. The averaging is done by using the average, region-flux spectrum as the weighting function. The flux spectrum can be calculated using discrete ordinates or diffusion theory by choosing the appropriate value of IDAT2 in the input data. The user also has the option of using the flux spectrum in an infinite homogeneous medium containing a spatially uniform source of arbitrary spectrum as the weighting function. Because this calculation is spatially independent, requiring only one mesh interval and one inner iteration per group, very little computing time is required.

The technique of group collapsing has two requirements as follows:

- 1) The actual pointwise spectrum in the region must not differ appreciably from the average region spectrum. If the spectrum varies rapidly with spatial position, multiple zones should be used to describe the material.
- 2) The energy bounds of the few group data must correspond to the energy bounds of the 52 energy group data.

When microscopic weighted cross sections are requested, a set of cross sections is produced for each component of each material in each zone. Since the mixing table is used to determine the components of a material, MS in the input data must be greater than zero when microscopic weighting is specified. When macroscopic cross sections are requested, a set of cross sections is produced for each material in each zone.

If the cross section structure for the weighted cross sections will not accommodate the complete multigroup scattering matrix, the "extra" transfer coefficients are placed such that they transfer as far down (or up) as possible.

Upscatter removal is accomplished by zone by subtracting the reaction rate due to $\sigma_{j \rightarrow i}$ from the reaction rate due to $\sigma_{i \rightarrow j}$, where $j > i$. Thus, the net transfer rate between groups j and i is preserved.

The few group cross sections obtained from ANISN-W can be used for subsequent calculations in the ANISN-W and DOT-IIW codes. The few group energy bounds should coincide with the 16 energy group structure given in Table 5-1 if the data are to be used with the gamma ray energy production data library prepared for the APPROPOS code.

5.2 USE OF THE APPROPOS CODE TO PROVIDE GROUP-COLLAPSED DATA

The APPROPOS code can also be used to provide few group data from the 52 group cross section data. The use of the APPROPOS code instead of the ANISN-W code has the following advantages:

- 1) The APPROPOS code does not have the severe core data storage limitations that the ANISN-W code has because the APPROPOS code processes the fine group microscopic data one set at a time instead of all at once.
- 2) The APPROPOS code has the capability of generating coupled, neutron-photon, cross section sets.
- 3) With a set of region dependent spectra as input data or an ANISN-W flux output tape, as many sets of cross sections may be generated, as desired. Any fine group cross section set can be weighted over any input spectra.
- 4) Reciprocal weighting of transport corrected cross sections may be computed, if desired.

In addition, the APPROPOS code has the following features in common with the ANISN-W code:

- 1) The flux weighting algorithm is identical,
- 2) Upscatter removal is identical, and
- 3) The group collapse algorithm is identical.

The APPROPOS code is limited in that only the region dependent flux spectra from an ANISN-W calculation is calculated as a weighting function. However, the use of the weighting function in the APPROPOS code is such that, if provided on cards or tape, the flux and its higher moments can be used as weighting functions.

In general, the APPROPOS code will provide group-collapsed, upscatter-removed, cross section data more conveniently and economically than the ANISN-W code.

TABLE 5-1

"FEW GROUP" NEUTRON ENERGY GROUP STRUCTURE

<u>"Few Group" Number</u>	<u>Energy Bounds (eV)</u>	<u>Lethargy Bounds</u>
1	2.87×10^6 to 1.0×10^7	0 to 1.25
2	1.35×10^6 to 2.87×10^6	1.25 to 2.00
3	8.21×10^5 to 1.35×10^6	2.00 to 2.50
4	3.88×10^5 to 8.21×10^5	2.50 to 3.25
5	1.11×10^5 to 3.88×10^5	3.25 to 4.50
6	1.50×10^4 to 1.11×10^5	4.50 to 6.50
7	5.53×10^3 to 1.50×10^4	6.50 to 7.50
8	5.83×10^2 to 5.53×10^3	7.50 to 9.75
9	7.89×10^1 to 5.83×10^2	9.75 to 11.75
10	1.068×10^1 to 7.89×10^1	11.75 to 13.75
11	1.86×10^0 to 1.068×10^1	13.75 to 15.50
12	3.0×10^{-1} to 1.86×10^0	15.50 to 17.32
13	1.2×10^{-1} to 3.0×10^{-1}	17.32 to 18.24
14	6.0×10^{-2} to 1.2×10^{-1}	18.24 to 18.93
15	2.0×10^{-2} to 6.0×10^{-2}	18.93 to 20.03
16	0.0 to 2.0×10^{-2}	20.03 to ∞

6.0 NUCLEAR AND RADIATION ANALYSIS BASIC DATA

In the nuclear and radiation analysis of a nuclear system, certain basic, nuclear data are necessary. In this section, the following basic data are described:

- 1) Spectrum of prompt gamma ray energy from the fission of $^{235}\text{Uranium}$,
- 2) Spectrum of decay gamma ray energy from the fission of $^{235}\text{Uranium}$ as a function of reactor run time,
- 3) Neutron and gamma ray dose conversion factors,
- 4) Spectrum of gamma ray energy due to (n, γ) , $(n; p, \gamma)$ and $(n; \alpha, \gamma)$ reactions, and
- 5) Spectrum of gamma ray energy due to $(n; n', \gamma)$ reactions.

The above information is included in the basic data library of the APPROPOS cross section preparation code.

6.1 PROMPT GAMMA RAY ENERGY SPECTRUM

Table 6-1 shows the spectrum of prompt gamma ray energy emitted from the fission of $^{235}\text{Uranium}$. (6.1) These data include the isomeric transition gamma rays emitted between 0 and 10^{-3} seconds after fission. (6.2) A total of 8.178 MeV/Sec-Fission is released. These data are used in the calculation of the prompt gamma ray distributed source due to (n, f) reactions.

6.2 DECAY GAMMA RAY ENERGY SPECTRUM

Table 6-2 shows the spectrum of decay gamma ray energy as a function of reactor run time from the fission of $^{235}\text{Uranium}$. Reactor run times from 10^1 to 10^8 seconds are included. These data were obtained from the S-4 code. (6.3) The spectral dependence was obtained from the 408 code. (6.4) These data are used in the calculation of the decay gamma ray distributed source.

6.3 NEUTRON AND GAMMA RAY DOSE CONVERSION FACTORS

Conversion factors for obtaining neutron kinetic energy dose rate from neutron fluxes are shown in Table 6-3. Conversion factors for obtaining gamma ray dose rate from photon energy fluxes are shown in Table 6-4. The neutron dose conversion factors are

shown in Table 6-4. The neutron dose conversion factors are obtained from Reference 6.5. The gamma ray dose conversion factors are obtained by hand calculations using the GAMLEG-W energy absorption data.

6.4 CAPTURE GAMMA RAY ENERGY SPECTRUM

The spectrum of gamma ray energy due to the (n, γ) reaction as a function of element (or isotope) is given in Table 6-5. For certain elements, as noted in the table, the spectrum of gamma ray energy is due to $(n;p, \gamma)$, $(n;\alpha, \gamma)$ or $(n;t, \gamma)$ reactions. The basic data source for each element or isotope is given in Table 6-6. Comparisons of the literature data are given in Reference 6.6. These data are used in the calculation of the secondary gamma ray distributed source due to (n, γ) , $(n;p, \gamma)$, and $(n;\alpha, \gamma)$ reactions.

6.5 INELASTIC GAMMA RAY ENERGY SPECTRUM

The spectrum of gamma ray energy due to $(n;n', \gamma)$ reactions as a function of element (or isotope) is calculated for use in the APPROPOS code and is shown in Table 6-7. The basic data source for each element or isotope is given in Table 6-8. These data contain both continuum and discrete level data, where applicable. The yield data are given as a function of two variables, the excitation neutron energy group, E_n , and the gamma ray energy group, E_γ .

The POPOP4 code^(6.7) is used to generate these data. The POPOP4 code is modified to multiply the yield data by the average gamma ray energy of the respective gamma ray group or by the discrete gamma ray energy. This modification is necessary to obtain the gamma ray production data in the proper units. These data are used in the calculation of the secondary gamma ray distributed source due to $(n;n', \gamma)$ reactions.

TABLE 6-1
 PROMPT GAMMA RAY ENERGY SPECTRUM

<u>Group Number</u>	<u>Gamma Ray Energy (MeV)</u>	<u>Energy Release Rate (MeV/Sec-Fission)</u>
1	7.50 - 9.50	0.003
2	7.00 - 7.50	0.015
3	6.00 - 7.00	0.040
4	5.00 - 6.00	0.111
5	4.00 - 5.00	0.252
6	3.00 - 4.00	0.559
7	2.60 - 3.00	0.363
8	2.20 - 2.60	0.503
9	1.80 - 2.20	0.708
10	1.35 - 1.80	0.947
11	0.90 - 1.35	1.389
12	0.40 - 0.90	2.053
13	0.10 - 0.40	1.235
Total		<u>8.178</u>

TABLE 6-2

DECAY GAMMA ENERGY RELEASE RATES AS A FUNCTION OF REACTOR RUN TIME

Gamma Ray Energy (MeV)	Reactor Run Time, seconds									
	10 ¹	10 ²	10 ³	3.6x10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁸		
7.5 - 9.5	0.	0.	0.	0.	0.	0.	0.	0.	0.	
7.0 - 7.5	0.	0.	0.	0.	0.	0.	0.	0.	0.	
6.0 - 7.0	0.	0.	0.	0.	0.	0.	0.	0.	0.	
5.0 - 6.0	0.0196	0.0362	0.0427	0.0427	0.0427	0.0427	0.0427	0.0427	0.0427	
4.0 - 5.0	0.0954	0.1800	0.2276	0.2302	0.2302	0.2302	0.2302	0.2302	0.2302	
3.0 - 4.0	0.2133	0.4283	0.5553	0.5870	0.5897	0.5897	0.5897	0.5897	0.5897	
2.6 - 3.0	0.1195	0.2572	0.3463	0.3690	0.3731	0.3731	0.3731	0.3731	0.3731	
2.2 - 2.6	0.1302	0.2895	0.4379	0.5000	0.5384	0.5605	0.5642	0.5658	0.5658	
1.8 - 2.2	0.1909	0.3635	0.5194	0.5870	0.6262	0.7000	0.7072	0.7075	0.7075	
1.35-1.8	0.2356	0.4829	0.7349	0.8510	0.9256	1.000	1.041	1.092	1.092	
0.9 - 1.35	0.2829	0.5416	0.8791	1.009	1.089	1.147	1.169	1.212	1.212	
0.4 - 0.9	0.3486	0.6745	0.9854	1.152	1.262	1.475	1.600	1.695	1.695	
0.1 - 0.4	0.0803	0.1550	0.2293	0.2670	0.2923	0.3364	0.3691	0.3892	0.3892	
Total (MeV/Sec-Fission)	1.716	3.409	4.958	5.595	5.969	6.455	6.685	6.897	6.897	

TABLE 6-3

NEUTRON KINETIC ENERGY DOSE RATE CONVERSION FACTORS, (DOSE UNITS/(N/cm²-sec))

Group Number	Neutron Energy (eV)	Rem/Hr	Rad(Tissue)/Hr
1	2.87(6) - 1.00(7)	1.20(-4)	1.68(-5)
2	1.35(6) - 2.57(6)	1.05(-4)	1.13(-5)
3	8.21(5) - 1.35(6)	8.80(-5)	8.45(-6)
4	3.88(5) - 8.21(5)	6.35(-5)	6.15(-6)
5	1.11(5) - 3.88(5)	3.25(-5)	3.65(-6)
6	1.50(4) - 1.11(5)	1.03(-5)	1.30(-6)
7	5.53(3) - 1.50(4)	1.15(-6)	3.17(-7)
8	5.83(2) - 5.53(3)	1.73(-7)	8.00(-8)
9	7.89(1) - 5.83(2)	2.10(-8)	1.05(-8)
10	1.068(1) - 7.89(1)	9.00(-9)	4.40(-9)
11	1.86(0) - 1.068(1)	1.90(-8)	6.95(-9)
12	3.00(-1) - 1.86(0)	5.62(-8)	1.79(-8)
13	1.20(-1) - 3.00(-1)	1.00(-7)	3.33(-8)
14	6.00(-2) - 1.20(-1)	1.00(-7)	3.33(-8)
15	2.00(-2) - 6.00(-2)	1.00(-7)	3.33(-8)
16	0.0 - 2.00(-2)	1.00(-7)	3.33(-8)

TABLE 6-4

GAMMA RAY ENERGY DOSE RATE CONVERSION FACTORS, (DOSE UNITS/(MeV/cm²-sec))

Group Number	Gamma Ray Energy (MeV)	Rads (Carbon)/Hr	Roentgen/Hr	Rads (Tissue)/Hr or Rem/Hr
1	7.50 - 9.50	8.957(-7)	1.063(-6)	9.965(-7)
2	7.00 - 7.50	9.148(-7)	1.083(-6)	1.017(-6)
3	6.00 - 7.00	9.475(-7)	1.116(-6)	1.052(-6)
4	5.00 - 6.00	9.954(-7)	1.166(-6)	1.103(-6)
5	4.00 - 5.00	1.066(-6)	1.240(-6)	1.180(-6)
6	3.00 - 4.00	1.155(-6)	1.332(-6)	1.275(-6)
7	2.60 - 3.00	1.232(-6)	1.417(-6)	1.359(-6)
8	2.20 - 2.60	1.295(-6)	1.504(-6)	1.429(-6)
9	1.80 - 2.20	1.368(-6)	1.554(-6)	1.505(-6)
10	1.35 - 1.80	1.465(-6)	1.673(-6)	1.611(-6)
11	0.90 - 1.35	1.580(-6)	1.803(-6)	1.738(-6)
12	0.40 - 0.90	1.851(-6)	2.112(-6)	2.035(-6)
13	0.10 - 0.40	3.311(-6)	3.516(-6)	3.388(-6)

TABLE 6-5
CAPTURE GAMMA RAY ENERGY SPECTRUM

Energy Bounds (MeV)	MeV/Reaction			
	Hydrogen	Beryllium	Boron ¹	Carbon
7.50 - 9.50	0.	0.	0.	0.
7.00 - 7.50	0.	0.	0.	0.
6.00 - 7.00	0.	4.279E+00	0.	0.
5.00 - 6.00	0.	1.200E-01	0.	0.
4.00 - 5.00	0.	0.	0.	3.375E+00
3.00 - 4.00	0.	1.571E+00	0.	1.191E+00
2.60 - 3.00	0.	0.	0.	0.
2.20 - 2.60	2.225E+00	6.278E-01	0.	0.
1.80 - 2.20	0.	0.	0.	0.
1.35 - 1.80	0.	0.	0.	0.
.90 - 1.35	0.	0.	0.	3.744E-01
.40 - .90	0.	2.174E-01	4.780E-01	0.
.01 - .40	0.	0.	0.	0.
Total Energy Released	2.225E+00	6.815E+00	4.780E-01	4.940E+00

Energy Bounds (MeV)	MeV/Reaction			
	Aluminum	Titanium	Chromium	Iron
7.50 - 9.50	1.749E+00	6.474E-02	4.649E+00	3.709E+00
7.00 - 7.50	9.863E-02	4.637E-02	8.673E-01	5.298E-01
6.00 - 7.00	4.569E-01	4.960E+00	7.791E-01	7.160E-01
5.00 - 6.00	4.097E-01	4.896E-02	5.738E-01	7.527E-01
4.00 - 5.00	1.131E+00	5.471E-01	2.293E-01	6.597E-01
3.00 - 4.00	8.835E-01	4.587E-01	2.882E-01	6.493E-01
2.60 - 3.00	3.842E-01	9.359E-02	0.	2.273E-01
2.20 - 2.60	2.039E-01	6.710E-02	9.920E-02	0.
1.80 - 2.20	1.751E-01	5.388E-02	8.039E-02	9.799E-02
1.35 - 1.80	2.070E+00	1.729E+00	7.483E-02	3.276E-01
.90 - 1.35	6.875E-02	1.049E-01	8.332E-02	2.554E-02
.40 - .90	3.337E-02	0.	4.578E-01	2.534E-02
.01 - .40	5.644E-02	9.067E-02	0.	4.674E-02
Total Energy Released	7.725E+00	8.265E+00	8.182E+00	7.767E+00

Energy Bounds (MeV)	MeV/Reaction			
	Copper	Niobium	Molybdenum	²³⁵ Uranium
7.50 - 9.50	3.887E+00	4.700E-02	3.461E-01	0.
7.00 - 7.50	1.104E+00	1.200E-01	9.618E-02	0.
6.00 - 7.00	1.069E+00	3.180E-01	1.556E+00	8.493E-02
5.00 - 6.00	5.435E-01	1.188E+00	1.077E+00	5.182E-02
4.00 - 5.00	4.009E-01	1.231E+00	8.147E-01	2.081E-01
3.00 - 4.00	1.553E-01	1.482E+00	6.922E-01	4.597E-01
2.60 - 3.00	6.298E-02	6.720E-01	4.448E-01	3.219E-01
2.20 - 2.60	4.643E-02	6.980E-01	3.127E-01	4.576E-01
1.80 - 2.20	3.762E-02	6.980E-01	3.898E-01	5.744E-01
1.35 - 1.80	4.043E-02	4.000E-01	3.872E-01	7.870E-01
.90 - 1.35	5.047E-02	1.450E-01	3.600E-01	1.159E+00
.40 - .90	1.587E-01	9.300E-02	2.337E+00	1.694E+00
.01 - .40	1.612E-01	1.200E-01	5.411E-02	6.095E-01
Total Energy Released	7.718E+00	7.212E+00	8.868E+00	6.409E+00

¹ Spectrum from (n;α, γ) reaction.

TABLE 6-5 (CONTINUED)

Energy Bounds (MeV)	MeV/Reaction			
	²³⁸ Uranium	Nickel	Manganese	Tantalum
7.50 - 9.50	0.	6.306E+00	0.	0.
7.00 - 7.50	0.	8.056E-02	2.285E+00	0.
6.00 - 7.00	0.	1.135E+00	5.976E-01	1.550E-01
5.00 - 6.00	0.	4.776E-01	1.396E+00	1.312E-01
4.00 - 5.00	1.120E-01	1.380E-01	6.628E-01	1.181E+00
3.00 - 4.00	4.500E-01	1.443E-01	4.549E-01	9.183E-01
2.60 - 3.00	1.040E-01	1.899E-01	1.193E-01	7.053E-01
2.20 - 2.60	2.990E-01	4.354E-02	2.215E-01	6.045E-01
1.80 - 2.20	6.340E-01	9.180E-02	1.274E+00	6.234E-01
1.35 - 1.80	7.160E-01	6.400E-02	7.898E-02	6.695E-01
.90 - 1.35	6.190E-01	3.517E-02	6.333E-03	5.126E-01
.40 - .90	1.069E+00	8.763E-02	1.400E-01	4.248E-01
.01 - .40	6.260E-01	7.321E-02	3.323E-02	1.046E-01
Total Energy Released	4.629E+00	8.867E+00	7.270E+00	6.030E+00

Energy Bounds (MeV)	MeV/Reaction			
	Gadolinium	Tungsten	Silicon	Oxygen ²
7.50 - 9.50	6.575E-03	0.	2.413E-01	5.854E-03
7.00 - 7.50	2.267E-01	1.446E-01	5.156E-01	3.563E-01
6.00 - 7.00	6.128E-01	1.278E+00	8.120E-01	4.226E+00
5.00 - 6.00	5.644E-01	1.572E+00	4.637E-01	0.
4.00 - 5.00	1.017E-01	1.173E+00	3.470E+00	0.
3.00 - 4.00	0.	9.502E-01	2.081E+00	0.
2.60 - 3.00	3.776E-02	2.527E-01	3.089E-01	2.441E-02
2.20 - 2.60	8.830E-02	2.761E-01	1.400E-02	0.
1.80 - 2.20	3.073E-01	1.257E-01	4.612E-01	6.448E-04
1.35 - 1.80	5.393E-01	2.069E-01	7.908E-02	1.930E-03
.90 - 1.35	3.382E+00	9.032E-02	1.687E-01	8.342E-07
.40 - .90	5.079E-02	7.708E-01	1.737E-02	0.
.01 - .40	7.818E-01	3.902E-02	0.	0.
Total Energy Released	6.699E+00	6.879E+00	8.633E+00	4.615E+00

Energy Bounds (MeV)	MeV/Reaction			
	Magnesium	Zirconium	Lead	⁶ Lithium
7.50 - 9.50	4.833E-01	1.450E-01	0.	0.
7.00 - 7.50	1.972E-02	5.500E-02	6.930E+00	2.541E+00
6.00 - 7.00	4.673E-01	1.383E+00	3.397E-01	1.966E+00
5.00 - 6.00	5.080E-01	8.200E-01	0.	0.
4.00 - 5.00	4.282E-01	1.102E+00	0.	1.670E+00
3.00 - 4.00	4.599E+00	1.612E+00	0.	0.
2.60 - 3.00	1.084E+00	7.320E-01	0.	9.400E-01
2.20 - 2.60	1.949E-01	7.030E-01	0.	0.
1.80 - 2.20	3.229E-01	9.700E-01	0.	0.
1.35 - 1.80	0.	5.330E-01	0.	0.
.90 - 1.35	5.365E-01	4.740E-01	0.	0.
.40 - .90	4.519E-01	9.500E-02	0.	1.390E-01
.01 - .40	5.975E-02	5.800E-02	0.	0.
Total Energy Released	9.155E+00	8.682E+00	7.270E+00	7.256E+00

²Spectrum from (n,p,γ) reaction.

TABLE 6-5 (CONTINUED)

Energy Bounds (MeV)	MeV/Reaction			
	Lithium	Lithium	Silver	Indium
7.50 - 9.50	0.	0.	0.	0.
7.00 - 7.50	0.	1.885E-01	2.692E-01	0.
6.00 - 7.00	0.	1.458E-01	8.783E-01	8.904E-02
5.00 - 6.00	0.	0.	2.217E+00	8.727E-01
4.00 - 5.00	0.	1.239E-01	1.062E+00	8.679E-01
3.00 - 4.00	0.	0.	5.953E-01	4.400E-01
2.60 - 3.00	0.	6.970E-02	1.839E-01	1.167E-01
2.20 - 2.60	0.	0.	2.030E-01	1.286E-01
1.80 - 2.20	1.616E+00	1.496E+00	3.233E-01	1.283E+00
1.35 - 1.80	0.	0.	2.145E-01	3.279E-01
.90 - 1.35	4.040E-01	3.740E-01	1.893E-02	1.874E+00
.40 - .90	0.	1.030E-02	3.294E-01	5.049E-01
.01 - .40	0.	0.	6.590E-01	2.205E-01
Total Energy Released	2.020E+00	2.408E+00	6.954E+00	6.725E+00

Energy Bounds (MeV)	MeV/Reaction			
	Gold	Cadmium	Nitrogen	Cobalt
7.50 - 9.50	0.	3.773E-01	5.125E-01	0.
7.00 - 7.50	0.	0.	6.993E-01	6.647E-01
6.00 - 7.00	2.248E+00	2.880E-01	1.242E+00	1.594E+00
5.00 - 6.00	1.858E+00	1.837E+00	3.872E+00	1.371E+00
4.00 - 5.00	1.298E+00	6.558E-01	7.129E-01	4.468E-01
3.00 - 4.00	2.696E-01	9.332E-01	9.617E-01	1.858E-01
2.60 - 3.00	6.053E-02	7.014E-01	0.	1.458E-02
2.20 - 2.60	7.319E-02	7.699E-01	3.424E-01	0.
1.80 - 2.20	4.985E-02	3.485E-01	7.307E-01	1.310E-01
1.35 - 1.80	1.491E-01	6.648E-01	1.014E-01	1.596E-01
.90 - 1.35	6.483E-02	3.311E-01	0.	1.315E-01
.40 - .90	4.571E-02	2.139E+00	2.414E-01	2.295E-01
.01 - .40	0.	1.406E-03	3.719E-02	1.328E-01
Total Energy Released	6.117E+00	9.047E+00	9.453E+00	5.061E+00

TABLE 6-6

BASIC DATA SOURCE FOR CAPTURE GAMMA RAY ENERGY SPECTRAL DATA

<u>Element or Isotope</u>	<u>Reference</u>	<u>Element or Isotope</u>	<u>Reference</u>
Hydrogen	6.8	Manganese	6.12
Carbon	6.12	Tantalum	6.14
Beryllium	6.12	Gadolinium	6.8
Boron	6.10	Tungsten	6.8
¹⁰ Boron	6.10	Silicon	6.8
Aluminum	6.12	Oxygen	6.8
Titanium	6.11	Magnesium	6.8
Chromium	6.8	Zirconium	6.13
Iron	6.11	Lead	6.12
Copper	6.12	⁶ Lithium	6.8
Niobium	6.13	⁷ Lithium	6.8
Molybdenum	6.12	Lithium	6.8
²³⁵ Uranium	6.9	Silver	6.8
²³⁸ Uranium	6.10	Indium	6.8
Nickel	6.8	Cadmium	6.8
Gold	6.12	Nitrogen	6.8
Cobalt	6.8		

TABLE 6-7
NEUTRON INELASTIC SCATTER GAMMA RAY ENERGY SPECTRUM

BERYLLIUM NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)					
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015
7.50- 9.50	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	0.0	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	0.0	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	0.0	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	1.620E 00	7.981E-02	0.0	0.0	0.0	0.0
1.80- 2.20	0.0	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	0.0	0.0	0.0	0.0	0.0	0.0
0.90- 1.35	0.0	0.0	0.0	0.0	0.0	0.0
0.40- 0.90	0.0	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	1.620E 00	7.981E-02	0.0	0.0	0.0	0.0

CARBON NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)					
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015
7.50- 9.50	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	4.267E 00	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	0.0	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	0.0	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	0.0	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	0.0	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	0.0	0.0	0.0	0.0	0.0	0.0
0.90- 1.35	0.0	0.0	0.0	0.0	0.0	0.0
0.40- 0.90	0.0	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	4.267E 00	0.0	0.0	0.0	0.0	0.0

TABLE 6-7 (CONTINUED)

NITROGEN NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)					
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015
7.50- 9.50	3.844E-01	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	1.596E-01	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	7.674E-01	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	9.127E-01	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	9.399E-01	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	1.859E-01	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	9.762E-02	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	2.373E 00	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	1.750E 00	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	4.511E-01	0.0	0.0	0.0	0.0	0.0
0.90- 1.35	1.153E-03	0.0	0.0	0.0	0.0	0.0
0.40- 0.90	1.640E-04	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	4.035E-05	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	8.017E 00	0.0	0.0	0.0	0.0	0.0

OXYGEN NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)					
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015
7.50- 9.50	2.009E-03	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	1.163E-01	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	5.231E 00	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	0.0	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	0.0	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	1.299E-03	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	0.0	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	1.810E-03	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	0.0	0.0	0.0	0.0	0.0	0.0
0.90- 1.35	0.0	0.0	0.0	0.0	0.0	0.0
0.40- 0.90	0.0	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	5.361E 00	0.0	0.0	0.0	0.0	0.0

TABLE 6-7 (CONTINUED)

MAGNESIUM NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)						
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015	
7.50- 9.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	4.046E-03	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	2.775E-01	0.0	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	1.133E-01	0.0	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	1.449E-01	0.0	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	3.516E-04	0.0	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	1.629E-01	3.077E-01	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	8.775E-01	2.353E 00	0.0	0.0	0.0	0.0	0.0
0.90- 1.35	3.051E-02	7.435E-02	3.896E-01	0.0	0.0	0.0	0.0
0.40- 0.90	1.361E-02	7.789E-02	5.909E-01	0.0	0.0	0.0	0.0
0.10- 0.40	3.397E-03	2.343E-02	6.329E-02	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	1.628E 00	2.836E 00	1.044E 00	0.0	0.0	0.0	0.0

ALUMINUM NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)						
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015	
7.50- 9.50	1.469E-01	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	4.828E-02	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	2.414E-01	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	3.493E-01	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	4.529E-01	0.0	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	3.904E-01	0.0	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	2.651E-01	0.0	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	4.937E-01	3.126E-01	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	4.440E-01	2.067E-01	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	3.841E-01	2.833E-01	1.824E-01	0.0	0.0	0.0	0.0
0.90- 1.35	2.912E-01	5.546E-01	2.350E-01	0.0	0.0	0.0	0.0
0.40- 0.90	6.128E-02	9.109E-02	2.037E-01	0.0	0.0	0.0	0.0
0.10- 0.40	1.507E-02	2.241E-02	5.013E-02	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	3.584E 00	1.471E 00	6.713E-01	0.0	0.0	0.0	0.0



TABLE 6-7 (CONTINUED)

SILICON NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)					
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015
7.50- 9.50	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	1.324E-01	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	1.535E-01	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	1.470E-01	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	1.255E-01	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	7.457E-02	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	1.045E-01	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	1.299E-01	6.121E-02	0.0	0.0	0.0	0.0
1.80- 2.20	6.644E-01	6.786E-01	0.0	0.0	0.0	0.0
1.35- 1.80	7.897E-01	8.842E-01	2.850E-01	0.0	0.0	0.0
0.90- 1.35	1.495E-02	2.756E-01	5.483E-01	0.0	0.0	0.0
0.40- 0.90	7.465E-03	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	1.837E-03	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	2.346E 00	1.900E 00	8.333E-01	0.0	0.0	0.0

TITANIUM NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)					
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015
7.50- 9.50	1.884E-01	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	1.459E-01	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	3.129E-01	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	7.003E-01	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	8.843E-01	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	1.008E 00	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	2.849E-01	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	1.557E-01	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	1.260E-01	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	2.824E-01	1.566E-01	0.0	0.0	0.0	0.0
0.90- 1.35	8.235E-01	1.057E 00	1.748E 00	0.0	0.0	0.0
0.40- 0.90	1.121E-02	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	1.005E-03	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	4.925E 00	1.214E 00	1.748E 00	0.0	0.0	0.0

TABLE 6-7 (CONTINUED)
CHROMIUM NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)					
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015
7.50- 9.50	5.564E-01	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	1.374E-01	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	4.928E-01	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	4.622E-01	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	7.284E-01	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	5.864E-01	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	1.951E-01	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	1.514E-01	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	1.653E-01	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	3.527E-01	0.0	0.0	0.0	0.0	0.0
0.90- 1.35	4.990E-01	0.0	0.0	0.0	0.0	0.0
0.40- 0.90	2.922E-01	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	1.261E-01	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	4.745E 00	0.0	0.0	0.0	0.0	0.0

IRON NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)					
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015
7.50- 9.50	1.325E-01	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	6.514E-02	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	2.336E-01	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	4.213E-01	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	3.249E-01	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	7.980E-01	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	5.095E-01	2.100E-03	0.0	0.0	0.0	0.0
2.20- 2.60	4.367E-01	1.800E-03	0.0	0.0	0.0	0.0
1.80- 2.20	4.959E-01	3.348E-02	0.0	0.0	0.0	0.0
1.35- 1.80	5.686E-01	6.195E-02	0.0	0.0	0.0	0.0
0.90- 1.35	4.731E-01	2.520E-01	2.347E-01	0.0	0.0	0.0
0.40- 0.90	3.377E-01	2.551E-01	2.674E-01	0.0	0.0	0.0
0.10- 0.40	8.307E-02	6.520E-02	6.578E-02	0.0	0.0	0.0
TOTAL ENERGY RELEASED	4.881E 00	4.816E-01	5.679E-01	0.0	0.0	0.0

TABLE 6-7 (CONTINUED)

NICKEL NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)						
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015	0.0
7.50- 9.50	6.318E-02	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	3.375E-02	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	1.983E-01	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	2.424E-01	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	5.909E-01	0.0	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	5.402E-01	0.0	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	3.446E-01	0.0	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	3.687E-01	3.916E-03	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	2.478E-01	2.816E-02	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	1.234E 00	1.246E 00	1.203E 00	0.0	0.0	0.0	0.0
0.90- 1.35	4.077E-01	2.867E-01	2.522E-01	0.0	0.0	0.0	0.0
0.40- 0.90	2.637E-01	2.534E-02	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	8.453E-02	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	4.670E 00	1.590E 00	1.455E 00	0.0	0.0	0.0	0.0

ZIRCONIUM NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)						
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015	0.0
7.50- 9.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	5.517E-01	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	7.388E-01	0.0	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	7.420E-01	0.0	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	2.344E-01	0.0	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	3.551E-01	2.243E-01	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	3.294E-01	2.545E-01	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	2.968E-01	2.485E-01	1.187E-01	0.0	0.0	0.0	0.0
0.90- 1.35	2.203E-01	3.398E-01	2.812E-01	0.0	0.0	0.0	0.0
0.40- 0.90	1.414E-01	2.181E-01	1.805E-01	0.0	0.0	0.0	0.0
0.10- 0.40	3.479E-02	5.366E-02	4.440E-02	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	3.695E 00	1.339E 00	6.248E-01	0.0	0.0	0.0	0.0

TABLE 6-7 (CONTINUED)

TUNGSTEN NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)											
	10.000-	2.870	2.870-	1.350	1.350-	0.821	0.821-	0.388	0.388-	0.111	0.111-	0.015
7.50- 9.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	2.046E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	4.252E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	6.941E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	3.778E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	5.197E-01	7.579E-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	7.891E-01	2.326E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	1.017E 00	4.418E-01	1.133E-02	0.0	3.020E-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.90- 1.35	1.386E 00	8.259E-01	1.683E-01	0.0	4.488E-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.40- 0.90	6.342E-01	4.260E-01	2.252E-01	0.0	1.984E-01	1.814E-01	0.0	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	4.140E-02	5.798E-02	1.075E-01	0.0	1.328E-01	1.253E-01	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	6.090E 00	2.060E 00	5.124E-01	3.791E-01	3.067E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0

LEAD NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)											
	10.000-	2.870	2.870-	1.350	1.350-	0.821	0.821-	0.388	0.388-	0.111	0.111-	0.015
7.50- 9.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	3.173E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	1.938E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	5.517E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	4.217E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	6.665E-01	1.477E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	2.016E-01	3.363E-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	1.471E-01	4.190E-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	2.049E-01	5.285E-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.90- 1.35	2.027E-01	2.352E-01	1.169E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.40- 0.90	3.071E-01	5.997E-01	3.446E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	7.938E-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	3.222E 00	1.111E 00	4.615E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TABLE 6-7 (CONTINUED)

²³⁵URANIUM NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)					
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015
7.50- 9.50	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	3.662E-03	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	3.749E-02	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	7.234E-02	8.006E-04	0.0	0.0	0.0	0.0
2.20- 2.60	1.494E-01	6.072E-03	0.0	0.0	0.0	0.0
1.80- 2.20	2.811E-01	3.019E-02	0.0	0.0	0.0	0.0
1.35- 1.80	5.657E-01	1.706E-01	2.046E-02	0.0	0.0	0.0
0.90- 1.35	8.553E-01	4.843E-01	1.682E-01	2.311E-02	0.0	0.0
0.40- 0.90	9.392E-01	8.125E-01	5.021E-01	1.813E-01	9.482E-02	9.474E-02
0.10- 0.40	2.303E-01	2.604E-01	2.166E-01	2.005E-01	1.679E-01	1.678E-01
TOTAL ENERGY RELEASED	3.143E 00	1.765E 00	9.075E-01	4.049E-01	2.628E-01	2.625E-01

²³⁸URANIUM NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)					
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015
7.50- 9.50	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	4.399E-02	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	4.727E-01	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	6.730E-01	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	3.881E-01	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	1.229E-01	5.337E-03	0.0	0.0	0.0	0.0
2.20- 2.60	1.290E-01	2.361E-02	0.0	0.0	0.0	0.0
1.80- 2.20	1.437E-01	4.600E-02	0.0	0.0	0.0	0.0
1.35- 1.80	1.795E-01	1.112E-01	8.632E-03	0.0	0.0	0.0
0.90- 1.35	1.829E-01	1.742E-01	5.205E-02	6.925E-03	0.0	0.0
0.40- 0.90	2.360E-01	2.785E-01	2.386E-01	1.212E-01	5.621E-02	0.0
0.10- 0.40	1.744E-01	2.187E-01	1.941E-01	2.025E-01	9.954E-02	0.0
TOTAL ENERGY RELEASED	2.746E 00	8.576E-01	4.934E-01	3.307E-01	1.557E-01	0.0

TABLE 6-8

BASIC DATA SOURCE FOR INELASTIC GAMMA RAY ENERGY SPECTRAL DATA

<u>Element or Isotope</u>	<u>Reference</u>
Carbon	6. 16
Aluminum	6. 19
Titanium	6. 15
Chromium	6. 16
Iron	6. 16
Niobium	6. 8
²³⁵ Uranium	6. 16
²³⁸ Uranium	6. 16
Nickel	6. 16
Tungsten	6. 16
Oxygen	6. 20
Magnesium	6. 17
Zirconium	6. 16
Lead	6. 18
⁶ Lithium	6. 8
⁷ Lithium	6. 8
Lithium	6. 8
Nitrogen	6. 19

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APPENDIX

PAIR-PRODUCTION AND PHOTO-ELECTRIC DATA

This Appendix presents a tabulation of pair-production, photo-electric, and Compton absorption as well as Compton scatter and the total gamma ray cross section for 51 elements in units of barns/atom ($\text{cm}^2 \times 10^{24}/\text{atom}$). These pointwise data are provided from 0.01 to 20.0 MeV. The pair-production and photo-electric data are obtained from Reference 4.3 and constitute the data on Master Library Tape No. 5. The Compton absorption and scatter are analytically computed from the Klein-Nishina equations given in Reference 4.1.

ATOMIC NUMBER 1.0000 ATOMIC WEIGHT 1.0080

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	5.629998E-03	0.0	3.437237E-02	4.000237E-02	5.017221E-02	5.580221E-02
2	1.500000E 01	4.619997E-03	0.0	4.097287E-02	4.559286E-02	6.171521E-02	6.633520E-02
3	1.000000E 01	3.280000E-03	0.0	5.143309E-02	5.471309E-02	8.164507E-02	8.492506E-02
4	8.000000E 00	2.620000E-03	0.0	5.762141E-02	6.024141E-02	9.460688E-02	9.722686E-02
5	6.000000E 00	1.840000E-03	0.0	6.580788E-02	6.764787E-02	1.135283E-01	1.153682E-01
6	5.000000E 00	1.420000E-03	0.0	7.097393E-02	7.239389E-02	1.268361E-01	1.282561E-01
7	4.000000E 00	9.889998E-04	0.0	7.709569E-02	7.808465E-02	1.445169E-01	1.455059E-01
8	3.000000E 00	5.539998E-04	0.0	8.434695E-02	8.490092E-02	1.695408E-01	1.700947E-01
9	2.000000E 00	1.810000E-04	0.0	9.256107E-02	9.274203E-02	2.089118E-01	2.090928E-01
10	1.500000E 00	4.399999E-05	0.0	9.645903E-02	9.650302E-02	2.396047E-01	2.396487E-01
11	1.000000E 00	0.0	0.0	9.868318E-02	9.868318E-02	2.864686E-01	2.864686E-01
12	8.000000E-01	0.0	0.0	9.814864E-02	9.814864E-02	3.138748E-01	3.138748E-01
13	6.000000E-01	0.0	0.0	9.556723E-02	9.556723E-02	3.505424E-01	3.505424E-01
14	5.000000E-01	0.0	0.0	9.284145E-02	9.284145E-02	3.742978E-01	3.742978E-01
15	4.000000E-01	0.0	0.0	8.841389E-02	8.841389E-02	4.035369E-01	4.035369E-01
16	3.000000E-01	0.0	0.0	8.113396E-02	8.113396E-02	4.407337E-01	4.407337E-01
17	2.000000E-01	0.0	0.0	6.869644E-02	6.869644E-02	4.901260E-01	4.901260E-01
18	1.500000E-01	0.0	0.0	5.914575E-02	5.914575E-02	5.216139E-01	5.216139E-01
19	9.999996E-02	0.0	0.0	4.597974E-02	4.597974E-02	5.595576E-01	5.595576E-01
20	7.999998E-02	0.0	0.0	3.931659E-02	3.931659E-02	5.770202E-01	5.770202E-01
21	6.000000E-02	0.0	0.0	3.162211E-02	3.162211E-02	5.960569E-01	5.960569E-01
22	5.000000E-02	0.0	0.0	2.732527E-02	2.732527E-02	6.062340E-01	6.062340E-01
23	4.000000E-02	0.0	0.0	2.268934E-02	2.268934E-02	6.168922E-01	6.168922E-01
24	3.000000E-02	0.0	0.0	1.767951E-02	1.767951E-02	6.280657E-01	6.280657E-01
25	2.000000E-02	0.0	0.0	1.225793E-02	1.225793E-02	6.397932E-01	6.397932E-01
26	1.500000E-02	0.0	2.000000E-03	9.379208E-03	1.137920E-02	6.458774E-01	6.478774E-01
27	9.999998E-03	0.0	1.040000E-02	6.381094E-03	1.678109E-02	6.521161E-01	6.625161E-01

ELEMENT ID NO. 2 HELIUM

ATOMIC NUMBER 2.0000 ATOMIC WEIGHT 4.0026

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.790000E-02	0.0	6.874472E-02	8.664471E-02	1.003444E-01	1.182444E-01
2	1.500000E 01	1.470000E-02	0.0	8.194566E-02	9.664565E-02	1.234304E-01	1.381304E-01
3	1.000000E 01	1.080000E-02	0.0	1.028662E-01	1.136661E-01	1.632901E-01	1.740901E-01
4	8.000000E 00	8.789998E-03	0.0	1.152428E-01	1.240328E-01	1.892138E-01	1.980037E-01
5	6.000000E 00	6.439999E-03	0.0	1.316158E-01	1.380558E-01	2.270565E-01	2.334965E-01
6	5.000000E 00	5.059998E-03	0.0	1.419479E-01	1.470079E-01	2.536722E-01	2.587322E-01
7	4.000000E 00	3.650000E-03	0.0	1.541914E-01	1.578413E-01	2.890339E-01	2.926838E-01
8	3.000000E 00	2.130000E-03	0.0	1.686939E-01	1.708239E-01	3.390815E-01	3.412115E-01
9	2.000000E 00	7.149999E-04	0.0	1.851221E-01	1.858371E-01	4.178237E-01	4.185386E-01
10	1.500000E 00	1.770000E-04	0.0	1.929181E-01	1.930950E-01	4.792094E-01	4.793864E-01
11	1.000000E 00	0.0	0.0	1.973664E-01	1.973664E-01	5.729373E-01	5.729373E-01
12	8.000000E-01	0.0	0.0	1.962973E-01	1.962973E-01	6.277496E-01	6.277496E-01
13	6.000000E-01	0.0	0.0	1.911345E-01	1.911345E-01	7.010849E-01	7.010849E-01
14	5.000000E-01	0.0	0.0	1.856829E-01	1.856829E-01	7.485956E-01	7.485956E-01
15	4.000000E-01	0.0	0.0	1.768278E-01	1.768278E-01	8.070738E-01	8.070738E-01
16	3.000000E-01	0.0	0.0	1.622679E-01	1.622679E-01	8.814675E-01	8.814675E-01
17	2.000000E-01	0.0	0.0	1.373929E-01	1.373929E-01	9.802519E-01	9.802519E-01
18	1.500000E-01	0.0	0.0	1.182909E-01	1.182909E-01	1.043227E 00	1.043227E 00
19	9.999996E-02	0.0	0.0	9.195995E-02	9.195995E-02	1.119115E 00	1.119115E 00
20	7.999998E-02	0.0	0.0	7.863331E-02	7.863331E-02	1.154040E 00	1.154040E 00
21	6.000000E-02	0.0	0.0	6.324387E-02	6.324387E-02	1.192113E 00	1.192113E 00
22	5.000000E-02	0.0	0.0	5.465031E-02	5.465031E-02	1.212467E 00	1.212467E 00
23	4.000000E-02	0.0	1.180000E-03	4.537868E-02	4.655868E-02	1.233784E 00	1.234963E 00
24	3.000000E-02	0.0	3.600000E-03	3.535938E-02	3.895938E-02	1.256131E 00	1.259730E 00
25	2.000000E-02	0.0	1.710000E-02	2.451611E-02	4.161610E-02	1.279586E 00	1.296685E 00
26	1.500000E-02	0.0	5.200000E-02	1.875877E-02	7.075876E-02	1.291755E 00	1.343754E 00
27	9.999998E-03	0.0	2.460000E-01	1.276207E-02	2.587621E-01	1.304232E 00	1.550231E 00

ATOMIC NUMBER 3.0000 ATOMIC WEIGHT 6.9390

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.00000E 01	3.630000E-02	0.0	1.031171E-01	1.394171E-01	1.505166E-01	1.868166E-01
2	1.50000E 01	3.030000E-02	0.0	1.229185E-01	1.532185E-01	1.851456E-01	2.154456E-01
3	1.00000E 01	2.250000E-02	0.0	1.542993E-01	1.767993E-01	2.449352E-01	2.674352E-01
4	8.00000E 00	1.840000E-02	0.0	1.723643E-01	1.912642E-01	2.838206E-01	3.022206E-01
5	6.00000E 00	1.370000E-02	0.0	1.974238E-01	2.111237E-01	3.405848E-01	3.542847E-01
6	5.00000E 00	1.080000E-02	0.0	2.129219E-01	2.237219E-01	3.805084E-01	3.913083E-01
7	4.00000E 00	7.909998E-03	0.0	2.312871E-01	2.391970E-01	4.335508E-01	4.414608E-01
8	3.00000E 00	4.679997E-03	0.0	2.530409E-01	2.577208E-01	5.086223E-01	5.133023E-01
9	2.00000E 00	1.590000E-03	0.0	2.776832E-01	2.792732E-01	6.267355E-01	6.263255E-01
10	1.50000E 00	3.970000E-04	0.0	2.893771E-01	2.897741E-01	7.188141E-01	7.192111E-01
11	1.00000E 00	0.0	0.0	2.960495E-01	2.960495E-01	8.594059E-01	8.594059E-01
12	8.00000E-01	0.0	0.0	2.944459E-01	2.944459E-01	9.416243E-01	9.416243E-01
13	6.00000E-01	0.0	0.0	2.867016E-01	2.867016E-01	1.051627E 00	1.051627E 00
14	5.00000E-01	0.0	0.0	2.785243E-01	2.785243E-01	1.122893E 00	1.122893E 00
15	4.00000E-01	0.0	0.0	2.652413E-01	2.652413E-01	1.210610E 00	1.210610E 00
16	3.00000E-01	0.0	0.0	2.434015E-01	2.434015E-01	1.322201E 00	1.322201E 00
17	2.00000E-01	0.0	0.0	2.060890E-01	2.060890E-01	1.470377E 00	1.470377E 00
18	1.50000E-01	0.0	0.0	1.774368E-01	1.774368E-01	1.564841E 00	1.564841E 00
19	9.999996E-02	0.0	0.0	1.379395E-01	1.379395E-01	1.678673E 00	1.678673E 00
20	7.999998E-02	0.0	0.0	1.179495E-01	1.179495E-01	1.731060E 00	1.731060E 00
21	6.00000E-02	0.0	2.300000E-03	9.486580E-02	9.716576E-02	1.788170E 00	1.790469E 00
22	5.00000E-02	0.0	4.419997E-03	8.197594E-02	8.639592E-02	1.818702E 00	1.823121E 00
23	4.00000E-02	0.0	9.979997E-03	6.806755E-02	7.804751E-02	1.850676E 00	1.860655E 00
24	3.00000E-02	0.0	2.860000E-02	5.303860E-02	8.163857E-02	1.884196E 00	1.912796E 00
25	2.00000E-02	0.0	1.250000E-01	3.677368E-02	1.617737E-01	1.919379E 00	2.044379E 00
26	1.50000E-02	0.0	3.609999E-01	2.813721E-02	3.891371E-01	1.937632E 00	2.298631E 00
27	9.999998E-03	0.0	1.599999E 00	1.914310E-02	1.619143E 00	1.956347E 00	3.556347E 00

ELEMENT ID NO. 4 BERYLLIUM

ATOMIC NUMBER 4.0000 ATOMIC WEIGHT 9.0122

ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
2.000000E 01	6.140000E-02	0.0	1.374895E-01	1.988895E-01	2.006888E-01	2.620888E-01
1.500000E 01	5.130000E-02	0.0	1.638914E-01	2.151914E-01	2.468608E-01	2.981608E-01
1.000000E 01	3.870000E-02	0.0	2.057324E-01	2.444324E-01	3.265803E-01	3.652803E-01
8.000000E 00	3.160000E-02	0.0	2.304857E-01	2.620857E-01	3.784275E-01	4.100275E-01
6.000000E 00	2.350000E-02	0.0	2.632316E-01	2.867316E-01	4.541130E-01	4.776130E-01
5.000000E 00	1.880000E-02	0.0	2.838959E-01	3.026958E-01	5.073445E-01	5.261444E-01
4.000000E 00	1.380000E-02	0.0	3.083827E-01	3.221827E-01	5.780678E-01	5.918677E-01
3.000000E 00	8.259997E-03	0.0	3.373878E-01	3.456478E-01	6.781631E-01	6.864230E-01
2.000000E 00	2.810000E-03	0.0	3.702443E-01	3.730542E-01	8.356473E-01	8.384573E-01
1.500000E 00	7.099998E-04	0.0	3.858361E-01	3.865461E-01	9.584188E-01	9.591288E-01
1.000000E 00	0.0	0.0	3.947322E-01	3.947322E-01	1.145874E 00	1.145874E 00
8.000000E-01	0.0	0.0	3.925943E-01	3.925943E-01	1.255499E 00	1.255499E 00
6.000000E-01	0.0	0.0	3.822689E-01	3.822689E-01	1.402169E 00	1.402169E 00
5.000000E-01	0.0	0.0	3.713655E-01	3.713655E-01	1.497190E 00	1.497190E 00
4.000000E-01	0.0	0.0	3.536558E-01	3.536558E-01	1.614147E 00	1.614147E 00
3.000000E-01	0.0	0.0	3.245363E-01	3.245363E-01	1.762935E 00	1.762935E 00
2.000000E-01	0.0	0.0	2.747860E-01	2.747860E-01	1.960504E 00	1.960504E 00
1.500000E-01	0.0	0.0	2.365828E-01	2.365828E-01	2.086455E 00	2.086455E 00
9.999996E-02	0.0	1.840000E-03	1.839190E-01	1.857589E-01	2.238230E 00	2.240069E 00
7.999998E-02	0.0	3.950000E-03	1.572666E-01	1.612166E-01	2.308081E 00	2.312030E 00
6.000000E-02	0.0	1.080000E-02	1.264877E-01	1.372877E-01	2.384227E 00	2.395026E 00
5.000000E-02	0.0	2.060000E-02	1.093006E-01	1.299006E-01	2.424935E 00	2.445535E 00
4.000000E-02	0.0	4.500000E-02	9.075737E-02	1.357573E-01	2.467568E 00	2.512568E 00
3.000000E-02	0.0	1.230000E-01	7.071781E-02	1.937178E-01	2.512262E 00	2.635262E 00
2.000000E-02	0.0	5.150000E-01	4.903221E-02	5.640322E-01	2.559173E 00	3.074172E 00
1.500000E-02	0.0	1.419999E 00	3.751659E-02	1.457516E 00	2.583509E 00	4.003509E 00
9.999998E-03	0.0	6.000000E 00	2.552509E-02	6.025525E 00	2.608464E 00	8.608464E 00

ATOMIC NUMBER 5.0000 ATOMIC WEIGHT 10.8110

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	9.239995E-02	0.0	1.718619E-01	2.642618E-01	2.508610E-01	3.432610E-01
2	1.500000E 01	7.739997E-02	0.0	2.048643E-01	2.822643E-01	3.085760E-01	3.859760E-01
3	1.000000E 01	5.870000E-02	0.0	2.571655E-01	3.158655E-01	4.082254E-01	4.669253E-01
4	8.000000E 00	4.820000E-02	0.0	2.881071E-01	3.363070E-01	4.730344E-01	5.212343E-01
5	6.000000E 00	3.570000E-02	0.0	3.290395E-01	3.647395E-01	5.676413E-01	6.033412E-01
6	5.000000E 00	2.890000E-02	0.0	3.548698E-01	3.837698E-01	6.341806E-01	6.630806E-01
7	4.000000E 00	2.130000E-02	0.0	3.854784E-01	4.067784E-01	7.225847E-01	7.438847E-01
8	3.000000E 00	1.270000E-02	0.0	4.217348E-01	4.344347E-01	8.477038E-01	8.604038E-01
9	2.000000E 00	4.389998E-03	0.0	4.628047E-01	4.671946E-01	1.044559E 00	1.048948E 00
10	1.500000E 00	1.100000E-03	0.0	4.822944E-01	4.833944E-01	1.198023E 00	1.199122E 00
11	1.000000E 00	0.0	0.0	4.934153E-01	4.934153E-01	1.432343E 00	1.432343E 00
12	8.000000E-01	0.0	0.0	4.907427E-01	4.907427E-01	1.569373E 00	1.569373E 00
13	6.000000E-01	0.0	0.0	4.778357E-01	4.778357E-01	1.752711E 00	1.752711E 00
14	5.000000E-01	0.0	0.0	4.642076E-01	4.642076E-01	1.871489E 00	1.871489E 00
15	4.000000E-01	0.0	0.0	4.420691E-01	4.420691E-01	2.017684E 00	2.017684E 00
16	3.000000E-01	0.0	0.0	4.056702E-01	4.056702E-01	2.203669E 00	2.203669E 00
17	2.000000E-01	0.0	0.0	3.434820E-01	3.434820E-01	2.450625E 00	2.450629E 00
18	1.500000E-01	0.0	1.620000E-03	2.957287E-01	2.973487E-01	2.608069E 00	2.609689E 00
19	9.999996E-02	0.0	6.299999E-03	2.298985E-01	2.361984E-01	2.797788E 00	2.804088E 00
20	7.999998E-02	0.0	1.360000E-02	1.965828E-01	2.101828E-01	2.885100E 00	2.898700E 00
21	6.000000E-02	0.0	3.620000E-02	1.581106E-01	1.943106E-01	2.980284E 00	3.016483E 00
22	5.000000E-02	0.0	6.750000E-02	1.366262E-01	2.041262E-01	3.031170E 00	3.098669E 00
23	4.000000E-02	0.0	1.440000E-01	1.134462E-01	2.574462E-01	3.084460E 00	3.228459E 00
24	3.000000E-02	0.0	3.850000E-01	8.839798E-02	4.733980E-01	3.140328E 00	3.525328E 00
25	2.000000E-02	0.0	1.549999E 00	6.128979E-02	1.611289E 00	3.198966E 00	4.748965E 00
26	1.500000E-02	0.0	4.099999E 00	4.689598E-02	4.146895E 00	3.229386E 00	7.329386E 00
27	9.999998E-03	0.0	1.650000E 01	3.190613E-02	1.653191E 01	3.260580E 00	1.976057E 01

ELEMENT ID NO. 6 CARBON

ATOMIC NUMBER 6.0000 ATOMIC WEIGHT 12.0111

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.300000E-01	0.0	2.062343E-01	3.362343E-01	3.010333E-01	4.310333E-01
2	1.500000E 01	1.090000E-01	0.0	2.458372E-01	3.548372E-01	3.702912E-01	4.792912E-01
3	1.000000E 01	8.249998E-02	0.0	3.085986E-01	3.910986E-01	4.898704E-01	5.723704E-01
4	8.000000E 00	6.839997E-02	0.0	3.457285E-01	4.141285E-01	5.676413E-01	6.360412E-01
5	6.000000E 00	5.100000E-02	0.0	3.948475E-01	4.458475E-01	6.811695E-01	7.321695E-01
6	5.000000E 00	4.140000E-02	0.0	4.258438E-01	4.672437E-01	7.610167E-01	8.024167E-01
7	4.000000E 00	3.060000E-02	0.0	4.625741E-01	4.931741E-01	8.671017E-01	8.977016E-01
8	3.000000E 00	1.840000E-02	0.0	5.060815E-01	5.244814E-01	1.017244E 00	1.035644E 00
9	2.000000E 00	6.299999E-03	0.0	5.553658E-01	5.616658E-01	1.253470E 00	1.259770E 00
10	1.500000E 00	1.580000E-03	0.0	5.787537E-01	5.803337E-01	1.437628E 00	1.439207E 00
11	1.000000E 00	0.0	0.0	5.920992E-01	5.920992E-01	1.718811E 00	1.718811E 00
12	8.000000E-01	0.0	0.0	5.888920E-01	5.888920E-01	1.883248E 00	1.883248E 00
13	6.000000E-01	0.0	0.0	5.734034E-01	5.734034E-01	2.103254E 00	2.103254E 00
14	5.000000E-01	0.0	0.0	5.570488E-01	5.570488E-01	2.245787E 00	2.245787E 00
15	4.000000E-01	0.0	0.0	5.304832E-01	5.304832E-01	2.421221E 00	2.421221E 00
16	3.000000E-01	0.0	0.0	4.868031E-01	4.868031E-01	2.644402E 00	2.644402E 00
17	2.000000E-01	0.0	1.830000E-03	4.121780E-01	4.140080E-01	2.940755E 00	2.942584E 00
18	1.500000E-01	0.0	4.659999E-03	3.548737E-01	3.595336E-01	3.129683E 00	3.134342E 00
19	9.999996E-02	0.0	1.720000E-02	2.758789E-01	2.930789E-01	3.357346E 00	3.374545E 00
20	7.999998E-02	0.0	3.570000E-02	2.358999E-01	2.715999E-01	3.462121E 00	3.497821E 00
21	6.000000E-02	0.0	9.599996E-02	1.897326E-01	2.857325E-01	3.576341E 00	3.672340E 00
22	5.000000E-02	0.0	1.770000E-01	1.639519E-01	3.409519E-01	3.637403E 00	3.814403E 00
23	4.000000E-02	0.0	3.699999E-01	1.361361E-01	5.061360E-01	3.701352E 00	4.071352E 00
24	3.000000E-02	0.0	9.800000E-01	1.060772E-01	1.086077E 00	3.768394E 00	4.748393E 00
25	2.000000E-02	0.0	3.820000E 00	7.354736E-02	3.893547E 00	3.838758E 00	7.658758E 00
26	1.500000E-02	0.0	9.750000E 00	5.627537E-02	9.806275E 00	3.875264E 00	1.362526E 01
27	9.999998E-03	0.0	3.800000E 01	3.828621E-02	3.803828E 01	3.912696E 00	4.191269E 01

ELEMENT ID NO. 7 NITROGEN

ATOMIC NUMBER 7.0000 ATOMIC WEIGHT 14.0067

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.730000E-01	0.0	2.406066E-01	4.136066E-01	3.512055E-01	5.242054E-01
2	1.500000E 01	1.460000E-01	0.0	2.868101E-01	4.328101E-01	4.320065E-01	5.780064E-01
3	1.000000E 01	1.100000E-01	0.0	3.600317E-01	4.700316E-01	5.715155E-01	6.815155E-01
4	8.000000E 00	9.189999E-02	0.0	4.033499E-01	4.952499E-01	6.622481E-01	7.541481E-01
5	6.000000E 00	6.919998E-02	0.0	4.606553E-01	5.298553E-01	7.946978E-01	8.638977E-01
6	5.000000E 00	5.630000E-02	0.0	4.968177E-01	5.531177E-01	8.878528E-01	9.441528E-01
7	4.000000E 00	4.140000E-02	0.0	5.396698E-01	5.816698E-01	1.011619E 00	1.053019E 00
8	3.000000E 00	2.480000E-02	0.0	5.904281E-01	6.152280E-01	1.186785E 00	1.211584E 00
9	2.000000E 00	8.579999E-03	0.0	6.479269E-01	6.565069E-01	1.462382E 00	1.470962E 00
10	1.500000E 00	2.140000E-03	0.0	6.752138E-01	6.773538E-01	1.677233E 00	1.679372E 00
11	1.000000E 00	0.0	0.0	6.907816E-01	6.907816E-01	2.005280E 00	2.005280E 00
12	8.000000E-01	0.0	0.0	6.870403E-01	6.870403E-01	2.197123E 00	2.197123E 00
13	6.000000E-01	0.0	0.0	6.689701E-01	6.689701E-01	2.453796E 00	2.453796E 00
14	5.000000E-01	0.0	0.0	6.498899E-01	6.498899E-01	2.620084E 00	2.620084E 00
15	4.000000E-01	0.0	0.0	6.188965E-01	6.188965E-01	2.824758E 00	2.824758E 00
16	3.000000E-01	0.0	1.060000E-03	5.679379E-01	5.689978E-01	3.085135E 00	3.086195E 00
17	2.000000E-01	0.0	3.969997E-03	4.808750E-01	4.848450E-01	3.430882E 00	3.434851E 00
18	1.500000E-01	0.0	9.999998E-03	4.140196E-01	4.240196E-01	3.651297E 00	3.661296E 00
19	9.999996E-02	0.0	3.730000E-02	3.218575E-01	3.591574E-01	3.916903E 00	3.954202E 00
20	7.999998E-02	0.0	7.900000E-02	2.752161E-01	3.542161E-01	4.039141E 00	4.118140E 00
21	6.000000E-02	0.0	2.040000E-01	2.213545E-01	4.253545E-01	4.172398E 00	4.376397E 00
22	5.000000E-02	0.0	3.770000E-01	1.912775E-01	5.682775E-01	4.243638E 00	4.620638E 00
23	4.000000E-02	0.0	7.900000E-01	1.588259E-01	9.488258E-01	4.318245E 00	5.108245E 00
24	3.000000E-02	0.0	2.059999E 00	1.237564E-01	2.183756E 00	4.396460E 00	6.456459E 00
25	2.000000E-02	0.0	8.020000E 00	8.580494E-02	8.105804E 00	4.478552E 00	1.249855E 01
26	1.500000E-02	0.0	2.039999E 01	6.565380E-02	2.046564E 01	4.521141E 00	2.492113E 01
27	9.999998E-03	0.0	7.779999E 01	4.466724E-02	7.784465E 01	4.564812E 00	8.236479E 01

ELEMENT ID NO. 8 OXYGEN

ATOMIC NUMBER 8.0000 ATOMIC WEIGHT 15.9994

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	2.250000E-01	0.0	2.749790E-01	4.999790E-01	4.013777E-01	6.263776E-01
2	1.500000E 01	1.880000E-01	0.0	3.277829E-01	5.157829E-01	4.937217E-01	6.817216E-01
3	1.000000E 01	1.420000E-01	0.0	4.114648E-01	5.534647E-01	6.531606E-01	7.951605E-01
4	8.000000E 00	1.190000E-01	0.0	4.609713E-01	5.799713E-01	7.568550E-01	8.758550E-01
5	6.000000E 00	8.989996E-02	0.0	5.264632E-01	6.163632E-01	9.082260E-01	9.981260E-01
6	5.000000E 00	7.269996E-02	0.0	5.677912E-01	6.404911E-01	1.014688E 00	1.087388E 00
7	4.000000E 00	5.430000E-02	0.0	6.167655E-01	6.710654E-01	1.156136E 00	1.210435E 00
8	3.000000E 00	3.230000E-02	0.0	6.747756E-01	7.070756E-01	1.356326E 00	1.388626E 00
9	2.000000E 00	1.110000E-02	0.0	7.404881E-01	7.515880E-01	1.671294E 00	1.682394E 00
10	1.500000E 00	2.800000E-03	0.0	7.716722E-01	7.744722E-01	1.916838E 00	1.919638E 00
11	1.000000E 00	0.0	0.0	7.894659E-01	7.894659E-01	2.291749E 00	2.291749E 00
12	8.000000E-01	0.0	0.0	7.851887E-01	7.851887E-01	2.510998E 00	2.510998E 00
13	6.000000E-01	0.0	0.0	7.645378E-01	7.645378E-01	2.804339E 00	2.804339E 00
14	5.000000E-01	0.0	0.0	7.427311E-01	7.427311E-01	2.994382E 00	2.994382E 00
15	4.000000E-01	0.0	0.0	7.073116E-01	7.073116E-01	3.228295E 00	3.228295E 00
16	3.000000E-01	0.0	2.090000E-03	6.490717E-01	6.511617E-01	3.525869E 00	3.527959E 00
17	2.000000E-01	0.0	7.649999E-03	5.495710E-01	5.572210E-01	3.921007E 00	3.928657E 00
18	1.500000E-01	0.0	1.940000E-02	4.731655E-01	4.925655E-01	4.172911E 00	4.192310E 00
19	9.999996E-02	0.0	7.169998E-02	3.678379E-01	4.395379E-01	4.476460E 00	4.548160E 00
20	7.999998E-02	0.0	1.500000E-01	3.145332E-01	4.645332E-01	4.616161E 00	4.766161E 00
21	6.000000E-02	0.0	3.900000E-01	2.529764E-01	6.429764E-01	4.768455E 00	5.158454E 00
22	5.000000E-02	0.0	7.100000E-01	2.186022E-01	9.286022E-01	4.849872E 00	5.559871E 00
23	4.000000E-02	0.0	1.490000E 00	1.815147E-01	1.671515E 00	4.935137E 00	6.425137E 00
24	3.000000E-02	0.0	3.900000E 00	1.414366E-01	4.041436E 00	5.024526E 00	8.924525E 00
25	2.000000E-02	0.0	1.490000E 01	9.806347E-02	1.499806E 01	5.118345E 00	2.001834E 01
26	1.500000E-02	0.0	3.829999E 01	7.503319E-02	3.837502E 01	5.167019E 00	4.346700E 01
27	9.999998E-03	0.0	1.410000E 02	5.104923E-02	1.410510E 02	5.216928E 00	1.462169E 02

ELEMENT ID NO. 9 SODIUM

ATOMIC NUMBER 11.0000 ATOMIC WEIGHT 22.9898

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	4.150000E-01	0.0	3.780961E-01	7.930961E-01	5.518943E-01	9.668943E-01
2	1.500000E 01	3.510000E-01	0.0	4.507015E-01	8.017015E-01	6.788673E-01	1.029867E 00
3	1.000000E 01	2.650000E-01	0.0	5.657641E-01	8.307641E-01	8.980958E-01	1.163095E 00
4	8.000000E 00	2.210000E-01	0.0	6.338351E-01	8.548350E-01	1.040675E 00	1.261675E 00
5	6.000000E 00	1.680000E-01	0.0	7.238870E-01	8.918869E-01	1.248811E 00	1.416810E 00
6	5.000000E 00	1.370000E-01	0.0	7.807131E-01	9.177131E-01	1.395197E 00	1.532196E 00
7	4.000000E 00	1.020000E-01	0.0	8.480526E-01	9.500526E-01	1.589686E 00	1.691686E 00
8	3.000000E 00	6.140000E-02	0.0	9.278163E-01	9.892163E-01	1.864948E 00	1.926348E 00
9	2.000000E 00	2.140000E-02	0.0	1.018172E 00	1.039572E 00	2.298030E 00	2.319429E 00
10	1.500000E 00	5.369999E-03	0.0	1.061049E 00	1.066419E 00	2.635652E 00	2.641021E 00
11	1.000000E 00	0.0	0.0	1.085515E 00	1.085515E 00	3.151155E 00	3.151155E 00
12	8.000000E-01	0.0	0.0	1.079636E 00	1.079636E 00	3.452622E 00	3.452622E 00
13	6.000000E-01	0.0	1.280000E-03	1.051240E 00	1.052520E 00	3.855967E 00	3.857246E 00
14	5.000000E-01	0.0	2.200000E-03	1.021255E 00	1.023455E 00	4.117275E 00	4.119474E 00
15	4.000000E-01	0.0	4.299998E-03	9.725533E-01	9.768533E-01	4.438906E 00	4.443205E 00
16	3.000000E-01	0.0	1.050000E-02	8.924732E-01	9.029732E-01	4.848070E 00	4.858570E 00
17	2.000000E-01	0.0	3.800000E-02	7.556610E-01	7.936610E-01	5.391385E 00	5.429384E 00
18	1.500000E-01	0.0	9.449995E-02	6.506023E-01	7.451023E-01	5.737752E 00	5.832252E 00
19	9.999996E-02	0.0	3.430000E-01	5.057774E-01	8.487774E-01	6.155133E 00	6.498133E 00
20	7.999998E-02	0.0	7.160000E-01	4.324827E-01	1.148482E 00	6.347221E 00	7.063221E 00
21	6.000000E-02	0.0	1.809999E 00	3.478432E-01	2.157843E 00	6.556625E 00	8.366625E 00
22	5.000000E-02	0.0	3.299999E 00	3.005781E-01	3.600577E 00	6.68573E 00	9.968573E 00
23	4.000000E-02	0.0	6.799999E 00	2.495832E-01	7.049582E 00	6.785813E 00	1.358581E 01
24	3.000000E-02	0.0	1.739999E 01	1.944742E-01	1.759447E 01	6.908722E 00	2.430872E 01
25	2.000000E-02	0.0	6.550000E 01	1.348372E-01	6.563483E 01	7.037724E 00	7.253772E 01
26	1.500000E-02	0.0	1.640000E 02	1.031713E-01	1.641032E 02	7.104651E 00	1.711046E 02
27	9.999998E-03	0.0	5.700000E 02	7.019138E-02	5.700701E 02	7.173276E 00	5.771731E 02

ELEMENT ID NO. 10 MAGNESIUM

ATOMIC NUMBER 12.0000 ATOMIC WEIGHT 24.3120

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	4.880000E-01	0.0	4.124685E-01	9.004685E-01	6.020665E-01	1.090066E 00
2	1.500000E 01	4.119999E-01	0.0	4.916744E-01	9.036744E-01	7.405825E-01	1.152582E 00
3	1.000000E 01	3.140000E-01	0.0	6.171972E-01	9.311971E-01	9.797409E-01	1.293740E 00
4	8.000000E 00	2.610000E-01	0.0	6.914570E-01	9.524570E-01	1.135283E 00	1.396282E 00
5	6.000000E 00	2.000000E-01	0.0	7.896948E-01	9.896948E-01	1.362339E 00	1.562339E 00
6	5.000000E 00	1.619999E-01	0.0	8.516868E-01	1.013686E 00	1.522033E 00	1.684032E 00
7	4.000000E 00	1.220000E-01	0.0	9.251482E-01	1.047148E 00	1.734203E 00	1.856203E 00
8	3.000000E 00	7.309997E-02	0.0	1.012163E 00	1.085262E 00	2.034489E 00	2.107588E 00
9	2.000000E 00	2.550000E-02	0.0	1.110733E 00	1.136232E 00	2.506942E 00	2.532441E 00
10	1.500000E 00	6.399997E-03	0.0	1.157509E 00	1.163908E 00	2.875257E 00	2.881656E 00
11	1.000000E 00	0.0	0.0	1.184198E 00	1.184198E 00	3.437623E 00	3.437623E 00
12	8.000000E-01	0.0	0.0	1.177783E 00	1.177783E 00	3.766497E 00	3.766497E 00
13	6.000000E-01	0.0	2.050000E-03	1.146807E 00	1.148856E 00	4.206509E 00	4.208558E 00
14	5.000000E-01	0.0	3.450000E-03	1.114098E 00	1.117547E 00	4.491573E 00	4.495023E 00
15	4.000000E-01	0.0	6.749999E-03	1.060966E 00	1.067716E 00	4.842443E 00	4.849192E 00
16	3.000000E-01	0.0	1.650000E-02	9.736071E-01	9.901071E-01	5.288804E 00	5.305304E 00
17	2.000000E-01	0.0	5.800000E-02	8.243570E-01	8.823570E-01	5.881511E 00	5.939510E 00
18	1.500000E-01	0.0	1.400000E-01	7.097483E-01	8.497483E-01	6.259366E 00	6.399365E 00
19	9.999996E-02	0.0	5.220000E-01	5.517569E-01	1.073756E 00	6.714691E 00	7.236691E 00
20	7.999998E-02	0.0	1.070000E 00	4.717999E-01	1.541800E 00	6.924242E 00	7.994242E 00
21	6.000000E-02	0.0	2.700000E 00	3.794651E-01	3.079465E 00	7.152682E 00	9.852682E 00
22	5.000000E-02	0.0	4.900000E 00	3.279037E-01	5.227903E 00	7.274808E 00	1.217481E 01
23	4.000000E-02	0.0	1.010000E 01	2.722721E-01	1.037227E 01	7.402705E 00	1.750270E 01
24	3.000000E-02	0.0	2.570000E 01	2.121544E-01	2.591214E 01	7.536788E 00	3.323677E 01
25	2.000000E-02	0.0	9.659999E 01	1.470947E-01	9.674709E 01	7.677518E 00	1.042775E 02
26	1.500000E-02	0.0	2.380000E 02	1.125498E-01	2.381125E 02	7.750528E 00	2.457505E 02
27	9.999998E-03	0.0	8.220000E 02	7.657337E-02	8.220764E 02	7.825393E 00	8.298252E 02

ELEMENT ID NO. 11

ALUMINUM

ATOMIC NUMBER 13.0000 ATOMIC WEIGHT 26.9815

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	5.700000E-01	0.0	4.468408E-01	1.016840E 00	6.522387E-01	1.222239E 00
2	1.500000E 01	4.840000E-01	0.0	5.326473E-01	1.016646E 00	8.022977E-01	1.286297E 00
3	1.000000E 01	3.670000E-01	0.0	6.686295E-01	1.035629E 00	1.061385E 00	1.428385E 00
4	8.000000E 00	3.060000E-01	0.0	7.490779E-01	1.055078E 00	1.229889E 00	1.535889E 00
5	6.000000E 00	2.330000E-01	0.0	8.555027E-01	1.088502E 00	1.475867E 00	1.708867E 00
6	5.000000E 00	1.910000E-01	0.0	9.226614E-01	1.113661E 00	1.648870E 00	1.839869E 00
7	4.000000E 00	1.420000E-01	0.0	1.002243E 00	1.144242E 00	1.878720E 00	2.020720E 00
8	3.000000E 00	8.569998E-02	0.0	1.096510E 00	1.182209E 00	2.204029E 00	2.289728E 00
9	2.000000E 00	3.000000E-02	0.0	1.203294E 00	1.233294E 00	2.715854E 00	2.745853E 00
10	1.500000E 00	7.499997E-03	0.0	1.253967E 00	1.261467E 00	3.114861E 00	3.122360E 00
11	1.000000E 00	0.0	0.0	1.282881E 00	1.282881E 00	3.724092E 00	3.724092E 00
12	8.000000E-01	0.0	1.400000E-03	1.275932E 00	1.277332E 00	4.080372E 00	4.081772E 00
13	6.000000E-01	0.0	3.010000E-03	1.242373E 00	1.245383E 00	4.557051E 00	4.560061E 00
14	5.000000E-01	0.0	5.099997E-03	1.206939E 00	1.212038E 00	4.865870E 00	4.870970E 00
15	4.000000E-01	0.0	1.020000E-02	1.149381E 00	1.159580E 00	5.245979E 00	5.256179E 00
16	3.000000E-01	0.0	2.470000E-02	1.054742E 00	1.079441E 00	5.729538E 00	5.754237E 00
17	2.000000E-01	0.0	8.649999E-02	8.930540E-01	9.795540E-01	6.371637E 00	6.458137E 00
18	1.500000E-01	0.0	2.100000E-01	7.688942E-01	9.788942E-01	6.780980E 00	6.990979E 00
19	9.999996E-02	0.0	7.630000E-01	5.977364E-01	1.360736E 00	7.274248E 00	8.037248E 00
20	7.999998E-02	0.0	1.559999E 00	5.111160E-01	2.071115E 00	7.501262E 00	9.061261E 00
21	6.000000E-02	0.0	3.919999E 00	4.110880E-01	4.331087E 00	7.748739E 00	1.166874E 01
22	5.000000E-02	0.0	7.049999E 00	3.552284E-01	7.405228E 00	7.881042E 00	1.493104E 01
23	4.000000E-02	0.0	1.450000E 01	2.949619E-01	1.479496E 01	8.019598E 00	2.251959E 01
24	3.000000E-02	0.0	3.700000E 01	2.298336E-01	3.722983E 01	8.164854E 00	4.516484E 01
25	2.000000E-02	0.0	1.370000E 02	1.593533E-01	1.371593E 02	8.317311E 00	1.453173E 02
26	1.500000E-02	0.0	3.370000E 02	1.219301E-01	3.371218E 02	8.396406E 00	3.453962E 02
27	9.999998E-03	0.0	1.150000E 03	8.295441E-02	1.150083E 03	8.477509E 00	1.158477E 03

ELEMENT ID NO. 12

SILICON

ATOMIC NUMBER 14.0000

ATOMIC WEIGHT 28.0860

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	6.590000E-01	0.0	4.812132E-01	1.140213E 00	7.024109E-01	1.361410E 00
2	1.500000E 01	5.560000E-01	0.0	5.736201E-01	1.129620E 00	8.640130E-01	1.420012E 00
3	1.000000E 01	4.260000E-01	0.0	7.200625E-01	1.146062E 00	1.143030E 00	1.569030E 00
4	8.000000E 00	3.540000E-01	0.0	8.066998E-01	1.160699E 00	1.324496E 00	1.678495E 00
5	6.000000E 00	2.710000E-01	0.0	9.213107E-01	1.192310E 00	1.589396E 00	1.860395E 00
6	5.000000E 00	2.210000E-01	0.0	9.936351E-01	1.214635E 00	1.775705E 00	1.996705E 00
7	4.000000E 00	1.650000E-01	0.0	1.079339E 00	1.244339E 00	2.023237E 00	2.188237E 00
8	3.000000E 00	9.959996E-02	0.0	1.180858E 00	1.280457E 00	2.373570E 00	2.473170E 00
9	2.000000E 00	3.500000E-02	0.0	1.295856E 00	1.330855E 00	2.924766E 00	2.959765E 00
10	1.500000E 00	8.749999E-03	0.0	1.350427E 00	1.359177E 00	3.354465E 00	3.363215E 00
11	1.000000E 00	0.0	1.220000E-03	1.381564E 00	1.382784E 00	4.010560E 00	4.011780E 00
12	8.000000E-01	0.0	2.100000E-03	1.374081E 00	1.376181E 00	4.394246E 00	4.396346E 00
13	6.000000E-01	0.0	4.499998E-03	1.337941E 00	1.342441E 00	4.907594E 00	4.912093E 00
14	5.000000E-01	0.0	7.429998E-03	1.299780E 00	1.307209E 00	5.240169E 00	5.247598E 00
15	4.000000E-01	0.0	1.460000E-02	1.237794E 00	1.252394E 00	5.649516E 00	5.664116E 00
16	3.000000E-01	0.0	3.560000E-02	1.135876E 00	1.171475E 00	6.170272E 00	6.205872E 00
17	2.000000E-01	0.0	1.230000E-01	9.617500E-01	1.084749E 00	6.861763E 00	6.984762E 00
18	1.500000E-01	0.0	2.990000E-01	8.280401E-01	1.127040E 00	7.302594E 00	7.601594E 00
19	9.999996E-02	0.0	1.089999E 00	6.437159E-01	1.733715E 00	7.833806E 00	8.923805E 00
20	7.999998E-02	0.0	2.209999E 00	5.504332E-01	2.760432E 00	8.078282E 00	1.028828E 01
21	6.000000E-02	0.0	5.549999E 00	4.427099E-01	5.992709E 00	8.344796E 00	1.389480E 01
22	5.000000E-02	0.0	9.950000E 00	3.825541E-01	1.033255E 01	8.487276E 00	1.843727E 01
23	4.000000E-02	0.0	2.039999E 01	3.176508E-01	2.071764E 01	8.636490E 00	2.903648E 01
24	3.000000E-02	0.0	5.109999E 01	2.475128E-01	5.134750E 01	8.792919E 00	5.989290E 01
25	2.000000E-02	0.0	1.880000E 02	1.716108E-01	1.881716E 02	8.957105E 00	1.969571E 02
26	1.500000E-02	0.0	4.600000E 02	1.313086E-01	4.601311E 02	9.042283E 00	4.690422E 02
27	9.999998E-03	0.0	1.550000E 03	8.933544E-02	1.550089E 03	9.129624E 00	1.559129E 03

ATOMIC NUMBER 15.0000 ATOMIC WEIGHT 30.9738

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.00000E 01	7.510000E-01	0.0	5.155856E-01	1.266585E 00	7.525831E-01	1.503583E 00
2	1.50000E 01	6.370000E-01	0.0	6.145930E-01	1.251593E 00	9.257281E-01	1.562728E 00
3	1.00000E 01	4.880000E-01	0.0	7.714955E-01	1.259495E 00	1.224675E 00	1.712675E 00
4	8.00000E 00	4.040000E-01	0.0	8.643208E-01	1.268320E 00	1.419103E 00	1.823102E 00
5	6.00000E 00	3.110000E-01	0.0	9.871185E-01	1.298118E 00	1.702924E 00	2.013924E 00
6	5.00000E 00	2.550000E-01	0.0	1.064609E 00	1.319608E 00	1.902541E 00	2.157540E 00
7	4.00000E 00	1.890000E-01	0.0	1.156436E 00	1.345435E 00	2.167754E 00	2.356753E 00
8	3.00000E 00	1.140000E-01	0.0	1.265204E 00	1.379204E 00	2.543111E 00	2.657110E 00
9	2.00000E 00	4.010000E-02	0.0	1.388416E 00	1.428515E 00	3.133677E 00	3.173777E 00
10	1.50000E 00	1.020000E-02	0.0	1.446886E 00	1.457086E 00	3.594070E 00	3.604270E 00
11	1.00000E 00	0.0	1.760000E-03	1.480247E 00	1.482007E 00	4.297029E 00	4.298788E 00
12	8.00000E-01	0.0	3.000000E-03	1.472230E 00	1.475229E 00	4.708121E 00	4.711121E 00
13	6.00000E-01	0.0	6.299999E-03	1.433508E 00	1.439808E 00	5.258136E 00	5.264436E 00
14	5.00000E-01	0.0	1.030000E-02	1.392622E 00	1.402922E 00	5.614467E 00	5.624766E 00
15	4.00000E-01	0.0	2.070000E-02	1.326208E 00	1.346908E 00	6.053053E 00	6.073752E 00
16	3.00000E-01	0.0	5.010000E-02	1.217010E 00	1.267109E 00	6.611006E 00	6.661105E 00
17	2.00000E-01	0.0	1.760000E-01	1.030446E 00	1.206446E 00	7.351889E 00	7.527888E 00
18	1.50000E-01	0.0	4.190000E-01	8.871861E-01	1.306186E 00	7.824208E 00	8.243208E 00
19	9.999996E-02	0.0	1.500000E 00	6.896963E-01	2.189696E 00	8.393364E 00	9.893364E 00
20	7.999998E-02	0.0	3.059999E 00	5.897493E-01	3.649749E 00	8.655302E 00	1.171530E 01
21	6.000000E-02	0.0	7.650000E 00	4.743319E-01	8.124331E 00	8.940853E 00	1.659085E 01
22	5.000000E-02	0.0	1.360000E 01	4.098787E-01	1.400988E 01	9.093510E 00	2.269350E 01
23	4.000000E-02	0.0	2.759999E 01	3.403397E-01	2.794032E 01	9.253382E 00	3.685336E 01
24	3.000000E-02	0.0	6.900000E 01	2.651930E-01	6.926518E 01	9.420985E 00	7.842097E 01
25	2.000000E-02	0.0	2.520000E 02	1.838694E-01	2.521039E 02	9.596898E 00	2.615967E 02
26	1.500000E-02	0.0	6.130000E 02	1.406879E-01	6.131406E 02	9.688161E 00	6.226880E 02
27	9.999998E-03	0.0	2.060000E 03	9.571648E-02	2.060096E 03	9.781740E 00	2.069782E 03

ELEMENT ID NO. 14

SULFUR

ATOMIC NUMBER 16.0000 ATOMIC WEIGHT 32.0640

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.00000E 01	8.480000E-01	0.0	5.499579E-01	1.397958E 00	8.027554E-01	1.650755E 00
2	1.500000E 01	7.190000E-01	0.0	6.555659E-01	1.374565E 00	9.874434E-01	1.706443E 00
3	1.000000E 01	5.549999E-01	0.0	8.229295E-01	1.377929E 00	1.306321E 00	1.861320E 00
4	8.000000E 00	4.579999E-01	0.0	9.219426E-01	1.379942E 00	1.513710E 00	1.971709E 00
5	6.000000E 00	3.540000E-01	0.0	1.052926E 00	1.406925E 00	1.816452E 00	2.170451E 00
6	5.000000E 00	2.890000E-01	0.0	1.135583E 00	1.424582E 00	2.029378E 00	2.318377E 00
7	4.000000E 00	2.160000E-01	0.0	1.233531E 00	1.449531E 00	2.312271E 00	2.528271E 00
8	3.000000E 00	1.300000E-01	0.0	1.349551E 00	1.479550E 00	2.712652E 00	2.842651E 00
9	2.000000E 00	4.590000E-02	0.0	1.480977E 00	1.526876E 00	3.342589E 00	3.388489E 00
10	1.500000E 00	1.150000E-02	1.100000E-03	1.543344E 00	1.555944E 00	3.833675E 00	3.846274E 00
11	1.000000E 00	0.0	2.450000E-03	1.578931E 00	1.581381E 00	4.583498E 00	4.585948E 00
12	8.000000E-01	0.0	4.199997E-03	1.570378E 00	1.574578E 00	5.021996E 00	5.026196E 00
13	6.000000E-01	0.0	8.800000E-03	1.529076E 00	1.537875E 00	5.608679E 00	5.617478E 00
14	5.000000E-01	0.0	1.430000E-02	1.485463E 00	1.499763E 00	5.988765E 00	6.003064E 00
15	4.000000E-01	0.0	2.840000E-02	1.414622E 00	1.443022E 00	6.456591E 00	6.484990E 00
16	3.000000E-01	0.0	6.899995E-02	1.298143E 00	1.367143E 00	7.051740E 00	7.120739E 00
17	2.000000E-01	0.0	2.359999E-01	1.099143E 00	1.335142E 00	7.842015E 00	8.078014E 00
18	1.500000E-01	0.0	5.700000E-01	9.463320E-01	1.516332E 00	8.345822E 00	8.915822E 00
19	9.999996E-02	0.0	2.020000E 00	7.356758E-01	2.755675E 00	8.952922E 00	1.097292E 01
20	7.999998E-02	0.0	4.129999E 00	6.290655E-01	4.759065E 00	9.232323E 00	1.336232E 01
21	6.000000E-02	0.0	1.020000E 01	5.059538E-01	1.070595E 01	9.536910E 00	1.973691E 01
22	5.000000E-02	0.0	1.820000E 01	4.372044E-01	1.863719E 01	9.699744E 00	2.789973E 01
23	4.000000E-02	0.0	3.700000E 01	3.630295E-01	3.736302E 01	9.870275E 00	4.687027E 01
24	3.000000E-02	0.0	9.220000E 01	2.828722E-01	9.248286E 01	1.004905E 01	1.022490E 02
25	2.000000E-02	0.0	3.300000E 02	1.961269E-01	3.301960E 02	1.023669E 01	3.402366E 02
26	1.500000E-02	0.0	8.010000E 02	1.500673E-01	8.011499E 02	1.033404E 01	8.113340E 02
27	9.999998E-03	0.0	2.660000E 03	1.020975E-01	2.660102E 03	1.043386E 01	2.670434E 03

ELEMENT ID NO. 15

POTASSIUM

ATOMIC NUMBER 19.0000 ATOMIC WEIGHT 39.1020

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.169999E 00	0.0	6.530751E-01	1.823073E 00	9.532720E-01	2.123271E 00
2	1.500000E 01	1.000000E 00	0.0	7.784838E-01	1.778483E 00	1.172588E 00	2.172588E 00
3	1.000000E 01	7.770000E-01	0.0	9.772286E-01	1.754229E 00	1.551256E 00	2.328256E 00
4	8.000000E 00	6.410000E-01	0.0	1.094806E 00	1.735806E 00	1.797530E 00	2.438530E 00
5	6.000000E 00	4.990000E-01	0.0	1.250350E 00	1.749350E 00	2.157037E 00	2.556036E 00
6	5.000000E 00	4.060000E-01	0.0	1.348505E 00	1.754504E 00	2.409885E 00	2.815885E 00
7	4.000000E 00	3.030000E-01	0.0	1.464819E 00	1.767818E 00	2.745822E 00	3.048821E 00
8	3.000000E 00	1.820000E-01	0.0	1.602592E 00	1.784592E 00	3.221274E 00	3.403274E 00
9	2.000000E 00	6.469995E-02	1.820000E-03	1.758660E 00	1.825180E 00	3.969324E 00	4.035843E 00
10	1.500000E 00	1.650000E-02	3.000000E-03	1.832722E 00	1.852221E 00	4.552489E 00	4.571988E 00
11	1.000000E 00	0.0	6.129999E-03	1.874981E 00	1.881110E 00	5.442904E 00	5.449033E 00
12	8.000000E-01	0.0	1.030000E-02	1.864824E 00	1.875124E 00	5.963620E 00	5.973920E 00
13	6.000000E-01	0.0	2.100000E-02	1.815778E 00	1.836778E 00	6.660306E 00	6.681306E 00
14	5.000000E-01	0.0	3.440000E-02	1.763988E 00	1.798388E 00	7.111658E 00	7.146058E 00
15	4.000000E-01	0.0	6.449997E-02	1.679864E 00	1.744364E 00	7.667201E 00	7.731701E 00
16	3.000000E-01	0.0	1.540000E-01	1.541545E 00	1.695544E 00	8.373940E 00	8.527940E 00
17	2.000000E-01	0.0	5.369999E-01	1.305232E 00	1.842232E 00	9.312392E 00	9.849392E 00
18	1.500000E-01	0.0	1.309999E 00	1.123769E 00	2.433768E 00	9.910664E 00	1.122066E 01
19	9.999996E-02	0.0	4.599999E 00	8.736153E-01	5.473615E 00	1.063179E 01	1.523159E 01
20	7.999998E-02	0.0	9.219999E 00	7.470150E-01	9.967014E 00	1.096338E 01	2.018338E 01
21	6.000000E-02	0.0	2.220000E 01	6.008196E-01	2.280081E 01	1.132508E 01	3.352507E 01
22	5.000000E-02	0.0	3.939999E 01	5.191803E-01	3.991917E 01	1.151845E 01	5.091843E 01
23	4.000000E-02	0.0	7.859999E 01	4.310970E-01	7.003108E 01	1.172095E 01	9.032094E 01
24	3.000000E-02	0.0	1.950000E 02	3.359108E-01	1.953359E 02	1.193325E 01	2.069332E 02
25	2.000000E-02	0.0	6.780000E 02	2.329006E-01	6.782327E 02	1.215607E 01	6.901560E 02
26	1.500000E-02	0.0	1.610000E 03	1.782045E-01	1.610178E 03	1.227167E 01	1.622271E 03
27	9.999998E-03	0.0	5.200000E 03	1.212406E-01	5.200121E 03	1.239020E 01	5.212387E 03

ELEMENT ID NO. 16

CALCIUM

ATOMIC NUMBER 20.0000 ATOMIC WEIGHT 40.0800

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.309999E 00	0.0	6.874470E-01	1.997446E 00	1.003444E 00	2.313443E 00
2	1.500000E 01	1.120000E 00	0.0	8.194566E-01	1.939456E 00	1.234303E 00	2.354303E 00
3	1.000000E 01	8.580000E-01	0.0	1.028661E 00	1.886661E 00	1.632901E 00	2.490901E 00
4	8.000000E 00	7.090000E-01	0.0	1.152428E 00	1.861427E 00	1.892138E 00	2.601137E 00
5	6.000000E 00	5.500000E-01	0.0	1.316157E 00	1.866157E 00	2.270565E 00	2.820564E 00
6	5.000000E 00	4.470000E-01	0.0	1.419479E 00	1.866479E 00	2.536722E 00	2.983722E 00
7	4.000000E 00	3.350000E-01	0.0	1.541914E 00	1.876913E 00	2.890339E 00	3.225338E 00
8	3.000000E 00	2.010000E-01	1.210000E-03	1.686939E 00	1.889149E 00	3.390815E 00	3.593023E 00
9	2.000000E 00	7.199997E-02	2.440000E-03	1.851221E 00	1.925660E 00	4.178236E 00	4.252675E 00
10	1.500000E 00	1.820000E-02	4.019998E-03	1.929181E 00	1.951401E 00	4.792094E 00	4.814314E 00
11	1.000000E 00	0.0	8.099999E-03	1.973663E 00	1.981763E 00	5.729372E 00	5.737472E 00
12	8.000000E-01	0.0	1.350000E-02	1.962973E 00	1.976472E 00	6.277495E 00	6.290995E 00
13	6.000000E-01	0.0	2.770000E-02	1.911345E 00	1.939044E 00	7.010848E 00	7.038548E 00
14	5.000000E-01	0.0	4.510000E-02	1.856829E 00	1.901928E 00	7.485955E 00	7.531054E 00
15	4.000000E-01	0.0	8.399999E-02	1.768278E 00	1.852278E 00	8.070738E 00	8.154737E 00
16	3.000000E-01	0.0	1.960000E-01	1.622680E 00	1.818679E 00	8.814674E 00	9.010674E 00
17	2.000000E-01	0.0	6.860000E-01	1.373929E 00	2.059929E 00	9.802519E 00	1.048852E 01
18	1.500000E-01	0.0	1.660000E 00	1.182915E 00	2.842915E 00	1.043228E 01	1.209228E 01
19	9.999996E-02	0.0	5.820000E 00	9.195948E-01	6.739594E 00	1.119115E 01	1.701114E 01
20	7.999998E-02	0.0	1.150000E 01	7.863321E-01	1.228633E 01	1.154040E 01	2.304039E 01
21	6.000000E-02	0.0	2.829999E 01	6.324415E-01	2.893242E 01	1.192114E 01	4.022112E 01
22	5.000000E-02	0.0	4.970000E 01	5.465050E-01	5.024649E 01	1.212468E 01	6.182468E 01
23	4.000000E-02	0.0	9.970000E 01	4.537868E-01	1.001538E 02	1.233784E 01	1.120378E 02
24	3.000000E-02	0.0	2.440000E 02	3.535900E-01	2.443536E 02	1.256131E 01	2.565613E 02
25	2.000000E-02	0.0	8.370000E 02	2.451591E-01	8.372451E 02	1.279586E 01	8.497957E 02
26	1.500000E-02	0.0	1.950000E 03	1.875839E-01	1.950188E 03	1.291755E 01	1.962917E 03
27	9.999998E-03	0.0	6.250000E 03	1.276226E-01	6.250125E 03	1.304232E 01	6.263039E 03

ATOMIC NUMBER	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.570000E 00	0.0	7.561920E-01	2.326191E 00	1.103788E 00	2.673788E 00
2	1.500000E 01	1.339999E 00	0.0	9.014022E-01	2.241401E 00	1.357734E 00	2.697733E 00
3	1.000000E 01	1.040000E 00	0.0	1.131527E 00	2.171527E 00	1.796191E 00	2.836191E 00
4	8.000000E 00	8.540000E-01	0.0	1.267671E 00	2.121670E 00	2.081351E 00	2.935350E 00
5	6.000000E 00	6.630000E-01	0.0	1.447774E 00	2.110773E 00	2.497622E 00	3.160621E 00
6	5.000000E 00	5.420000E-01	9.999999E-04	1.561427E 00	2.104426E 00	2.790394E 00	3.333393E 00
7	4.000000E 00	4.080000E-01	1.350000E-03	1.696106E 00	2.105455E 00	3.179373E 00	3.588722E 00
8	3.000000E 00	2.440000E-01	2.080000E-03	1.855633E 00	2.101712E 00	3.729897E 00	3.975976E 00
9	2.000000E 00	8.699995E-02	4.049998E-03	2.036344E 00	2.127393E 00	4.596060E 00	4.687109E 00
10	1.500000E 00	2.230000E-02	6.449997E-03	2.122099E 00	2.150848E 00	5.271303E 00	5.300053E 00
11	1.000000E 00	0.0	1.350000E-02	2.171030E 00	2.184529E 00	6.302309E 00	6.315808E 00
12	8.000000E-01	0.0	2.230000E-02	2.159270E 00	2.181570E 00	6.905245E 00	6.927545E 00
13	6.000000E-01	0.0	4.520000E-02	2.102479E 00	2.147678E 00	7.711933E 00	7.757133E 00
14	5.000000E-01	0.0	7.249999E-02	2.042512E 00	2.115011E 00	8.234551E 00	8.307051E 00
15	4.000000E-01	0.0	1.330000E-01	1.945106E 00	2.078105E 00	8.877811E 00	9.010811E 00
16	3.000000E-01	0.0	3.080000E-01	1.784946E 00	2.092946E 00	9.696141E 00	1.000414E 01
17	2.000000E-01	0.0	1.059999E 00	1.511321E 00	2.571321E 00	1.078277E 01	1.184277E 01
18	1.500000E-01	0.0	2.580000E 00	1.301206E 00	3.881206E 00	1.147550E 01	1.405550E 01
19	9.999996E-02	0.0	9.000000E 00	1.011555E 00	1.001155E 01	1.231027E 01	2.131026E 01
20	7.999998E-02	0.0	1.779999E 01	8.649654E-01	1.866495E 01	1.269444E 01	3.049443E 01
21	6.000000E-02	0.0	4.320000E 01	6.956863E-01	4.389568E 01	1.311325E 01	5.631325E 01
22	5.000000E-02	0.0	7.570000E 01	6.011562E-01	7.630115E 01	1.333715E 01	8.903714E 01
23	4.000000E-02	0.0	1.510000E 02	4.991655E-01	1.514992E 02	1.357163E 01	1.645716E 02
24	3.000000E-02	0.0	3.670000E 02	3.889494E-01	3.673889E 02	1.381744E 01	3.808174E 02
25	2.000000E-02	0.0	1.210000E 03	2.696743E-01	1.210270E 03	1.407545E 01	1.224075E 03
26	1.500000E-02	0.0	2.820000E 03	2.063427E-01	2.820206E 03	1.420930E 01	2.834209E 03
27	9.999998E-03	0.0	8.750000E 03	1.403837E-01	8.750137E 03	1.434655E 01	8.764344E 03

VANADIUM

ELEMENT ID NO. 18

ATOMIC NUMBER 23.0000 ATOMIC WEIGHT 50.9420

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.700000E 00	0.0	7.905639E-01	2.490563E 00	1.153960E 00	2.853960E 00
2	1.500000E 01	1.459999E 00	0.0	9.423759E-01	2.402374E 00	1.419450E 00	2.879449E 00
3	1.000000E 01	1.129999E 00	0.0	1.182961E 00	2.312960E 00	1.877836E 00	3.007835E 00
4	8.000000E 00	9.290000E-01	0.0	1.325292E 00	2.254292E 00	2.175958E 00	3.104958E 00
5	6.000000E 00	7.230000E-01	1.020000E-03	1.513582E 00	2.237601E 00	2.611150E 00	3.335169E 00
6	5.000000E 00	5.910000E-01	1.280000E-03	1.632401E 00	2.224681E 00	2.917231E 00	3.509510E 00
7	4.000000E 00	4.439999E-01	1.730000E-03	1.773201E 00	2.218930E 00	3.323890E 00	3.769619E 00
8	3.000000E 00	2.679999E-01	2.610000E-03	1.939980E 00	2.210589E 00	3.899437E 00	4.170046E 00
9	2.000000E 00	9.549999E-02	3.129997E-03	2.128904E 00	2.229534E 00	4.804972E 00	4.905602E 00
10	1.500000E 00	2.450000E-02	3.099999E-03	2.218558E 00	2.251158E 00	5.510908E 00	5.543508E 00
11	1.000000E 00	0.0	1.700000E-02	2.269712E 00	2.286712E 00	6.588778E 00	6.605777E 00
12	8.000000E-01	0.0	2.820000E-02	2.257419E 00	2.285618E 00	7.219119E 00	7.247318E 00
13	6.000000E-01	0.0	5.700000E-02	2.198046E 00	2.255045E 00	8.062475E 00	8.119474E 00
14	5.000000E-01	0.0	9.149998E-02	2.135353E 00	2.226852E 00	8.608849E 00	8.700348E 00
15	4.000000E-01	0.0	1.659999E-01	2.033519E 00	2.199518E 00	9.281348E 00	9.447348E 00
16	3.000000E-01	0.0	3.769999E-01	1.866081E 00	2.245081E 00	1.013688E 01	1.051587E 01
17	2.000000E-01	0.0	1.299999E 00	1.580018E 00	2.880017E 00	1.127290E 01	1.257290E 01
18	1.500000E-01	0.0	3.150000E 00	1.360352E 00	4.510351E 00	1.199712E 01	1.514712E 01
19	9.999996E-02	0.0	1.100000E 01	1.057533E 00	1.205753E 01	1.286982E 01	2.386981E 01
20	7.999998E-02	0.0	2.170000E 01	9.042816E-01	2.260428E 01	1.327146E 01	3.497145E 01
21	6.000000E-02	0.0	5.250000E 01	7.273083E-01	5.322729E 01	1.370931E 01	6.620930E 01
22	5.000000E-02	0.0	9.229999E 01	6.284819E-01	9.292847E 01	1.394338E 01	1.062434E 02
23	4.000000E-02	0.0	1.840000E 02	5.218554E-01	1.845219E 02	1.418852E 01	1.981885E 02
24	3.000000E-02	0.0	4.420000E 02	4.066286E-01	4.424065E 02	1.444551E 01	4.564453E 02
25	2.000000E-02	0.0	1.430000E 03	2.819319E-01	1.430282E 03	1.471524E 01	1.444715E 03
26	1.500000E-02	0.0	3.300000E 03	2.157211E-01	3.300216E 03	1.485518E 01	3.314855E 03
27	9.999998E-03	0.0	1.010000E 04	1.467648E-01	1.010014E 04	1.499867E 01	1.011500E 04

ATOMIC NUMBER 24.0000 ATOMIC WEIGHT 51.9960

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.860000E 00	0.0	8.249369E-01	2.684937E 00	1.204133E 00	3.064133E 00
2	1.500000E 01	1.589999E 00	0.0	9.833348E-01	2.573347E 00	1.481165E 00	3.071164E 00
3	1.000000E 01	1.230000E 00	0.0	1.234393E 00	2.464393E 00	1.959481E 00	3.189481E 00
4	8.000000E 00	1.020000E 00	0.0	1.382914E 00	2.402913E 00	2.270565E 00	3.290565E 00
5	6.000000E 00	7.880000E-01	1.300000E-03	1.579391E 00	2.368690E 00	2.724678E 00	3.513977E 00
6	5.000000E 00	6.450000E-01	1.620000E-03	1.703375E 00	2.349995E 00	3.044066E 00	3.690685E 00
7	4.000000E 00	4.840000E-01	2.180000E-03	1.850297E 00	2.336476E 00	3.468407E 00	3.954585E 00
8	3.000000E 00	2.909999E-01	3.290000E-03	2.024327E 00	2.318617E 00	4.068978E 00	4.363267E 00
9	2.000000E 00	1.040000E-01	6.219998E-03	2.221465E 00	2.331685E 00	5.013884E 00	5.124103E 00
10	1.500000E 00	2.700000E-02	9.999998E-03	2.315017E 00	2.352016E 00	5.750513E 00	5.787512E 00
11	1.000000E 00	0.0	2.180000E-02	2.368397E 00	2.390196E 00	6.875247E 00	6.897046E 00
12	8.000000E-01	0.0	3.540000E-02	2.355567E 00	2.390966E 00	7.532994E 00	7.568394E 00
13	6.000000E-01	0.0	7.119995E-02	2.293613E 00	2.364813E 00	8.413018E 00	8.484218E 00
14	5.000000E-01	0.0	1.130000E-01	2.228194E 00	2.341194E 00	8.983147E 00	9.096147E 00
15	4.000000E-01	0.0	2.040000E-01	2.121934E 00	2.325933E 00	9.684886E 00	9.888885E 00
16	3.000000E-01	0.0	4.620000E-01	1.947215E 00	2.409215E 00	1.057761E 01	1.103961E 01
17	2.000000E-01	0.0	1.580000E 00	1.648714E 00	3.228714E 00	1.176302E 01	1.334302E 01
18	1.500000E-01	0.0	3.799999E 00	1.419497E 00	5.219497E 00	1.251873E 01	1.631873E 01
19	9.999996E-02	0.0	1.320000E 01	1.103514E 00	1.430351E 01	1.342938E 01	2.662938E 01
20	7.999998E-02	0.0	2.600000E 01	9.435987E-01	2.694359E 01	1.384848E 01	3.984848E 01
21	6.000000E-02	0.0	6.320000E 01	7.589302E-01	6.395892E 01	1.430536E 01	7.750536E 01
22	5.000000E-02	0.0	1.110000E 02	6.558065E-01	1.116558E 02	1.454962E 01	1.255496E 02
23	4.000000E-02	0.0	2.210000E 02	5.445442E-01	2.215445E 02	1.480541E 01	2.358054E 02
24	3.000000E-02	0.0	5.230000E 02	4.243088E-01	5.234241E 02	1.507358E 01	5.380735E 02
25	2.000000E-02	0.0	1.670000E 03	2.941904E-01	1.670294E 03	1.535504E 01	1.685355E 03
26	1.500000E-02	0.0	3.800000E 03	2.251005E-01	3.800225E 03	1.550106E 01	3.815501E 03
27	9.999998E-03	0.0	1.180000E 04	1.531467E-01	1.180015E 04	1.565079E 01	1.181565E 04

ELEMENT ID NO. 20

MANGANESE

ATOMIC NUMBER 25.0000

ATOMIC WEIGHT 54.9380

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	2.009999E 00	0.0	8.593090E-01	2.869308E 00	1.254305E 00	3.264304E 00
2	1.500000E 01	1.730000E 00	0.0	1.024321E 00	2.754320E 00	1.542880E 00	3.272880E 00
3	1.000000E 01	1.330000E 00	0.0	1.285827E 00	2.615827E 00	2.041126E 00	3.371126E 00
4	8.000000E 00	1.099999E 00	1.180000E-03	1.440535E 00	2.541714E 00	2.365171E 00	3.466351E 00
5	6.000000E 00	8.540000E-01	1.630000E-03	1.645198E 00	2.500828E 00	2.838206E 00	3.693835E 00
6	5.000000E 00	6.980000E-01	2.020000E-03	1.774348E 00	2.474368E 00	3.170902E 00	3.870922E 00
7	4.000000E 00	5.240000E-01	2.670000E-03	1.927393E 00	2.454062E 00	3.612924E 00	4.139592E 00
8	3.000000E 00	3.170000E-01	4.059996E-03	2.108674E 00	2.429733E 00	4.238519E 00	4.559578E 00
9	2.000000E 00	1.130000E-01	7.700000E-03	2.314027E 00	2.434727E 00	5.222795E 00	5.343495E 00
10	1.500000E 00	2.940000E-02	1.240000E-02	2.411475E 00	2.453275E 00	5.990117E 00	6.031917E 00
11	1.000000E 00	0.0	2.700000E-02	2.467080E 00	2.494080E 00	7.161716E 00	7.188715E 00
12	8.000000E-01	0.0	4.400000E-02	2.453716E 00	2.497716E 00	7.846869E 00	7.890869E 00
13	6.000000E-01	0.0	8.699995E-02	2.389181E 00	2.476181E 00	8.763560E 00	8.850560E 00
14	5.000000E-01	0.0	1.390000E-01	2.321036E 00	2.460036E 00	9.357445E 00	9.496445E 00
15	4.000000E-01	0.0	2.500000E-01	2.210348E 00	2.460348E 00	1.008842E 01	1.033842E 01
16	3.000000E-01	0.0	5.599999E-01	2.028349E 00	2.588348E 00	1.101834E 01	1.157834E 01
17	2.000000E-01	0.0	1.910000E 00	1.717411E 00	3.627411E 00	1.225315E 01	1.416315E 01
18	1.500000E-01	0.0	4.599999E 00	1.478643E 00	6.078643E 00	1.304035E 01	1.764034E 01
19	9.999996E-02	0.0	1.590000E 01	1.149494E 00	1.704948E 01	1.398894E 01	2.988893E 01
20	7.999998E-02	0.0	3.159999E 01	9.829149E-01	3.258290E 01	1.442550E 01	4.602548E 01
21	6.000000E-02	0.0	7.500000E 01	7.905531E-01	7.579054E 01	1.490142E 01	8.990141E 01
22	5.000000E-02	0.0	1.320000E 02	6.831312E-01	1.326831E 02	1.515585E 01	1.471558E 02
23	4.000000E-02	0.0	2.620000E 02	5.672331E-01	2.625671E 02	1.542230E 01	2.774221E 02
24	3.000000E-02	0.0	6.200000E 02	4.419880E-01	6.204419E 02	1.570164E 01	6.357014E 02
25	2.000000E-02	0.0	1.960000E 03	3.064489E-01	1.960306E 03	1.599483E 01	1.975995E 03
26	1.500000E-02	0.0	4.410000E 03	2.344723E-01	4.410234E 03	1.614693E 01	4.426145E 03
27	9.999998E-03	0.0	1.360000E 04	1.595154E-01	1.360016E 04	1.630289E 01	1.361630E 04

ELEMENT ID NO. 21

IRON

ATOMIC NUMBER 26.0000

ATOMIC WEIGHT 55.8470

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.00000E 01	2.16000E 00	0.0	8.936809E-01	3.053680E 00	1.304477E 00	3.464477E 00
2	1.50000E 01	1.86000E 00	0.0	1.065293E 00	2.925293E 00	1.604595E 00	3.464595E 00
3	1.00000E 01	1.429999E 00	1.130000E-03	1.337259E 00	2.768388E 00	2.122771E 00	3.553900E 00
4	8.00000E 00	1.19000E 00	1.450000E-03	1.498157E 00	2.689606E 00	2.459779E 00	3.651228E 00
5	6.00000E 00	9.23000E-01	2.00000E-03	1.711006E 00	2.636005E 00	2.951735E 00	3.876734E 00
6	5.00000E 00	7.56000E-01	2.50000E-03	1.845324E 00	2.603823E 00	3.297739E 00	4.056238E 00
7	4.00000E 00	5.65000E-01	3.33000E-03	2.004488E 00	2.572818E 00	3.757441E 00	4.325769E 00
8	3.00000E 00	3.44000E-01	4.999999E-03	2.193021E 00	2.542021E 00	4.408059E 00	4.757058E 00
9	2.00000E 00	1.23000E-01	9.299997E-03	2.406588E 00	2.538887E 00	5.431707E 00	5.564006E 00
10	1.50000E 00	3.20000E-02	1.50000E-02	2.507935E 00	2.554935E 00	6.229722E 00	6.276721E 00
11	1.00000E 00	0.0	3.28000E-02	2.565763E 00	2.598562E 00	7.448184E 00	7.480984E 00
12	8.00000E-01	0.0	5.40000E-02	2.551865E 00	2.605865E 00	8.160744E 00	8.214744E 00
13	6.00000E-01	0.0	1.07000E-01	2.484748E 00	2.591747E 00	9.114102E 00	9.221102E 00
14	5.00000E-01	0.0	1.68000E-01	2.413877E 00	2.581877E 00	9.731742E 00	9.899741E 00
15	4.00000E-01	0.0	3.03000E-01	2.298761E 00	2.601761E 00	1.049196E 01	1.079496E 01
16	3.00000E-01	0.0	6.70000E-01	2.109484E 00	2.779483E 00	1.145908E 01	1.212908E 01
17	2.00000E-01	0.0	2.27000E 00	1.786108E 00	4.056108E 00	1.274327E 01	1.501327E 01
18	1.50000E-01	0.0	5.48000E 00	1.537789E 00	7.017789E 00	1.356196E 01	1.904195E 01
19	9.99999E-02	0.0	1.889999E 01	1.195473E 00	2.009546E 01	1.454850E 01	3.344849E 01
20	7.99999E-02	0.0	3.75000E 01	1.022232E 00	3.852223E 01	1.500252E 01	5.250252E 01
21	6.00000E-02	0.0	8.909999E 01	8.221750E-01	8.992216E 01	1.549748E 01	1.045975E 02
22	5.00000E-02	0.0	1.56000E 02	7.104568E-01	1.567104E 02	1.576208E 01	1.717621E 02
23	4.00000E-02	0.0	3.08000E 02	5.899115E-01	3.085898E 02	1.603918E 01	3.240391E 02
24	3.00000E-02	0.0	7.17000E 02	4.596558E-01	7.174595E 02	1.632970E 01	7.333296E 02
25	2.00000E-02	0.0	2.25000E 03	3.187103E-01	2.250319E 03	1.663461E 01	2.266635E 03
26	1.50000E-02	0.0	5.05000E 03	2.438507E-01	5.050242E 03	1.679280E 01	5.066789E 03
27	9.99999E-03	0.0	1.57000E 04	1.659088E-01	1.570016E 04	1.695502E 01	1.571695E 04

ELEMENT ID NO. 22

COBALT

ATOMIC NUMBER 27.0000 ATOMIC WEIGHT 58.9332

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	2.330000E 00	0.0	9.280539E-01	3.258054E 00	1.354650E 00	3.684649E 00
2	1.500000E 01	2.000000E 00	0.0	1.106267E 00	3.106267E 00	1.666310E 00	3.666310E 00
3	1.000000E 01	1.530000E 00	1.380000E-03	1.388693E 00	2.920073E 00	2.204416E 00	3.735796E 00
4	8.000000E 00	1.270000E 00	1.760000E-03	1.555778E 00	2.827537E 00	2.554385E 00	3.826144E 00
5	6.000000E 00	9.899999E-01	2.480000E-03	1.776814E 00	2.769293E 00	3.065263E 00	4.057742E 00
6	5.000000E 00	8.140000E-01	3.090000E-03	1.916297E 00	2.733386E 00	3.424575E 00	4.241664E 00
7	4.000000E 00	6.140000E-01	4.069999E-03	2.081584E 00	2.699654E 00	3.901958E 00	4.520026E 00
8	3.000000E 00	3.710000E-01	6.079998E-03	2.277368E 00	2.654448E 00	4.577600E 00	4.954679E 00
9	2.000000E 00	1.330000E-01	1.130000E-02	2.499149E 00	2.643449E 00	5.640619E 00	5.784918E 00
10	1.500000E 00	3.470000E-02	1.820000E-02	2.604394E 00	2.657293E 00	6.469327E 00	6.522226E 00
11	1.000000E 00	0.0	3.970000E-02	2.664446E 00	2.704145E 00	7.734653E 00	7.774352E 00
12	8.000000E-01	0.0	6.439996E-02	2.650014E 00	2.714414E 00	8.474619E 00	8.539019E 00
13	6.000000E-01	0.0	1.270000E-01	2.580316E 00	2.707315E 00	9.464645E 00	9.591645E 00
14	5.000000E-01	0.0	2.020000E-01	2.506719E 00	2.708718E 00	1.010604E 01	1.030804E 01
15	4.000000E-01	0.0	3.630000E-01	2.387176E 00	2.750175E 00	1.089550E 01	1.125850E 01
16	3.000000E-01	0.0	8.000000E-01	2.190617E 00	2.990616E 00	1.189981E 01	1.269981E 01
17	2.000000E-01	0.0	2.730000E 00	1.854804E 00	4.584804E 00	1.323340E 01	1.596340E 01
18	1.500000E-01	0.0	6.500000E 00	1.596934E 00	8.096934E 00	1.408357E 01	2.058357E 01
19	9.999996E-02	0.0	2.209999E 01	1.241453E 00	2.334143E 01	1.510806E 01	3.720804E 01
20	7.999998E-02	0.0	4.420000E 01	1.061548E 00	4.526154E 01	1.557954E 01	5.977954E 01
21	6.000000E-02	0.0	1.040000E 02	8.537827E-01	1.048538E 02	1.609352E 01	1.200935E 02
22	5.000000E-02	0.0	1.830000E 02	7.377815E-01	1.837378E 02	1.636832E 01	1.993683E 02
23	4.000000E-02	0.0	3.600000E 02	6.126099E-01	3.606125E 02	1.665608E 01	3.766560E 02
24	3.000000E-02	0.0	8.430000E 02	4.773407E-01	8.434773E 02	1.695776E 01	8.599578E 02
25	2.000000E-02	0.0	2.620000E 03	3.309631E-01	2.620331E 03	1.727441E 01	2.637274E 03
26	1.500000E-02	0.0	5.860000E 03	2.532501E-01	5.860250E 03	1.743869E 01	5.877438E 03
27	9.999998E-03	0.0	1.800000E 04	1.723022E-01	1.800017E 04	1.760713E 01	1.801761E 04

ATOMIC NUMBER 28.0000 ATOMIC WEIGHT 58.7100

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	2.509999E 00	0.0	9.624259E-01	3.472425E 00	1.404821E 00	3.914821E 00
2	1.500000E 01	2.150000E 00	1.110000E-03	1.147240E 00	3.298348E 00	1.728025E 00	3.879134E 00
3	1.000000E 01	1.639999E 00	1.670000E-03	1.440125E 00	3.081795E 00	2.286061E 00	3.927731E 00
4	8.000000E 00	1.370000E 00	2.140000E-03	1.613400E 00	2.985539E 00	2.648993E 00	4.021132E 00
5	6.000000E 00	1.059999E 00	3.000000E-03	1.842622E 00	2.905621E 00	3.178791E 00	4.241790E 00
6	5.000000E 00	8.750000E-01	3.740000E-03	1.987270E 00	2.866010E 00	3.551411E 00	4.430150E 00
7	4.000000E 00	6.600000E-01	4.919998E-03	2.158680E 00	2.823600E 00	4.046474E 00	4.711393E 00
8	3.000000E 00	4.000000E-01	7.299997E-03	2.361714E 00	2.769013E 00	4.747141E 00	5.154440E 00
9	2.000000E 00	1.440000E-01	1.350000E-02	2.591710E 00	2.749209E 00	5.849531E 00	6.007030E 00
10	1.500000E 00	3.750000E-02	2.210000E-02	2.700853E 00	2.760453E 00	6.708932E 00	6.768531E 00
11	1.000000E 00	0.0	4.750000E-02	2.763129E 00	2.810629E 00	8.021121E 00	8.068621E 00
12	8.000000E-01	0.0	7.729995E-02	2.748161E 00	2.825460E 00	8.788493E 00	8.865792E 00
13	6.000000E-01	0.0	1.510000E-01	2.675882E 00	2.826881E 00	9.815187E 00	9.966187E 00
14	5.000000E-01	0.0	2.399999E-01	2.599561E 00	2.839561E 00	1.048034E 01	1.072034E 01
15	4.000000E-01	0.0	4.299999E-01	2.475589E 00	2.905588E 00	1.129903E 01	1.172903E 01
16	3.000000E-01	0.0	9.400000E-01	2.271750E 00	3.211750E 00	1.234054E 01	1.328054E 01
17	2.000000E-01	0.0	3.209999E 00	1.923500E 00	5.133499E 00	1.372353E 01	1.693352E 01
18	1.500000E-01	0.0	7.669999E 00	1.656080E 00	9.326079E 00	1.460519E 01	2.227518E 01
19	9.999996E-02	0.0	2.620000E 01	1.287433E 00	2.748743E 01	1.566761E 01	4.186760E 01
20	7.999998E-02	0.0	5.139999E 01	1.100856E 00	5.250084E 01	1.615656E 01	6.755655E 01
21	6.000000E-02	0.0	1.220000E 02	8.854170E-01	1.228854E 02	1.668959E 01	1.386896E 02
22	5.000000E-02	0.0	2.130000E 02	7.651062E-01	2.137651E 02	1.697455E 01	2.299745E 02
23	4.000000E-02	0.0	4.180000E 02	6.353149E-01	4.186353E 02	1.727298E 01	4.352729E 02
24	3.000000E-02	0.0	9.580000E 02	4.950256E-01	9.584949E 02	1.758583E 01	9.755857E 02
25	2.000000E-02	0.0	3.000000E 03	3.432159E-01	3.000343E 03	1.791420E 01	3.017914E 03
26	1.500000E-02	0.0	6.700000E 03	2.626190E-01	6.700262E 03	1.808456E 01	6.718082E 03
27	9.999998E-03	0.0	2.060000E 04	1.786804E-01	2.060018E 04	1.825925E 01	2.061826E 04

ELEMENT ID NO. 24

COPPER

ATOMIC NUMBER 29.0000 ATOMIC WEIGHT 63.5400

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	2.669999E 00	9.999999E-04	9.967979E-01	3.667796E 00	1.454993E 00	4.125992E 00
2	1.500000E 01	2.299999E 00	1.290000E-03	1.188212E 00	3.489501E 00	1.789741E 00	4.091029E 00
3	1.000000E 01	1.750000E 00	2.000000E-03	1.491558E 00	3.243558E 00	2.367706E 00	4.119706E 00
4	8.000000E 00	1.469999E 00	2.600000E-03	1.671021E 00	3.143620E 00	2.743599E 00	4.216198E 00
5	6.000000E 00	1.139999E 00	3.620000E-03	1.908429E 00	3.052048E 00	3.292319E 00	4.435938E 00
6	5.000000E 00	9.390000E-01	4.499998E-03	2.058245E 00	3.001744E 00	3.678247E 00	4.621746E 00
7	4.000000E 00	7.079999E-01	5.899999E-03	2.235775E 00	2.949675E 00	4.190991E 00	4.904890E 00
8	3.000000E 00	4.310000E-01	8.699998E-03	2.446061E 00	2.885760E 00	4.916681E 00	5.356380E 00
9	2.000000E 00	1.550000E-01	1.610000E-02	2.684271E 00	2.855371E 00	6.058443E 00	6.229543E 00
10	1.500000E 00	4.060000E-02	2.670000E-02	2.797312E 00	2.864612E 00	6.948536E 00	7.015835E 00
11	1.000000E 00	0.0	5.700000E-02	2.861812E 00	2.918811E 00	8.307590E 00	8.364589E 00
12	8.000000E-01	0.0	9.199995E-02	2.846311E 00	2.938310E 00	9.102368E 00	9.194367E 00
13	6.000000E-01	0.0	1.799999E-01	2.771449E 00	2.951448E 00	1.016573E 01	1.034573E 01
14	5.000000E-01	0.0	2.819999E-01	2.692402E 00	2.974401E 00	1.085464E 01	1.113663E 01
15	4.000000E-01	0.0	5.060000E-01	2.564003E 00	3.070003E 00	1.170257E 01	1.220857E 01
16	3.000000E-01	0.0	1.099999E 00	2.352885E 00	3.452885E 00	1.278128E 01	1.388128E 01
17	2.000000E-01	0.0	3.770000E 00	1.992197E 00	5.762197E 00	1.421365E 01	1.798364E 01
18	1.500000E-01	0.0	8.910000E 00	1.715226E 00	1.062523E 01	1.512680E 01	2.403679E 01
19	9.999996E-02	0.0	3.050000E 01	1.333400E 00	3.183339E 01	1.622716E 01	4.672716E 01
20	7.999998E-02	0.0	5.970000E 01	1.140179E 00	6.084016E 01	1.673358E 01	7.643358E 01
21	6.000000E-02	0.0	1.410000E 02	9.170380E-01	1.419170E 02	1.728564E 01	1.582856E 02
22	5.000000E-02	0.0	2.440000E 02	7.924347E-01	2.447924E 02	1.758078E 01	2.615806E 02
23	4.000000E-02	0.0	4.790000E 02	6.579895E-01	4.796580E 02	1.788986E 01	4.968896E 02
24	3.000000E-02	0.0	1.100000E 03	5.127106E-01	1.100513E 03	1.821390E 01	1.118214E 03
25	2.000000E-02	0.0	3.410000E 03	3.554840E-01	3.410355E 03	1.855400E 01	3.428554E 03
26	1.500000E-02	0.0	7.600000E 03	2.720032E-01	7.600270E 03	1.873044E 01	7.618727E 03
27	9.999998E-03	0.0	2.340000E 04	1.850586E-01	2.340018E 04	1.891136E 01	2.341891E 04

ATOMIC NUMBER 30.0000 ATOMIC WEIGHT 65.3700

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	2.870000E 00	1.150000E-03	1.031171E 00	3.902320E 00	1.505166E 00	4.376315E 00
2	1.500000E 01	2.459999E 00	1.500000E-03	1.229185E 00	3.690683E 00	1.851456E 00	4.312954E 00
3	1.000000E 01	1.889999E 00	2.320000E-03	1.542992E 00	3.435310E 00	2.449351E 00	4.341670E 00
4	8.000000E 00	1.570000E 00	3.010000E-03	1.728642E 00	3.301652E 00	2.838206E 00	4.411216E 00
5	6.000000E 00	1.230000E 00	4.199997E-03	1.974237E 00	3.208437E 00	3.405848E 00	4.640047E 00
6	5.000000E 00	1.009999E 00	5.299997E-03	2.129219E 00	3.144518E 00	3.805083E 00	4.820382E 00
7	4.000000E 00	7.580000E-01	7.029999E-03	2.312871E 00	3.077901E 00	4.335508E 00	5.100537E 00
8	3.000000E 00	4.610000E-01	1.030000E-02	2.530409E 00	3.001708E 00	5.086223E 00	5.557522E 00
9	2.000000E 00	1.670000E-01	1.880000E-02	2.776833E 00	2.962632E 00	6.267355E 00	6.453155E 00
10	1.500000E 00	4.380000E-02	3.120000E-02	2.893771E 00	2.968771E 00	7.188141E 00	7.263140E 00
11	1.000000E 00	0.0	6.779999E-02	2.960495E 00	3.028295E 00	8.594058E 00	8.661858E 00
12	8.000000E-01	0.0	1.070000E-01	2.944459E 00	3.051458E 00	9.416243E 00	9.523242E 00
13	6.000000E-01	0.0	2.120000E-01	2.867017E 00	3.079017E 00	1.051627E 01	1.072827E 01
14	5.000000E-01	0.0	3.350000E-01	2.785243E 00	3.120242E 00	1.122893E 01	1.156393E 01
15	4.000000E-01	0.0	5.969999E-01	2.652416E 00	3.249415E 00	1.210611E 01	1.270311E 01
16	3.000000E-01	0.0	1.299999E 00	2.434019E 00	3.734018E 00	1.322201E 01	1.452201E 01
17	2.000000E-01	0.0	4.370000E 00	2.060893E 00	6.430893E 00	1.470378E 01	1.907378E 01
18	1.500000E-01	0.0	1.040000E 01	1.774372E 00	1.217437E 01	1.564842E 01	2.604842E 01
19	9.999996E-02	0.0	3.520000E 01	1.379392E 00	3.657938E 01	1.678673E 01	5.198672E 01
20	7.999998E-02	0.0	6.900000E 01	1.179489E 00	7.017949E 01	1.731059E 01	8.631059E 01
21	6.000000E-02	0.0	1.630000E 02	9.486694E-01	1.639487E 02	1.788170E 01	1.808817E 02
22	5.000000E-02	0.0	2.820000E 02	8.197632E-01	2.828196E 02	1.818701E 01	5.001870E 02
23	4.000000E-02	0.0	5.430000E 02	6.806793E-01	5.436807E 02	1.850676E 01	5.615066E 02
24	3.000000E-02	0.0	1.240000E 03	5.303802E-01	1.240530E 03	1.884196E 01	1.258842E 03
25	2.000000E-02	0.0	3.880000E 03	3.677368E-01	3.880368E 03	1.919379E 01	3.899194E 03
26	1.500000E-02	0.0	8.600000E 03	2.813721E-01	8.600281E 03	1.937631E 01	8.619375E 03
27	9.999998E-03	0.0	2.640000E 04	1.914368E-01	2.640019E 04	1.956348E 01	2.641956E 04

ELEMENT ID NO. 26

YTTRIUM

ATOMIC NUMBER 39.0000 ATOMIC WEIGHT 88.9050

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	4.740000E 00	3.520000E-03	1.340522E 00	6.084041E 00	1.956716E 00	6.700234E 00
2	1.500000E 01	4.070000E 00	4.779998E-03	1.597940E 00	5.672720E 00	2.406893E 00	6.481672E 00
3	1.000000E 01	3.139999E 00	7.499997E-03	2.005891E 00	5.153390E 00	3.184157E 00	6.331656E 00
4	8.000000E 00	2.629999E 00	9.900000E-03	2.247235E 00	4.887134E 00	3.689668E 00	6.329566E 00
5	6.000000E 00	2.059999E 00	1.380000E-02	2.566508E 00	4.640307E 00	4.427602E 00	6.501401E 00
6	5.000000E 00	1.709999E 00	1.750000E-02	2.767984E 00	4.495483E 00	4.946609E 00	6.674108E 00
7	4.000000E 00	1.299999E 00	2.370000E-02	3.006732E 00	4.330431E 00	5.636161E 00	6.959860E 00
8	3.000000E 00	8.010000E-01	3.580000E-02	3.289531E 00	4.126330E 00	6.612089E 00	7.448889E 00
9	2.000000E 00	2.959999E-01	6.599998E-02	3.609881E 00	3.971881E 00	8.147561E 00	8.509561E 00
10	1.500000E 00	7.909995E-02	1.050000E-01	3.761903E 00	3.946002E 00	9.344584E 00	9.528683E 00
11	1.000000E 00	0.0	2.280000E-01	3.848643E 00	4.076643E 00	1.117228E 01	1.140028E 01
12	8.000000E-01	0.0	3.670000E-01	3.827797E 00	4.194797E 00	1.224112E 01	1.260812E 01
13	6.000000E-01	0.0	7.200000E-01	3.727121E 00	4.447121E 00	1.367115E 01	1.439115E 01
14	5.000000E-01	0.0	1.129999E 00	3.620816E 00	4.750815E 00	1.459761E 01	1.572761E 01
15	4.000000E-01	0.0	1.990000E 00	3.448141E 00	5.438141E 00	1.573794E 01	1.772794E 01
16	3.000000E-01	0.0	4.320000E 00	3.164224E 00	7.484223E 00	1.718861E 01	2.150861E 01
17	2.000000E-01	0.0	1.410000E 01	2.679153E 00	1.677914E 01	1.911490E 01	3.321489E 01
18	1.500000E-01	0.0	3.300000E 01	2.306686E 00	3.530669E 01	2.034294E 01	5.334294E 01
19	9.999996E-02	0.0	1.090000E 02	1.793213E 00	1.107932E 02	2.182274E 01	1.308227E 02
20	7.999998E-02	0.0	2.080000E 02	1.533356E 00	2.095334E 02	2.250378E 01	2.305038E 02
21	6.000000E-02	0.0	4.770000E 02	1.233261E 00	4.782332E 02	2.324622E 01	5.002461E 02
22	5.000000E-02	0.0	8.000000E 02	1.065674E 00	8.010657E 02	2.364311E 01	8.236431E 02
23	4.000000E-02	0.0	1.500000E 03	8.848877E-01	1.500885E 03	2.405879E 01	1.524059E 03
24	3.000000E-02	0.0	3.320000E 03	6.894989E-01	3.320689E 03	2.449455E 01	3.344494E 03
25	2.000000E-02	0.0	1.010000E 04	4.780731E-01	1.010048E 04	2.495193E 01	1.012495E 04
26	1.704800E-02	0.0	1.570000E 04	4.123383E-01	1.570041E 04	2.509131E 01	1.572509E 04
27	1.703800E-02	0.0	2.110000E 03	4.120941E-01	2.110412E 03	2.509178E 01	2.135092E 03
28	1.500000E-02	0.0	3.060000E 03	3.657837E-01	3.060366E 03	2.518921E 01	3.085189E 03
29	9.999998E-03	0.0	9.630000E 03	2.488708E-01	9.630246E 03	2.543253E 01	9.655430E 03

ATOMIC NUMBER 40.0000 ATOMIC WEIGHT 91.2200

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.00000E 01	4.99000E 00	3.919996E-03	1.374894E 00	6.368814E 00	2.006888E 00	7.000808E 00
2	1.50000E 01	4.27000E 00	5.339999E-03	1.638914E 00	5.914253E 00	2.468608E 00	6.743947E 00
3	1.00000E 01	3.27000E 00	8.419998E-03	2.057323E 00	5.335743E 00	3.265802E 00	6.544222E 00
4	8.00000E 00	2.75000E 00	1.10000E-02	2.304857E 00	5.065857E 00	3.784275E 00	6.545275E 00
5	6.00000E 00	2.16999E 00	1.55000E-02	2.632317E 00	4.817815E 00	4.541130E 00	6.726228E 00
6	5.00000E 00	1.80999E 00	1.95000E-02	2.838958E 00	4.668457E 00	5.073444E 00	6.902944E 00
7	4.00000E 00	1.37000E 00	2.63000E-02	3.083828E 00	4.480127E 00	5.780678E 00	7.176977E 00
8	3.00000E 00	8.44000E-01	4.02000E-02	3.373878E 00	4.258078E 00	6.781631E 00	7.665830E 00
9	2.00000E 00	3.13000E-01	7.449996E-02	3.702442E 00	4.089942E 00	8.356473E 00	8.743972E 00
10	1.50000E 00	8.39999E-02	1.18000E-01	3.858361E 00	4.060361E 00	9.584188E 00	9.786187E 00
11	1.00000E 00	0.0	2.53000E-01	3.947328E 00	4.200327E 00	1.145875E 01	1.171174E 01
12	8.00000E-01	0.0	4.10000E-01	3.925945E 00	4.335945E 00	1.255499E 01	1.296499E 01
13	6.00000E-01	0.0	8.09999E-01	3.822689E 00	4.632689E 00	1.402170E 01	1.483170E 01
14	5.00000E-01	0.0	1.27000E 00	3.713657E 00	4.983657E 00	1.497191E 01	1.624190E 01
15	4.00000E-01	0.0	2.23000E 00	3.536544E 00	5.766543E 00	1.614146E 01	1.837146E 01
16	3.00000E-01	0.0	4.84999E 00	3.245358E 00	8.095358E 00	1.762935E 01	2.247934E 01
17	2.00000E-01	0.0	1.58000E 01	2.747849E 00	1.854784E 01	1.960503E 01	3.540501E 01
18	1.50000E-01	0.0	3.65999E 01	2.365829E 00	3.896582E 01	2.086455E 01	5.746454E 01
19	9.99999E-02	0.0	1.20000E 02	1.839188E 00	1.218392E 02	2.238229E 01	1.423823E 02
20	7.99999E-02	0.0	2.30000E 02	1.572662E 00	2.315727E 02	2.308080E 01	2.539808E 02
21	6.00000E-02	0.0	5.25000E 02	1.264893E 00	5.262649E 02	2.384227E 01	5.488420E 02
22	5.00000E-02	0.0	8.80000E 02	1.093018E 00	8.810930E 02	2.424936E 01	9.042493E 02
23	4.00000E-02	0.0	1.63000E 03	9.075623E-01	1.630907E 03	2.467567E 01	1.654676E 03
24	3.00000E-02	0.0	3.62000E 03	7.071838E-01	3.620707E 03	2.512262E 01	3.645123E 03
25	2.00000E-02	0.0	1.10000E 04	4.903107E-01	1.100049E 04	2.559172E 01	1.102559E 04
26	1.80000E-02	0.0	1.48000E 04	4.448090E-01	1.480044E 04	2.568834E 01	1.482569E 04
27	1.799800E-02	0.0	2.01000E 03	4.447632E-01	2.010445E 03	2.568843E 01	2.035688E 03
28	1.50000E-02	0.0	3.39000E 03	3.751678E-01	3.390375E 03	2.583508E 01	3.415835E 03
29	9.99999E-03	0.0	1.07000E 04	2.552490E-01	1.070025E 04	2.608464E 01	1.072608E 04

ATOMIC NUMBER 41.0000 ATOMIC WEIGHT 92.9060

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.00000E 01	5.209999E 00	4.369996E-03	1.409266E 00	6.623635E 00	2.057060E 00	7.271429E 00
2	1.50000E 01	4.480000E 00	5.919997E-03	1.679887E 00	6.165806E 00	2.530323E 00	7.016242E 00
3	1.00000E 01	3.450000E 00	9.269997E-03	2.108757E 00	5.568027E 00	3.347447E 00	6.806717E 00
4	8.00000E 00	2.889999E 00	1.210000E-02	2.362478E 00	5.264577E 00	3.878881E 00	6.780980E 00
5	6.00000E 00	2.280000E 00	1.710000E-02	2.698125E 00	4.995224E 00	4.654658E 00	6.951757E 00
6	5.00000E 00	1.889999E 00	2.180000E-02	2.909932E 00	4.821731E 00	5.200280E 00	7.112079E 00
7	4.00000E 00	1.440000E 00	2.930000E-02	3.160924E 00	4.630223E 00	5.925195E 00	7.394494E 00
8	3.00000E 00	8.870000E-01	4.500000E-02	3.458225E 00	4.390224E 00	6.951171E 00	7.883169E 00
9	2.00000E 00	3.300000E-01	8.299994E-02	3.795004E 00	4.208003E 00	8.565385E 00	8.978384E 00
10	1.50000E 00	8.999997E-02	1.320000E-01	3.954820E 00	4.176819E 00	9.823792E 00	1.004579E 01
11	1.00000E 00	0.0	2.819999E-01	4.046011E 00	4.328011E 00	1.174521E 01	1.202721E 01
12	8.00000E-01	0.0	4.590000E-01	4.024095E 00	4.483094E 00	1.286887E 01	1.332787E 01
13	6.00000E-01	0.0	9.000000E-01	3.918257E 00	4.818256E 00	1.437224E 01	1.527224E 01
14	5.00000E-01	0.0	1.419999E 00	3.806499E 00	5.226499E 00	1.534621E 01	1.676620E 01
15	4.00000E-01	0.0	2.480000E 00	3.624970E 00	6.104970E 00	1.654501E 01	1.902501E 01
16	3.00000E-01	0.0	5.400000E 00	3.326478E 00	8.726478E 00	1.807007E 01	2.347006E 01
17	2.00000E-01	0.0	1.750000E 01	2.816559E 00	2.031656E 01	2.009515E 01	3.759515E 01
18	1.50000E-01	0.0	4.039999E 01	2.424988E 00	4.282498E 01	2.138617E 01	6.178616E 01
19	9.999996E-02	0.0	1.320000E 02	1.885162E 00	1.338852E 02	2.294185E 01	1.549418E 02
20	7.999998E-02	0.0	2.520000E 02	1.611984E 00	2.536120E 02	2.365782E 01	2.756577E 02
21	6.000000E-02	0.0	5.770000E 02	1.296509E 00	5.782964E 02	2.443832E 01	6.014382E 02
22	5.000000E-02	0.0	9.700000E 02	1.120346E 00	9.711201E 02	2.485559E 01	9.948555E 02
23	4.000000E-02	0.0	1.800000E 03	9.302673E-01	1.800930E 03	2.529257E 01	1.825292E 03
24	3.000000E-02	0.0	3.950000E 03	7.248535E-01	3.950725E 03	2.575069E 01	3.975750E 03
25	2.000000E-02	0.0	1.210000E 04	5.025787E-01	1.210050E 04	2.623152E 01	1.212623E 04
26	1.900000E-02	0.0	1.390000E 04	4.793396E-01	1.390048E 04	2.628090E 01	1.392628E 04
27	1.898300E-02	0.0	1.930000E 03	4.790192E-01	1.930479E 03	2.628160E 01	1.956281E 03
28	1.500000E-02	0.0	3.770000E 03	3.845520E-01	3.770385E 03	2.648097E 01	3.796481E 03
29	9.999998E-03	0.0	1.180000E 04	2.616272E-01	1.180026E 04	2.673676E 01	1.182673E 04

ATOMIC NUMBER 42.0000 ATOMIC WEIGHT 95.9400

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	5.480000E 00	4.859999E-03	1.443639E 00	6.928498E 00	2.107232E 00	7.592092E 00
2	1.500000E 01	4.679999E 00	6.609999E-03	1.720860E 00	6.407469E 00	2.592038E 00	7.278647E 00
3	1.000000E 01	3.580000E 00	1.040000E-02	2.160190E 00	5.750589E 00	3.429092E 00	7.019492E 00
4	8.000000E 00	3.040000E 00	1.350000E-02	2.420100E 00	5.473599E 00	3.973489E 00	7.026988E 00
5	6.000000E 00	2.370000E 00	1.900000E-02	2.763932E 00	5.152931E 00	4.768187E 00	7.157186E 00
6	5.000000E 00	1.980000E 00	2.410000E-02	2.980906E 00	4.985005E 00	5.327117E 00	7.331216E 00
7	4.000000E 00	1.509999E 00	3.270000E-02	3.238019E 00	4.780718E 00	6.069712E 00	7.612411E 00
8	3.000000E 00	9.320000E-01	5.000000E-02	3.542572E 00	4.524571E 00	7.120711E 00	8.102710E 00
9	2.000000E 00	3.500000E-01	9.299999E-02	3.887565E 00	4.330564E 00	8.774297E 00	9.217296E 00
10	1.500000E 00	9.549999E-02	1.490000E-01	4.051279E 00	4.295778E 00	1.006340E 01	1.030790E 01
11	1.000000E 00	0.0	3.099999E-01	4.144693E 00	4.454693E 00	1.203168E 01	1.234168E 01
12	8.000000E-01	0.0	5.100000E-01	4.122243E 00	4.632242E 00	1.318274E 01	1.369274E 01
13	6.000000E-01	0.0	1.000000E 00	4.013824E 00	5.013824E 00	1.472278E 01	1.572278E 01
14	5.000000E-01	0.0	1.570000E 00	3.899341E 00	5.469340E 00	1.572051E 01	1.729050E 01
15	4.000000E-01	0.0	2.799999E 00	3.713381E 00	6.513380E 00	1.694855E 01	1.974854E 01
16	3.000000E-01	0.0	6.000000E 00	3.407614E 00	9.407614E 00	1.851080E 01	2.451080E 01
17	2.000000E-01	0.0	1.939999E 01	2.885254E 00	2.228525E 01	2.058528E 01	3.998528E 01
18	1.500000E-01	0.0	4.459999E 01	2.484116E 00	4.708411E 01	2.190778E 01	6.650777E 01
19	9.999996E-02	0.0	1.460000E 02	1.931152E 00	1.479312E 02	2.350142E 01	1.695014E 02
20	7.999998E-02	0.0	2.780000E 02	1.651291E 00	2.796511E 02	2.423483E 01	3.022346E 02
21	6.000000E-02	0.0	6.300000E 02	1.328125E 00	6.313281E 02	2.503438E 01	6.550342E 02
22	5.000000E-02	0.0	1.050000E 03	1.147659E 00	1.051147E 03	2.546182E 01	1.075462E 03
23	4.000000E-02	0.0	1.950000E 03	9.529572E-01	1.950953E 03	2.590947E 01	1.975909E 03
24	3.000000E-02	0.0	4.310000E 03	7.425385E-01	4.310742E 03	2.637875E 01	4.336375E 03
25	2.001000E-02	0.0	1.320000E 04	5.150604E-01	1.320051E 04	2.687080E 01	1.322687E 04
26	2.000000E-02	0.0	1.840000E 03	5.148315E-01	1.840515E 03	2.687131E 01	1.866871E 03
27	1.500000E-02	0.0	4.180000E 03	3.939362E-01	4.180391E 03	2.712685E 01	4.207125E 03
28	9.999998E-03	0.0	1.310000E 04	2.680054E-01	1.310027E 04	2.738887E 01	1.312739E 04

ELEMENT ID NO. 30

SILVER

ATOMIC NUMBER 47.0000

ATOMIC WEIGHT 107.8700

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	6.730000E 00	7.979997E-03	1.615500E 00	8.353479E 00	2.358093E 00	9.096072E 00
2	1.500000E 01	5.790000E 00	1.090000E-02	1.925724E 00	7.726624E 00	2.900615E 00	8.701514E 00
3	1.000000E 01	4.450000E 00	1.730000E-02	2.417355E 00	6.884654E 00	3.837317E 00	8.304617E 00
4	8.000000E 00	3.750000E 00	2.230000E-02	2.708206E 00	6.480506E 00	4.446523E 00	8.218822E 00
5	6.000000E 00	2.959999E 00	3.210000E-02	3.092972E 00	6.085071E 00	5.335828E 00	8.327927E 00
6	5.000000E 00	2.500000E 00	4.000000E-02	3.335775E 00	5.875775E 00	5.961297E 00	8.501297E 00
7	4.000000E 00	1.889999E 00	5.450000E-02	3.623498E 00	5.567997E 00	6.792296E 00	8.736795E 00
8	3.000000E 00	1.179999E 00	8.279997E-02	3.964307E 00	5.227106E 00	7.968415E 00	9.231215E 00
9	2.000000E 00	4.489999E-01	1.530000E-01	4.350370E 00	4.952370E 00	9.818856E 00	1.042086E 01
10	1.500000E 00	1.260000E-01	2.449999E-01	4.533575E 00	4.904574E 00	1.126142E 01	1.163242E 01
11	1.000000E 00	0.0	5.250000E-01	4.638109E 00	5.163109E 00	1.346402E 01	1.398902E 01
12	8.000000E-01	0.0	8.500000E-01	4.612987E 00	5.462986E 00	1.475211E 01	1.560211E 01
13	6.000000E-01	0.0	1.650000E 00	4.491645E 00	6.141644E 00	1.647548E 01	1.812547E 01
14	5.000000E-01	0.0	2.599999E 00	4.363547E 00	6.963547E 00	1.759200E 01	2.019199E 01
15	4.000000E-01	0.0	4.610000E 00	4.155451E 00	8.765450E 00	1.896623E 01	2.357622E 01
16	3.000000E-01	0.0	9.900000E 00	3.813293E 00	1.371329E 01	2.071448E 01	3.061447E 01
17	2.000000E-01	0.0	3.150000E 01	3.228745E 00	3.472874E 01	2.303592E 01	5.453592E 01
18	1.500000E-01	0.0	7.209999E 01	2.779846E 00	7.487984E 01	2.451584E 01	9.661583E 01
19	9.999996E-02	0.0	2.290000E 02	2.161041E 00	2.311610E 02	2.629919E 01	2.552992E 02
20	7.999998E-02	0.0	4.310000E 02	1.847870E 00	4.328477E 02	2.711993E 01	4.581199E 02
21	6.000000E-02	0.0	9.700000E 02	1.486237E 00	9.714861E 02	2.801466E 01	9.980146E 02
22	5.000000E-02	0.0	1.600000E 03	1.284286E 00	1.601284E 03	2.849300E 01	1.628493E 03
23	4.000000E-02	0.0	2.960000E 03	1.066406E 00	2.961066E 03	2.899393E 01	2.988994E 03
24	3.000000E-02	0.0	6.500000E 03	8.309326E-01	6.500828E 03	2.951907E 01	6.529516E 03
25	2.552000E-02	0.0	1.010000E 04	7.192841E-01	1.010072E 04	2.976268E 01	1.012976E 04
26	2.551400E-02	0.0	1.500000E 03	7.191467E-01	1.500719E 03	2.976302E 01	1.529763E 03
27	2.000000E-02	0.0	2.980000E 03	5.761108E-01	2.980576E 03	3.007027E 01	3.010070E 03
28	1.500000E-02	0.0	6.730000E 03	4.408264E-01	6.730438E 03	3.035623E 01	6.760355E 03
29	9.999998E-03	0.0	2.070000E 04	2.999115E-01	2.070030E 04	3.064944E 01	2.073065E 04

ATOMIC NUMBER		48.0000		ATOMIC WEIGHT		112.4000			
ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL			
1	2.000000E 01	7.009999E 00	8.699998E-03	1.649874E 00	8.668572E 00	2.408266E 00	9.426965E 00		
2	1.500000E 01	6.040000E 00	1.966697E 00	1.966697E 00	8.018597E 00	2.962330E 00	9.014230E 00		
3	1.000000E 01	4.650000E 00	1.890000E-02	2.468789E 00	7.137689E 00	3.918963E 00	8.587863E 00		
4	8.000000E 00	3.910000E 00	2.430000E-02	2.765828E 00	6.700128E 00	4.541130E 00	8.475430E 00		
5	6.000000E 00	3.089999E 00	3.500000E-02	3.158780E 00	6.283779E 00	5.449356E 00	8.574355E 00		
6	5.000000E 00	2.599999E 00	4.410000E-02	3.406751E 00	6.050850E 00	6.088134E 00	8.732233E 00		
7	4.000000E 00	1.969999E 00	5.940000E-02	3.700593E 00	5.729992E 00	6.936813E 00	8.966212E 00		
8	3.000000E 00	1.230000E 00	9.029996E-02	4.048654E 00	5.368953E 00	8.137957E 00	9.458256E 00		
9	2.000000E 00	4.700000E-01	1.680000E-01	4.442931E 00	5.080931E 00	1.002777E 01	1.066577E 01		
10	1.500000E 00	1.330000E-01	2.690000E-01	4.630033E 00	5.032033E 00	1.150103E 01	1.190302E 01		
11	1.000000E 00	0.0	5.779999E-01	4.736793E 00	5.314792E 00	1.375049E 01	1.432849E 01		
12	8.000000E-01	0.0	9.299999E-01	4.711135E 00	5.641134E 00	1.506599E 01	1.599599E 01		
13	6.000000E-01	0.0	1.799999E 00	4.587225E 00	6.387224E 00	1.682603E 01	1.862602E 01		
14	5.000000E-01	0.0	2.839999E 00	4.456388E 00	7.296388E 00	1.796629E 01	2.080629E 01		
15	4.000000E-01	0.0	5.099999E 00	4.243861E 00	9.343861E 00	1.936977E 01	2.446976E 01		
16	3.000000E-01	0.0	1.080000E 01	3.894424E 00	1.469442E 01	2.115521E 01	3.195520E 01		
17	2.000000E-01	0.0	3.429999E 01	3.297424E 00	3.759741E 01	2.552603E 01	5.782602E 01		
18	1.500000E-01	0.0	7.850000E 01	2.838989E 00	8.133899E 01	2.503746E 01	1.035375E 02		
19	9.999996E-02	0.0	2.480000E 02	2.207031E 00	2.502070E 02	2.685876E 01	2.748586E 02		
20	7.999998E-02	0.0	4.670000E 02	1.887192E 00	4.688870E 02	2.769696E 01	4.946968E 02		
21	6.000000E-02	0.0	1.050000E 03	1.517853E 00	1.051518E 03	2.861072E 01	1.078611E 03		
22	5.000000E-02	0.0	1.740000E 03	1.311615E 00	1.741312E 03	2.909923E 01	1.769099E 03		
23	4.000000E-02	0.0	3.200000E 03	1.089081E 00	3.201089E 03	2.961081E 01	3.229611E 03		
24	3.000000E-02	0.0	7.000000E 03	8.486176E-01	7.000848E 03	3.014714E 01	7.030145E 03		
25	2.672000E-02	0.0	9.580000E 03	7.655334E-01	9.580762E 03	3.032877E 01	9.610328E 03		
26	2.671100E-02	0.0	1.450000E 03	7.653046E-01	1.450765E 03	3.032927E 01	1.480329E 03		
27	2.000000E-02	0.0	3.270000E 03	5.883789E-01	3.270588E 03	3.071007E 01	3.300710E 03		
28	1.500000E-02	0.0	7.370000E 03	4.501953E-01	7.370449E 03	3.100211E 01	7.401000E 03		
29	9.999998E-03	0.0	2.260000E 04	3.062897E-01	2.260030E 04	3.130156E 01	2.263130E 04		

ELEMENT ID NO. 32

INDIUM

ATOMIC NUMBER 49.0000 ATOMIC WEIGHT 114.8200

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	7.309999E 00	9.559996E-03	1.684245E 00	9.003804E 00	2.458438E 00	9.777997E 00
2	1.500000E 01	6.270000E 00	1.310000E-02	2.007670E 00	8.290770E 00	3.024045E 00	9.307145E 00
3	1.000000E 01	4.830000E 00	2.070000E-02	2.520222E 00	7.370921E 00	4.000608E 00	8.851308E 00
4	8.000000E 00	4.049999E 00	2.680000E-02	2.823449E 00	6.900248E 00	4.635736E 00	8.712535E 00
5	6.000000E 00	3.219999E 00	3.850000E-02	3.224587E 00	6.483087E 00	5.562884E 00	8.821383E 00
6	5.000000E 00	2.709999E 00	4.820000E-02	3.477724E 00	6.235923E 00	6.214970E 00	8.973168E 00
7	4.000000E 00	2.059999E 00	6.500000E-02	3.777689E 00	5.902688E 00	7.081330E 00	9.206329E 00
8	3.000000E 00	1.290000E 00	9.899998E-02	4.133000E 00	5.522000E 00	8.307497E 00	9.696497E 00
9	2.000000E 00	4.949999E-01	1.840000E-01	4.535492E 00	5.214492E 00	1.023668E 01	1.091568E 01
10	1.500000E 00	1.400000E-01	2.959999E-01	4.726492E 00	5.162492E 00	1.174063E 01	1.217663E 01
11	1.000000E 00	0.0	6.320000E-01	4.835476E 00	5.467476E 00	1.403696E 01	1.466896E 01
12	8.000000E-01	0.0	1.009999E 00	4.809283E 00	5.819283E 00	1.537986E 01	1.638986E 01
13	6.000000E-01	0.0	1.990000E 00	4.682791E 00	6.672791E 00	1.717657E 01	1.916656E 01
14	5.000000E-01	0.0	3.120000E 00	4.549231E 00	7.669230E 00	1.834059E 01	2.146059E 01
15	4.000000E-01	0.0	5.549999E 00	4.332273E 00	9.882272E 00	1.977330E 01	2.532329E 01
16	3.000000E-01	0.0	1.180000E 01	3.975571E 00	1.577557E 01	2.159595E 01	3.339594E 01
17	2.000000E-01	0.0	3.729999E 01	3.366119E 00	4.066611E 01	2.401616E 01	6.131615E 01
18	1.500000E-01	0.0	8.500000E 01	2.898132E 00	8.789813E 01	2.555907E 01	1.105591E 02
19	9.999996E-02	0.0	2.680000E 02	2.253006E 00	2.702529E 02	2.741832E 01	2.954182E 02
20	7.999998E-02	0.0	5.060000E 02	1.926514E 00	5.079265E 02	2.827399E 01	5.342739E 02
21	6.000000E-02	0.0	1.130000E 03	1.549469E 00	1.131549E 03	2.920677E 01	1.159207E 03
22	5.000000E-02	0.0	1.870000E 03	1.338943E 00	1.871339E 03	2.970546E 01	1.899705E 03
23	4.000000E-02	0.0	3.420000E 03	1.111771E 00	3.421112E 03	3.022771E 01	3.450228E 03
24	3.000000E-02	0.0	7.500000E 03	8.662872E-01	7.500863E 03	3.077521E 01	7.530773E 03
25	2.800000E-02	0.0	9.120000E 03	8.148499E-01	9.120813E 03	3.088791E 01	9.150887E 03
26	2.794000E-02	0.0	1.390000E 03	8.132782E-01	1.390813E 03	3.089130E 01	1.420891E 03
27	2.000000E-02	0.0	3.600000E 03	6.006317E-01	3.600601E 03	3.134985E 01	3.631350E 03
28	1.500000E-02	0.0	8.030000E 03	4.595795E-01	8.030457E 03	3.164798E 01	8.061645E 03
29	9.999998E-03	0.0	2.460000E 04	3.126678E-01	2.460031E 04	3.195367E 01	2.463195E 04

ATOMIC NUMBER 50.0000 ATOMIC WEIGHT 118.6900

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	7.620000E 00	1.040000E-02	1.718617E 00	9.349017E 00	2.508610E 00	1.013901E 01
2	1.500000E 01	6.509999E 00	1.420000E-02	2.048643E 00	8.572842E 00	3.085760E 00	9.609959E 00
3	1.000000E 01	5.009999E 00	2.270000E-02	2.571655E 00	7.604354E 00	4.082253E 00	9.114952E 00
4	8.000000E 00	4.240000E 00	2.940000E-02	2.881071E 00	7.150471E 00	4.730344E 00	8.999743E 00
5	6.000000E 00	3.360000E 00	4.210000E-02	3.290396E 00	6.692495E 00	5.676413E 00	9.078512E 00
6	5.000000E 00	2.820000E 00	5.300000E-02	3.548697E 00	6.421697E 00	6.341805E 00	9.214805E 00
7	4.000000E 00	2.139999E 00	7.119995E-02	3.854785E 00	6.065984E 00	7.225847E 00	9.437046E 00
8	3.000000E 00	1.349999E 00	1.080000E-01	4.217347E 00	5.675346E 00	8.477037E 00	9.935037E 00
9	2.000000E 00	5.160000E-01	2.010000E-01	4.628053E 00	5.345052E 00	1.044559E 01	1.116259E 01
10	1.500000E 00	1.470000E-01	3.250000E-01	4.822951E 00	5.294950E 00	1.198024E 01	1.245223E 01
11	1.000000E 00	0.0	6.900000E-01	4.934159E 00	5.624159E 00	1.432343E 01	1.501343E 01
12	8.000000E-01	0.0	1.099999E 00	4.907433E 00	6.007432E 00	1.569374E 01	1.679373E 01
13	6.000000E-01	0.0	2.179999E 00	4.778356E 00	6.958355E 00	1.752711E 01	1.970711E 01
14	5.000000E-01	0.0	3.400000E 00	4.642073E 00	8.042072E 00	1.871489E 01	2.211488E 01
15	4.000000E-01	0.0	6.080000E 00	4.420684E 00	1.050068E 01	2.017683E 01	2.625682E 01
16	3.000000E-01	0.0	1.290000E 01	4.056702E 00	1.695670E 01	2.203668E 01	3.493668E 01
17	2.000000E-01	0.0	4.079999E 01	3.434814E 00	4.423480E 01	2.450629E 01	6.530627E 01
18	1.500000E-01	0.0	9.200000E 01	2.957291E 00	9.495729E 01	2.608069E 01	1.180807E 02
19	9.999996E-02	0.0	2.900000E 02	2.298996E 00	2.922988E 02	2.797787E 01	3.179778E 02
20	7.999998E-02	0.0	5.450000E 02	1.965820E 00	5.469658E 02	2.885100E 01	5.738508E 02
21	6.000000E-02	0.0	1.220000E 03	1.581116E 00	1.221581E 03	2.980284E 01	1.249803E 03
22	5.000000E-02	0.0	2.000000E 03	1.366257E 00	2.001366E 03	3.031169E 01	2.030312E 03
23	4.000000E-02	0.0	3.680000E 03	1.134476E 00	3.681134E 03	3.084460E 01	3.710844E 03
24	3.000000E-02	0.0	8.090000E 03	8.839722E-01	8.090883E 03	3.140327E 01	8.121402E 03
25	2.930000E-02	0.0	8.680000E 03	8.656921E-01	8.680863E 03	3.144341E 01	8.711441E 03
26	2.920000E-02	0.0	1.340000E 03	8.630676E-01	1.340863E 03	3.144914E 01	1.371449E 03
27	2.000000E-02	0.0	3.950000E 03	6.128998E-01	3.950613E 03	3.198965E 01	3.981990E 03
28	1.500000E-02	0.0	8.760000E 03	4.689636E-01	9.760469E 03	3.229387E 01	8.792293E 03
29	9.999998E-03	0.0	2.690000E 04	3.190460E-01	2.690032E 04	3.260579E 01	2.693261E 04

ELEMENT ID NO. 34

CESIUM

ATOMIC NUMBER 55.0000 ATOMIC WEIGHT 132.9050

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.00000E 01	9.03000E 00	1.55000E-02	1.890479E 00	1.093598E 01	2.759471E 00	1.180497E 01
2	1.50000E 01	7.75000E 00	2.14000E-02	2.253508E 00	1.002491E 01	3.394336E 00	1.116574E 01
3	1.00000E 01	5.95999E 00	3.42000E-02	2.828820E 00	8.823019E 00	4.490479E 00	1.048468E 01
4	8.00000E 00	5.05999E 00	4.44000E-02	3.169178E 00	8.273577E 00	5.203378E 00	1.030778E 01
5	6.00000E 00	4.03000E 00	6.37999E-02	3.619435E 00	7.713235E 00	6.244054E 00	1.033785E 01
6	5.00000E 00	3.37999E 00	8.09999E-02	3.903568E 00	7.364567E 00	6.975986E 00	1.043699E 01
7	4.00000E 00	2.59999E 00	1.08000E-01	4.240263E 00	6.948262E 00	7.948432E 00	1.065643E 01
8	3.00000E 00	1.63999E 00	1.65000E-01	4.639082E 00	6.444081E 00	9.324741E 00	1.112974E 01
9	2.00000E 00	6.45000E-01	3.06000E-01	5.090858E 00	6.041858E 00	1.149015E 01	1.244115E 01
10	1.50000E 00	1.87000E-01	5.00000E-01	5.305247E 00	5.992247E 00	1.317826E 01	1.386526E 01
11	1.00000E 00	0.0	1.05999E 00	5.427574E 00	6.487574E 00	1.575577E 01	1.681577E 01
12	8.00000E-01	0.0	1.70000E 00	5.398170E 00	7.098170E 00	1.726311E 01	1.896310E 01
13	6.00000E-01	0.0	3.33000E 00	5.256195E 00	8.586195E 00	1.927983E 01	2.260982E 01
14	5.00000E-01	0.0	5.16999E 00	5.106266E 00	1.027627E 01	2.058636E 01	2.575636E 01
15	4.00000E-01	0.0	9.20000E 00	4.862762E 00	1.406276E 01	2.219452E 01	3.139452E 01
16	3.00000E-01	0.0	1.95000E 01	4.462357E 00	2.396236E 01	2.424034E 01	4.374034E 01
17	2.00000E-01	0.0	6.00000E 01	3.778305E 00	6.377831E 01	2.695692E 01	8.695692E 01
18	1.50000E-01	0.0	1.35000E 02	3.253006E 00	1.382530E 02	2.868875E 01	1.636888E 02
19	9.99999E-02	0.0	4.19000E 02	2.528885E 00	4.215288E 02	3.077567E 01	4.497756E 02
20	7.99998E-02	0.0	7.80000E 02	2.162415E 00	7.821624E 02	3.173610E 01	8.117361E 02
21	6.00000E-02	0.0	1.73000E 03	1.739227E 00	1.731739E 03	3.278313E 01	1.762783E 03
22	5.00000E-02	0.0	2.85000E 03	1.502899E 00	2.851503E 03	3.334286E 01	2.883343E 03
23	4.00000E-02	0.0	5.19000E 03	1.247910E 00	5.191246E 03	3.392906E 01	5.223926E 03
24	3.599500E-02	0.0	6.89000E 03	1.140137E 00	6.891137E 03	3.417166E 01	6.924168E 03
25	3.598500E-02	0.0	1.12000E 03	1.139847E 00	1.121140E 03	3.417227E 01	1.154172E 03
26	3.00000E-02	0.0	1.88000E 03	9.723816E-01	1.880972E 03	3.454361E 01	1.914543E 03
27	2.00000E-02	0.0	5.85000E 03	6.741791E-01	5.850672E 03	3.518861E 01	5.885188E 03
28	1.50000E-02	0.0	1.30000E 04	5.158539E-01	1.300052E 04	3.552325E 01	1.303552E 04
29	9.99998E-03	0.0	3.94000E C4	3.509674E-01	3.940035E 04	3.586638E 01	3.943586E 04

ATOMIC NUMBER 56.0000 ATOMIC WEIGHT 137.3400

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	9.379999E 00	1.690000E-02	1.924852E 00	1.132175E 01	2.809644E 00	1.220654E 01
2	1.500000E 01	8.000000E 00	2.330000E-02	2.294481E 00	1.031778E 01	3.456052E 00	1.147935E 01
3	1.000000E 01	6.169999E 00	3.720000E-02	2.880253E 00	9.087452E 00	4.572124E 00	1.077932E 01
4	8.000000E 00	5.250000E 00	4.830000E-02	3.226800E 00	8.525100E 00	5.297985E 00	1.059628E 01
5	6.000000E 00	4.160000E 00	6.899995E-02	3.685243E 00	7.914242E 00	6.357582E 00	1.058658E 01
6	5.000000E 00	3.509999E 00	8.769995E-02	3.974542E 00	7.572241E 00	7.102822E 00	1.070052E 01
7	4.000000E 00	2.690000E 00	1.180000E-01	4.317359E 00	7.125358E 00	8.092949E 00	1.090095E 01
8	3.000000E 00	1.709999E 00	1.799999E-01	4.723430E 00	6.613428E 00	9.494283E 00	1.138428E 01
9	2.000000E 00	6.730000E-01	3.300000E-01	5.183419E 00	6.186419E 00	1.169906E 01	1.270206E 01
10	1.500000E 00	1.970000E-01	5.400000E-01	5.401706E 00	6.138705E 00	1.341786E 01	1.415486E 01
11	1.000000E 00	0.0	1.150000E 00	5.526252E 00	6.676251E 00	1.604224E 01	1.719223E 01
12	8.000000E-01	0.0	1.830000E 00	5.496317E 00	7.326317E 00	1.757698E 01	1.940697E 01
13	6.000000E-01	0.0	3.610000E 00	5.351760E 00	8.961760E 00	1.963037E 01	2.324036E 01
14	5.000000E-01	0.0	5.580000E 00	5.199107E 00	1.077911E 01	2.096066E 01	2.654065E 01
15	4.000000E-01	0.0	9.929999E 00	4.951172E 00	1.488117E 01	2.259805E 01	3.252805E 01
16	3.000000E-01	0.0	2.109999E 01	4.543503E 00	2.564349E 01	2.468108E 01	4.578107E 01
17	2.000000E-01	0.0	6.500000E 01	3.847000E 00	6.884700E 01	2.744705E 01	9.244705E 01
18	1.500000E-01	0.0	1.450000E 02	3.312164E 00	1.483122E 02	2.921037E 01	1.742104E 02
19	9.999996E-02	0.0	4.500000E 02	2.574860E 00	4.525747E 02	3.133522E 01	4.813352E 02
20	7.999998E-02	0.0	8.390000E 02	2.201736E 00	8.412017E 02	3.231313E 01	8.713130E 02
21	6.000000E-02	0.0	1.850000E 03	1.770844E 00	1.851771E 03	3.337918E 01	1.883379E 03
22	5.000000E-02	0.0	3.020000E 03	1.530212E 00	3.021530E 03	3.394910E 01	3.053949E 03
23	4.000000E-02	0.0	5.500000E 03	1.270615E 00	5.501270E 03	3.454596E 01	5.534543E 03
24	3.745100E-02	0.0	6.590000E 03	1.201141E 00	6.591199E 03	3.470262E 01	6.624699E 03
25	3.744100E-02	0.0	1.090000E 03	1.200882E 00	1.091201E 03	3.470325E 01	1.124703E 03
26	3.000000E-02	0.0	2.040000E 03	9.900513E-01	2.040990E 03	3.517168E 01	2.075172E 03
27	2.000000E-02	0.0	6.330000E 03	6.864471E-01	6.330684E 03	3.582841E 01	6.365828E 03
28	1.500000E-02	0.0	1.390000E 04	5.252380E-01	1.390052E 04	3.616913E 01	1.393617E 04
29	9.999998E-03	0.0	4.240000E 04	3.573456E-01	4.240036E 04	3.651849E 01	4.243652E 04

ATOMIC NUMBER 62.0000 ATOMIC WEIGHT 150.3500

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.120000E 01	2.620000E-02	2.131086E 00	1.335729E 01	3.110677E 00	1.433688E 01
2	1.500000E 01	9.639999E 00	3.640000E-02	2.540318E 00	1.221672E 01	3.826343E 00	1.350274E 01
3	1.000000E 01	7.469999E 00	5.790000E-02	3.188851E 00	1.071675E 01	5.061994E 00	1.258989E 01
4	8.000000E 00	6.320000E 00	7.589999E-02	3.572528E 00	9.968427E 00	5.865626E 00	1.226153E 01
5	6.000000E 00	5.030000E 00	1.080000E-01	4.080091E 00	9.218090E 00	7.038752E 00	1.217675E 01
6	5.000000E 00	4.270000E 00	1.370000E-01	4.400385E 00	8.807384E 00	7.863839E 00	1.227084E 01
7	4.000000E 00	3.309999E 00	1.849999E-01	4.779933E 00	8.274932E 00	8.960051E 00	1.245505E 01
8	3.000000E 00	2.129999E 00	2.790000E-01	5.229511E 00	7.638510E 00	1.051153E 01	1.292053E 01
9	2.000000E 00	8.550000E-01	5.200000E-01	5.738787E 00	7.113786E 00	1.295253E 01	1.432753E 01
10	1.500000E 00	2.560000E-01	8.600000E-01	5.980460E 00	7.096459E 00	1.485549E 01	1.597149E 01
11	1.000000E 00	0.0	1.799999E 00	6.118350E 00	7.918349E 00	1.776105E 01	1.956104E 01
12	8.000000E-01	0.0	2.870000E 00	6.085216E 00	8.955215E 00	1.946024E 01	2.233023E 01
13	6.000000E-01	0.0	5.589999E 00	5.925165E 00	1.151516E 01	2.173363E 01	2.732362E 01
14	5.000000E-01	0.0	8.750000E 00	5.756165E 00	1.450616E 01	2.320645E 01	3.195645E 01
15	4.000000E-01	0.0	1.530000E 01	5.481674E 00	2.078166E 01	2.501929E 01	4.031927E 01
16	3.000000E-01	0.0	3.259999E 01	5.030304E 00	3.763029E 01	2.732549E 01	5.992548E 01
17	2.000000E-01	0.0	9.850000E 01	4.259186E 00	1.027592E 02	3.038780E 01	1.288878E 02
18	1.500000E-01	0.0	2.170000E 02	3.667038E 00	2.206670E 02	3.234006E 01	2.493401E 02
19	9.999996E-02	0.0	6.550000E 02	2.850739E 00	6.578506E 02	3.469257E 01	6.896924E 02
20	7.999998E-02	0.0	1.200000E 03	2.437622E 00	1.202438E 03	3.577524E 01	1.235775E 03
21	6.000000E-02	0.0	2.620000E 03	1.960571E 00	2.621960E 03	3.695552E 01	2.656955E 03
22	5.000000E-02	0.0	4.300000E 03	1.694168E 00	4.301691E 03	3.758650E 01	4.337586E 03
23	4.684400E-02	0.0	5.140000E 03	1.605820E 00	5.141605E 03	3.779173E 01	5.177789E 03
24	4.683400E-02	0.0	8.970000E 02	1.605530E 00	8.986055E 02	3.779239E 01	9.347922E 02
25	4.000000E-02	0.0	1.410000E 03	1.406738E 00	1.411407E 03	3.824730E 01	1.448247E 03
26	3.000000E-02	0.0	3.150000E 03	1.096130E 00	3.151096E 03	3.894006E 01	3.183940E 03
27	2.000000E-02	0.0	9.590000E 03	7.599945E-01	9.590758E 03	3.966718E 01	9.629664E 03
28	1.500000E-02	0.0	2.090000E 04	5.815125E-01	2.090058E 04	4.004439E 01	2.094004E 04
29	9.999998E-03	0.0	6.280000E 04	3.956299E-01	6.280039E 04	4.043118E 01	6.284043E 04

ATOMIC NUMBER 64.0000 ATOMIC WEIGHT 157.2500

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.190000E 01	3.000000E-02	2.199832E 00	1.412983E 01	3.211021E 00	1.514102E 01
2	1.500000E 01	1.020000E 01	4.170000E-02	2.622263E 00	1.286396E 01	3.949773E 00	1.419147E 01
3	1.000000E 01	7.879999E 00	6.659997E-02	3.291718E 00	1.123832E 01	5.225285E 00	1.317188E 01
4	8.000000E 00	6.719999E 00	8.690000E-02	3.687771E 00	1.049467E 01	6.054840E 00	1.286174E 01
5	6.000000E 00	5.349999E 00	1.240000E-01	4.211706E 00	9.685705E 00	7.265808E 00	1.273981E 01
6	5.000000E 00	4.530000E 00	1.580000E-01	4.542334E 00	9.230333E 00	8.117512E 00	1.280551E 01
7	4.000000E 00	3.509999E 00	2.140000E-01	4.934124E 00	8.658123E 00	9.249084E 00	1.297308E 01
8	3.000000E 00	2.280000E 00	3.230000E-01	5.398205E 00	8.001204E 00	1.085061E 01	1.345361E 01
9	2.000000E 00	9.250000E-01	6.000000E-01	5.923908E 00	7.448908E 00	1.337036E 01	1.489536E 01
10	1.500000E 00	2.790000E-01	9.899999E-01	6.173378E 00	7.442377E 00	1.533470E 01	1.660370E 01
11	1.000000E 00	0.0	2.080000E 00	6.315716E 00	8.395716E 00	1.833398E 01	2.041397E 01
12	8.000000E-01	0.0	3.299999E 00	6.281509E 00	9.581509E 00	2.008798E 01	2.338797E 01
13	6.000000E-01	0.0	6.410000E 00	6.116302E 00	1.252630E 01	2.243471E 01	2.884470E 01
14	5.000000E-01	0.0	9.900000E 00	5.941849E 00	1.584185E 01	2.395505E 01	3.385504E 01
15	4.000000E-01	0.0	1.739999E 01	5.658493E 00	2.305849E 01	2.582635E 01	4.322635E 01
16	3.000000E-01	0.0	3.700000E 01	5.192581E 00	4.219258E 01	2.820695E 01	6.520695E 01
17	2.000000E-01	0.0	1.100000E 02	4.396576E 00	1.143966E 02	3.136806E 01	1.413681E 02
18	1.500000E-01	0.0	2.440000E 02	3.785324E 00	2.477853E 02	3.338329E 01	2.773831E 02
19	9.999996E-02	0.0	7.400000E 02	2.942703E 00	7.429426E 02	3.581168E 01	7.758115E 02
20	7.999998E-02	0.0	1.360000E 03	2.516266E 00	1.362516E 03	3.692929E 01	1.396929E 03
21	6.000000E-02	0.0	2.920000E 03	2.023804E 00	2.922024E 03	3.814763E 01	2.958147E 03
22	5.024900E-02	0.0	4.750000E 03	1.755936E 00	4.751754E 03	3.878239E 01	4.788781E 03
23	5.023900E-02	0.0	8.450000E 02	1.755646E 00	8.467556E 02	3.878307E 01	8.837830E 02
24	5.000000E-02	0.0	8.590000E 02	1.748810E 00	8.607428E 02	3.879897E 01	8.977988E 02
25	4.000000E-02	0.0	1.610000E 03	1.452118E 00	1.611452E 03	3.948109E 01	1.649481E 03
26	3.000000E-02	0.0	3.580000E 03	1.131485E 00	3.581131E 03	4.019620E 01	3.620196E 03
27	2.000000E-02	0.0	1.080000E 04	7.845154E-01	1.080078E 04	4.094676E 01	1.084095E 04
28	1.500000E-02	0.0	2.340000E 04	6.002655E-01	2.340060E 04	4.133615E 01	2.344134E 04
29	9.999998E-03	0.0	7.080000E 04	4.084015E-01	7.080038E 04	4.173543E 01	7.084169E 04

ATOMIC NUMBER 66.0000 ATOMIC WEIGHT 162.5000

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.260000E 01	3.430000E-02	2.268577E 00	1.490288E 01	3.311365E 00	1.594566E 01
2	1.500000E 01	1.070000E 01	4.750000E-02	2.704208E 00	1.345171E 01	4.073203E 00	1.482070E 01
3	1.000000E 01	8.379999E 00	7.599998E-02	3.394585E 00	1.185058E 01	5.388575E 00	1.384457E 01
4	8.000000E 00	7.070000E 00	9.949994E-02	3.803014E 00	1.097251E 01	6.244054E 00	1.341355E 01
5	6.000000E 00	5.679999E 00	1.429999E-01	4.343322E 00	1.016632E 01	7.492865E 00	1.331586E 01
6	5.000000E 00	4.820000E 00	1.810000E-01	4.684281E 00	9.685281E 00	8.371183E 00	1.337218E 01
7	4.000000E 00	3.730000E 00	2.430000E-01	5.088316E 00	9.061315E 00	9.538118E 00	1.351112E 01
8	3.000000E 00	2.440000E 00	3.690000E-01	5.566898E 00	8.375897E 00	1.118969E 01	1.399869E 01
9	2.000000E 00	1.000000E 00	6.849999E-01	6.109030E 00	7.794029E 00	1.378818E 01	1.547318E 01
10	1.500000E 00	3.010000E-01	1.139999E 00	6.366296E 00	7.807295E 00	1.581391E 01	1.725490E 01
11	1.000000E 00	0.0	2.379999E 00	6.513083E 00	8.893082E 00	1.890692E 01	2.128691E 01
12	8.000000E-01	0.0	3.780000E 00	6.477804E 00	1.025780E 01	2.071573E 01	2.449573E 01
13	6.000000E-01	0.0	7.320000E 00	6.307434E 00	1.362743E 01	2.313579E 01	3.045578E 01
14	5.000000E-01	0.0	1.130000E 01	6.127533E 00	1.742752E 01	2.470364E 01	3.600363E 01
15	4.000000E-01	0.0	1.959999E 01	5.835312E 00	2.543530E 01	2.663342E 01	4.623341E 01
16	3.000000E-01	0.0	4.170000E 01	5.354843E 00	4.705484E 01	2.908842E 01	7.078842E 01
17	2.000000E-01	0.0	1.250000E 02	4.533966E 00	1.295340E 02	3.234831E 01	1.573483E 02
18	1.500000E-01	0.0	2.750000E 02	3.903625E 00	2.789036E 02	3.442651E 01	3.094265E 02
19	9.999996E-02	0.0	8.300000E 02	3.034668E 00	8.330347E 02	3.693080E 01	8.669307E 02
20	7.999998E-02	0.0	1.510000E 03	2.594894E 00	1.512595E 03	3.808333E 01	1.548083E 03
21	6.000000E-02	0.0	3.260000E 03	2.087067E 00	3.262087E 03	3.933975E 01	3.299340E 03
22	5.388800E-02	0.0	4.400000E 03	1.916275E 00	4.401914E 03	3.974664E 01	4.439746E 03
23	5.378800E-02	0.0	7.970000E 02	1.913422E 00	7.989133E 02	3.975339E 01	8.367532E 02
24	5.000000E-02	0.0	9.780000E 02	1.803482E 00	9.798035E 02	4.001144E 01	1.018011E 03
25	4.000000E-02	0.0	1.840000E 03	1.497498E 00	1.841497E 03	4.071487E 01	1.880715E 03
26	3.000000E-02	0.0	4.090000E 03	1.166855E 00	4.091167E 03	4.145233E 01	4.131449E 03
27	2.000000E-02	0.0	1.220000E 04	8.090210E-01	1.220081E 04	4.222635E 01	1.224222E 04
28	1.500000E-02	0.0	2.640000E 04	6.190186E-01	2.640062E 04	4.262790E 01	2.644263E 04
29	9.999998E-03	0.0	7.930000E 04	4.211578E-01	7.930038E 04	4.303966E 01	7.934300E 04

ATOMIC NUMBER 70.0000 ATOMIC WEIGHT 173.0400

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.400000E 01	4.420000E-02	2.406066E 00	1.645026E 01	3.512054E 00	1.755624E 01
2	1.500000E 01	1.200000E 01	6.100000E-02	2.868101E 00	1.492910E 01	4.320065E 00	1.638104E 01
3	1.000000E 01	9.339999E 00	9.899998E-02	3.600317E 00	1.303932E 01	5.715155E 00	1.515415E 01
4	8.000000E 00	7.910000E 00	1.289999E-01	4.033500E 00	1.207250E 01	6.622481E 00	1.466148E 01
5	6.000000E 00	6.360000E 00	1.860000E-01	4.606554E 00	1.115255E 01	7.946978E 00	1.449298E 01
6	5.000000E 00	5.410000E 00	2.359999E-01	4.968177E 00	1.061418E 01	8.878528E 00	1.452453E 01
7	4.000000E 00	4.209999E 00	3.180000E-01	5.396699E 00	9.924698E 00	1.011619E 01	1.464419E 01
8	3.000000E 00	2.770000E 00	4.780000E-01	5.904286E 00	9.152286E 00	1.186785E 01	1.511585E 01
9	2.000000E 00	1.160000E 00	8.950000E-01	6.479275E 00	8.534274E 00	1.462383E 01	1.667882E 01
10	1.500000E 00	3.530000E-01	1.490000E 00	6.752127E 00	8.595126E 00	1.677232E 01	1.861531E 01
11	1.000000E 00	0.0	3.099999E 00	6.907815E 00	1.000781E 01	2.005280E 01	2.315279E 01
12	8.000000E-01	0.0	4.900000E 00	6.870393E 00	1.177039E 01	2.197122E 01	2.687122E 01
13	6.000000E-01	0.0	9.500000E 00	6.689713E 00	1.618971E 01	2.453796E 01	3.403796E 01
14	5.000000E-01	0.0	1.460000E 01	6.498901E 00	2.109889E 01	2.620084E 01	4.080083E 01
15	4.000000E-01	0.0	2.529999E 01	6.188965E 00	3.148895E 01	2.824757E 01	5.354756E 01
16	3.000000E-01	0.0	5.320000E 01	5.679367E 00	5.887936E 01	3.085135E 01	8.405135E 01
17	2.000000E-01	0.0	1.600000E 02	4.808746E 00	1.648087E 02	3.430881E 01	1.943088E 02
18	1.500000E-01	0.0	3.480000E 02	4.140213E 00	3.521401E 02	3.651297E 01	3.845129E 02
19	9.999996E-02	0.0	1.020000E 03	3.218582E 00	1.023219E 03	3.916902E 01	1.059169E 03
20	7.999998E-02	0.0	1.870000E 03	2.752167E 00	1.872752E 03	4.039140E 01	1.910391E 03
21	6.134200E-02	0.0	3.800000E 03	2.252228E 00	3.802252E 03	4.163080E 01	3.841631E 03
22	6.133200E-02	0.0	7.120000E 02	2.251938E 00	7.142517E 02	4.163150E 01	7.536313E 02
23	6.000000E-02	0.0	7.550000E 02	2.213547E 00	7.572134E 02	4.172397E 01	7.967239E 02
24	5.000000E-02	0.0	1.260000E 03	1.912766E 00	1.261913E 03	4.243637E 01	1.302436E 03
25	4.000000E-02	0.0	2.360000E 03	1.588257E 00	2.361588E 03	4.318245E 01	2.403182E 03
26	3.000000E-02	0.0	5.180000E 03	1.237564E 00	5.181234E 03	4.396458E 01	5.223961E 03
27	2.000000E-02	0.0	1.540000E 04	8.580627E-01	1.540086E 04	4.478552E 01	1.544479E 04
28	1.500000E-02	0.0	3.330000E 04	6.565399E-01	3.330066E 04	4.521141E 01	3.334521E 04
29	1.049900E-02	0.0	8.750000E 04	4.680176E-01	8.750044E 04	4.560403E 01	8.754556E 04
30	1.048900E-02	0.0	7.560000E 04	4.675598E-01	7.560044E 04	4.560490E 01	7.564556E 04
31	9.999998E-03	0.0	8.580000E 04	4.466705E-01	8.580044E 04	4.564812E 01	8.584563E 04

TABLE 6-7 (CONTINUED)

MAGNESIUM NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)									
GAMMA ENERGY GROUP BOUNDS (MEV)		NEUTRON ENERGY GROUP BOUNDS (MEV)							
		10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015		
7.50- 9.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	4.046E-03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	2.775E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	1.133E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	1.449E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	3.516E-04	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	1.629E-01	3.077E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	8.775E-01	2.353E 00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.90- 1.35	3.051E-02	7.435E-02	3.896E-01	0.0	0.0	0.0	0.0	0.0	0.0
0.40- 0.90	1.361E+02	7.789E-02	5.909E-01	0.0	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	3.397E-03	2.343E-02	6.329E-02	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	1.628E 00	2.836E 00	1.044E 00	0.0	0.0	0.0	0.0	0.0	0.0

ALUMINUM NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)									
GAMMA ENERGY GROUP BOUNDS (MEV)		NEUTRON ENERGY GROUP BOUNDS (MEV)							
		10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015		
7.50- 9.50	1.469E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	4.828E-02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	2.414E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	3.493E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	4.529E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	3.904E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	2.651E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	4.937E-01	3.126E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	4.440E-01	2.067E-01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	3.841E-01	2.833E-01	1.824E-01	0.0	0.0	0.0	0.0	0.0	0.0
0.90- 1.35	2.912E-01	5.546E-01	2.350E-01	0.0	0.0	0.0	0.0	0.0	0.0
0.40- 0.90	6.128E-02	9.109E-02	2.037E-01	0.0	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	1.507E-02	2.241E-02	5.013E-02	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	3.584E 00	1.471E 00	6.713E-01	0.0	0.0	0.0	0.0	0.0	0.0

TABLE 6-7 (CONTINUED)

SILICON NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)						
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015	0.015- 0.0
7.50- 9.50	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	1.324E-01	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	1.535E-01	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	1.470E-01	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	1.255E-01	0.0	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	7.457E-02	0.0	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	1.045E-01	0.0	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	1.299E-01	6.121E-02	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	6.644E-01	6.786E-01	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	7.897E-01	8.842E-01	2.850E-01	0.0	0.0	0.0	0.0
0.90- 1.35	1.495E-02	2.756E-01	5.483E-01	0.0	0.0	0.0	0.0
0.40- 0.90	7.465E-03	0.0	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	1.837E-03	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	2.346E 00	1.900E 00	8.333E-01	0.0	0.0	0.0	0.0

TITANIUM NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)						
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015	0.015- 0.0
7.50- 9.50	1.884E-01	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	1.459E-01	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	3.129E-01	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	7.003E-01	0.0	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	8.843E-01	0.0	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	1.008E 00	0.0	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	2.849E-01	0.0	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	1.557E-01	0.0	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	1.260E-01	0.0	0.0	0.0	0.0	0.0	0.0
1.35- 1.80	2.824E-01	1.566E-01	0.0	0.0	0.0	0.0	0.0
0.90- 1.35	8.235E-01	1.057E 00	1.748E 00	0.0	0.0	0.0	0.0
0.40- 0.90	1.121E-02	0.0	0.0	0.0	0.0	0.0	0.0
0.10- 0.40	1.005E-03	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL ENERGY RELEASED	4.925E 00	1.214E 00	1.748E 00	0.0	0.0	0.0	0.0

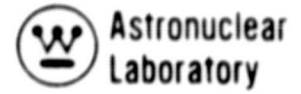
TABLE 6-7 (CONTINUED)

MAGNESIUM NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)					
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015
7.50- 9.50	0.0	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	0.0	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	0.0	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	4.046E-03	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	2.775E-01	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	1.133E-01	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	1.449E-01	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	3.516E-04	0.0	0.0	0.0	0.0	0.0
1.80- 2.20	1.629E-01	3.077E-01	0.0	0.0	0.0	0.0
1.35- 1.80	8.775E-01	2.353E 00	0.0	0.0	0.0	0.0
0.90- 1.35	3.051E-02	7.435E-02	3.896E-01	0.0	0.0	0.0
0.40- 0.90	1.361E+02	7.789E-02	5.909E-01	0.0	0.0	0.0
0.10- 0.40	3.397E-03	2.343E-02	6.329E-02	0.0	0.0	0.0
TOTAL ENERGY RELEASED	1.628E 00	2.836E 00	1.044E 00	0.0	0.0	0.0

ALUMINUM NEUTRON INELASTIC SCATTER GAMMA PRODUCTION, (MEV/NEUTRON EVENT)

GAMMA ENERGY GROUP BOUNDS (MEV)	NEUTRON ENERGY GROUP BOUNDS (MEV)					
	10.000- 2.870	2.870- 1.350	1.350- 0.821	0.821- 0.388	0.388- 0.111	0.111- 0.015
7.50- 9.50	1.469E-01	0.0	0.0	0.0	0.0	0.0
7.00- 7.50	4.828E-02	0.0	0.0	0.0	0.0	0.0
6.00- 7.00	2.414E-01	0.0	0.0	0.0	0.0	0.0
5.00- 6.00	3.493E-01	0.0	0.0	0.0	0.0	0.0
4.00- 5.00	4.529E-01	0.0	0.0	0.0	0.0	0.0
3.00- 4.00	3.904E-01	0.0	0.0	0.0	0.0	0.0
2.60- 3.00	2.651E-01	0.0	0.0	0.0	0.0	0.0
2.20- 2.60	4.937E-01	3.126E-01	0.0	0.0	0.0	0.0
1.80- 2.20	4.440E-01	2.067E-01	0.0	0.0	0.0	0.0
1.35- 1.80	3.841E-01	2.833E-01	1.824E-01	0.0	0.0	0.0
0.90- 1.35	2.912E-01	5.546E-01	2.350E-01	0.0	0.0	0.0
0.40- 0.90	6.128E-02	9.109E-02	2.037E-01	0.0	0.0	0.0
0.10- 0.40	1.507E-02	2.241E-02	5.013E-02	0.0	0.0	0.0
TOTAL ENERGY RELEASED	3.584E 00	1.471E 00	6.713E-01	0.0	0.0	0.0



Astronuclear Laboratory

ELEMENT ID NO. 40

HAFNIUM

ATOMIC NUMBER 72.0000 ATOMIC WEIGHT 178.4900

	ENERGY (MEV)	PAIR PROJ.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.470000E 01	5.000000E-02	2.474812E 00	1.722481E 01	3.612399E 00	1.836238E 01
2	1.500000E 01	1.260000E 01	6.949997E-02	2.950047E 00	1.561955E 01	4.443495E 00	1.711298E 01
3	1.000000E 01	9.830000E 00	1.120000E-01	3.703183E 00	1.364518E 01	5.878445E 00	1.582044E 01
4	8.000000E 00	8.320000E 00	1.460000E-01	4.148742E 00	1.261474E 01	6.811695E 00	1.527769E 01
5	6.000000E 00	6.700000E 00	2.120000E-01	4.738170E 00	1.165017E 01	8.174034E 00	1.508603E 01
6	5.000000E 00	5.690000E 00	2.690000E-01	5.110125E 00	1.106912E 01	9.132200E 00	1.509120E 01
7	4.000000E 00	4.450000E 00	3.600000E-01	5.550890E 00	1.036089E 01	1.040522E 01	1.521522E 01
8	3.000000E 00	2.950000E 00	5.400000E-01	6.072981E 00	9.562981E 00	1.220693E 01	1.569693E 01
9	2.000000E 00	1.240000E 00	1.000000E 00	6.664396E 00	8.904396E 00	1.504165E 01	1.728165E 01
10	1.500000E 00	3.800000E-01	1.660000E 00	6.945037E 00	8.985036E 00	1.725153E 01	1.929150E 01
11	1.000000E 00	0.0	3.490000E 00	7.105181E 00	1.059518E 01	2.062573E 01	2.411572E 01
12	8.000000E-01	0.0	5.500000E 00	7.066702E 00	1.256702E 01	2.259898E 01	2.809898E 01
13	6.000000E-01	0.0	1.060000E 01	6.880844E 00	1.748083E 01	2.523904E 01	3.583904E 01
14	5.000000E-01	0.0	1.650000E 01	6.684586E 00	2.318459E 01	2.694943E 01	4.344943E 01
15	4.000000E-01	0.0	2.839999E 01	6.365814E 00	3.476581E 01	2.905466E 01	5.745466E 01
16	3.000000E-01	0.0	6.009999E 01	5.841644E 00	6.594164E 01	3.173282E 01	9.183281E 01
17	2.000000E-01	0.0	1.770000E 02	4.946152E 00	1.819462E 02	3.528906E 01	2.122891E 02
18	1.500000E-01	0.0	3.850000E 02	4.258499E 00	3.892583E 02	3.755620E 01	4.225562E 02
19	9.999996E-02	0.0	1.130000E 03	3.310547E 00	1.133311E 03	4.028815E 01	1.170288E 03
20	7.999998E-02	0.0	2.050000E 03	2.830795E 00	2.052831E 03	4.154544E 01	2.091545E 03
21	6.535494E-02	0.0	3.530000E 03	2.433182E 00	3.532433E 03	4.253712E 01	3.572537E 03
22	6.534499E-02	0.0	6.740000E 02	2.432907E 00	6.764329E 02	4.253783E 01	7.165376E 02
23	6.000000E-02	0.0	8.550000E 02	2.276794E 00	8.572766E 02	4.291609E 01	8.979160E 02
24	5.000000E-02	0.0	1.440000E 03	1.967407E 00	1.441967E 03	4.364883E 01	1.483649E 03
25	4.000000E-02	0.0	2.660000E 03	1.633636E 00	2.661634E 03	4.441623E 01	2.704416E 03
26	3.000000E-02	0.0	5.840000E 03	1.272919E 00	5.841270E 03	4.522072E 01	5.885219E 03
27	2.000000E-02	0.0	1.730000E 04	8.825836E-01	1.730088E 04	4.606511E 01	1.734606E 04
28	1.500000E-02	0.0	3.720000E 04	6.753082E-01	3.720067E 04	4.650317E 01	3.724650E 04
29	1.128200E-02	0.0	8.020000E 04	5.156097E-01	8.020050E 04	4.683609E 01	8.024681E 04
30	1.127200E-02	0.0	6.920000E 04	5.151825E-01	6.920050E 04	4.683699E 01	6.924681E 04
31	1.074000E-02	0.0	7.860000E 04	4.919434E-01	7.860044E 04	4.688515E 01	7.864688E 04
32	1.073900E-02	0.0	5.690000E 04	4.918976E-01	5.690049E 04	4.688524E 01	5.694688E 04
33	9.999998E-03	0.0	6.860000E 04	4.594421E-01	6.860044E 04	4.695235E 01	6.864694E 04

ATOMIC NUMBER 73.0000 ATOMIC WEIGHT 180.9480

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.510000E 01	5.310000E-02	2.509183E 00	1.766228E 01	3.662571E 00	1.881564E 01
2	1.500000E 01	1.290000E 01	7.389998E-02	2.991019E 00	1.596492E 01	4.505210E 00	1.747910E 01
3	1.000000E 01	1.010000E 01	1.180000E-01	3.754616E 00	1.397261E 01	5.960090E 00	1.617809E 01
4	8.000000E 00	8.520000E 00	1.550000E-01	4.206363E 00	1.288136E 01	6.906301E 00	1.558130E 01
5	6.000000E 00	6.860000E 00	2.230000E-01	4.803977E 00	1.188698E 01	8.287562E 00	1.537056E 01
6	5.000000E 00	5.839999E 00	2.830000E-01	5.181098E 00	1.130410E 01	9.259036E 00	1.538204E 01
7	4.000000E 00	4.570000E 00	3.800000E-01	5.627986E 00	1.057798E 01	1.054974E 01	1.549974E 01
8	3.000000E 00	3.030000E 00	5.720000E-01	6.157328E 00	9.759327E 00	1.237648E 01	1.597847E 01
9	2.000000E 00	1.280000E 00	1.059999E 00	6.756958E 00	9.096957E 00	1.525056E 01	1.759056E 01
10	1.500000E 00	3.929999E-01	1.759999E 00	7.041500E 00	9.194499E 00	1.749113E 01	1.964412E 01
11	1.000000E 00	0.0	3.700000E 00	7.203864E 00	1.090386E 01	2.091220E 01	2.461220E 01
12	8.000000E-01	0.0	5.849999E 00	7.164849E 00	1.301485E 01	2.291286E 01	2.876285E 01
13	6.000000E-01	0.0	1.120000E 01	6.976410E 00	1.817641E 01	2.558958E 01	3.678958E 01
14	5.000000E-01	0.0	1.750000E 01	6.777420E 00	2.427742E 01	2.732373E 01	4.482373E 01
15	4.000000E-01	0.0	3.009999E 01	6.454224E 00	3.655421E 01	2.945819E 01	5.955818E 01
16	3.000000E-01	0.0	6.389999E 01	5.922775E 00	6.982277E 01	3.217355E 01	9.607355E 01
17	2.000000E-01	0.0	1.870000E 02	5.014847E 00	1.920148E 02	3.577919E 01	2.227792E 02
18	1.500000E-01	0.0	4.040000E 02	4.317642E 00	4.083176E 02	3.807780E 01	4.420776E 02
19	9.999996E-02	0.0	1.190000E 03	3.356522E 00	1.193356E 03	4.084770E 01	1.230848E 03
20	7.999998E-02	0.0	2.160000E 03	2.870117E 00	2.162870E 03	4.212247E 01	2.202122E 03
21	6.742597E-02	0.0	3.410000E 03	2.526642E 00	3.412527E 03	4.298177E 01	3.452982E 03
22	6.741595E-02	0.0	6.560000E 02	2.526352E 00	6.585261E 02	4.298247E 01	6.989824E 02
23	6.000000E-02	0.0	9.190000E 02	2.308411E 00	9.213083E 02	4.351215E 01	9.625120E 02
24	5.000000E-02	0.0	1.530000E 03	1.994751E 00	1.531995E 03	4.425508E 01	1.574255E 03
25	4.000000E-02	0.0	2.830000E 03	1.656326E 00	2.831656E 03	4.503313E 01	2.875033E 03
26	3.000000E-02	0.0	6.140000E 03	1.290604E 00	6.141289E 03	4.584879E 01	6.185848E 03
27	2.000000E-02	0.0	1.830000E 04	8.948212E-01	1.830089E 04	4.670490E 01	1.834670E 04
28	1.500000E-02	0.0	3.910000E 04	6.846924E-01	3.910068E 04	4.714905E 01	3.914715E 04
29	1.169000E-02	0.0	7.680000E 04	5.407867E-01	7.680050E 04	4.744923E 01	7.684744E 04
30	1.168000E-02	0.0	6.630000E 04	5.403595E-01	6.630050E 04	4.745015E 01	6.634744E 04
31	1.114600E-02	0.0	7.520000E 04	5.167694E-01	7.520050E 04	4.749905E 01	7.524744E 04
32	1.113600E-02	0.0	5.440000E 04	5.163269E-01	5.440052E 04	4.749997E 01	5.444750E 04
33	9.999998E-03	0.0	7.240000E 04	4.658203E-01	7.240044E 04	4.760446E 01	7.244756E 04

ELEMENT ID NO. 42

TUNGSTEN

ATOMIC NUMBER 74.0000

ATOMIC WEIGHT 183.8500

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.550000E 01	5.600000E-02	2.543555E 00	1.809955E 01	3.712743E 00	1.926874E 01
2	1.500000E 01	1.320000E 01	7.749999E-02	3.031992E 00	1.633094E 01	4.566925E 00	1.784442E 01
3	1.000000E 01	1.030000E 01	1.250000E-01	3.806048E 00	1.423105E 01	6.041735E 00	1.646672E 01
4	8.000000E 00	8.759999E 00	1.650000E-01	4.263985E 00	1.318898E 01	7.000909E 00	1.592591E 01
5	6.000000E 00	7.049999E 00	2.370000E-01	4.869785E 00	1.215678E 01	8.401091E 00	1.568809E 01
6	5.000000E 00	6.020000E 00	3.000000E-01	5.252073E 00	1.157207E 01	9.385873E 00	1.570587E 01
7	4.000000E 00	4.709999E 00	4.060000E-01	5.705081E 00	1.082108E 01	1.069425E 01	1.581025E 01
8	3.000000E 00	3.139999E 00	6.100000E-01	6.241674E 00	9.991673E 00	1.254602E 01	1.629601E 01
9	2.000000E 00	1.330000E 00	1.129999E 00	6.849519E 00	9.309518E 00	1.545948E 01	1.791946E 01
10	1.500000E 00	4.100000E-01	1.870000E 00	7.137963E 00	9.417963E 00	1.773074E 01	2.001073E 01
11	1.000000E 00	0.0	3.919999E 00	7.302547E 00	1.122255E 01	2.119867E 01	2.511867E 01
12	8.000000E-01	0.0	6.219999E 00	7.262997E 00	1.348300E 01	2.322673E 01	2.944672E 01
13	6.000000E-01	0.0	1.190000E 01	7.071960E 00	1.897195E 01	2.594012E 01	3.784012E 01
14	5.000000E-01	0.0	1.850000E 01	6.870270E 00	2.537027E 01	2.769803E 01	4.619803E 01
15	4.000000E-01	0.0	3.189999E 01	6.542633E 00	3.844263E 01	2.986172E 01	6.176172E 01
16	3.000000E-01	0.0	6.709999E 01	6.003906E 00	7.310390E 01	3.261429E 01	9.971428E 01
17	2.000000E-01	0.0	1.970000E 02	5.083542E 00	2.020835E 02	3.626932E 01	2.332693E 02
18	1.500000E-01	0.0	4.270000E 02	4.376785E 00	4.313767E 02	3.859943E 01	4.655994E 02
19	9.999996E-02	0.0	1.250000E 03	3.402496E 00	1.253402E 03	4.140726E 01	1.291407E 03
20	7.999998E-02	0.0	2.270000E 03	2.909424E 00	2.272909E 03	4.269948E 01	2.312699E 03
21	6.953496E-02	0.0	3.290000E 03	2.621887E 00	3.292622E 03	4.342107E 01	3.333421E 03
22	6.952494E-02	0.0	6.390000E 02	2.621643E 00	6.416216E 02	4.342180E 01	6.824216E 02
23	6.000000E-02	0.0	9.650000E 02	2.340042E 00	9.673398E 02	4.410820E 01	1.009108E 03
24	5.000000E-02	0.0	1.610000E 03	2.022079E 00	1.612022E 03	4.486131E 01	1.654861E 03
25	4.000000E-02	0.0	2.980000E 03	1.679001E 00	2.981679E 03	4.565001E 01	3.025650E 03
26	3.000000E-02	0.0	6.510000E 03	1.308289E 00	6.511305E 03	4.647685E 01	6.556477E 03
27	2.000000E-02	0.0	1.930000E 04	9.070892E-01	1.930091E 04	4.734470E 01	1.934734E 04
28	1.500000E-02	0.0	4.130000E 04	6.940613E-01	4.130069E 04	4.779492E 01	4.134779E 04
29	1.210800E-02	0.0	7.360000E 04	5.668335E-01	7.360056E 04	4.806052E 01	7.364800E 04
30	1.209800E-02	0.0	6.350000E 04	5.663757E-01	6.350056E 04	4.806143E 01	6.354806E 04
31	1.155100E-02	0.0	7.190000E 04	5.419769E-01	7.190050E 04	4.811212E 01	7.194806E 04
32	1.154100E-02	0.0	5.210000E 04	5.415192E-01	5.210054E 04	4.811304E 01	5.214811E 04
33	1.021400E-02	0.0	7.210000E 04	4.818878E-01	7.210044E 04	4.823659E 01	7.214819E 04
34	1.020400E-02	0.0	2.590000E 04	4.814301E-01	2.590048E 04	4.823752E 01	2.594823E 04
35	9.999998E-03	0.0	2.710000E 04	4.721985E-01	2.710047E 04	4.825658E 01	2.714825E 04

ATOMIC NUMBER 79.0000 ATOMIC WEIGHT 196.9670

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.00000E 01	1.75000E 01	7.559997E-02	2.715417E 00	2.029100E 01	3.963604E 00	2.153918E 01
2	1.50000E 01	1.48000E 01	1.040000E-01	3.236856E 00	1.814085E 01	4.875502E 00	1.977948E 01
3	1.00000E 01	1.16000E 01	1.680000E-01	4.063214E 00	1.583121E 01	6.449960E 00	1.821796E 01
4	8.00000E 00	9.83000E 00	2.200000E-01	4.552092E 00	1.460209E 01	7.473943E 00	1.752393E 01
5	6.00000E 00	7.98000E 00	3.180000E-01	5.198825E 00	1.349682E 01	8.968732E 00	1.726672E 01
6	5.00000E 00	6.83000E 00	4.020000E-01	5.606942E 00	1.283894E 01	1.002005E 01	1.725204E 01
7	4.00000E 00	5.379999E 00	5.480000E-01	6.090560E 00	1.201856E 01	1.141684E 01	1.734482E 01
8	3.00000E 00	3.620000E 00	8.200000E-01	6.663409E 00	1.110341E 01	1.339372E 01	1.783371E 01
9	2.00000E 00	1.570000E 00	1.520000E 00	7.312318E 00	1.040232E 01	1.650403E 01	1.959401E 01
10	1.50000E 00	4.899999E-01	2.500000E 00	7.620264E 00	1.061026E 01	1.892877E 01	2.191876E 01
11	1.00000E 00	0.0	5.270000E 00	7.795962E 00	1.306596E 01	2.263101E 01	2.790100E 01
12	8.00000E-01	0.0	8.299999E 00	7.753738E 00	1.605373E 01	2.479610E 01	3.309608E 01
13	6.00000E-01	0.0	1.580000E 01	7.549805E 00	2.334979E 01	2.769284E 01	4.349283E 01
14	5.00000E-01	0.0	2.420000E 01	7.334473E 00	3.153447E 01	2.956952E 01	5.376952E 01
15	4.00000E-01	0.0	4.189999E 01	6.984695E 00	4.888469E 01	3.187941E 01	7.377940E 01
16	3.00000E-01	0.0	8.700000E 01	6.409592E 00	9.340959E 01	3.481796E 01	1.218180E 02
17	2.00000E-01	0.0	2.520000E 02	5.427017E 00	2.574270E 02	3.871994E 01	2.907197E 02
18	1.50000E-01	0.0	5.400000E 02	4.672516E 00	5.446724E 02	4.120749E 01	5.812073E 02
19	9.999996E-02	0.0	1.580000E 03	3.632401E 00	1.583632E 03	4.420505E 01	1.624205E 03
20	8.073497E-02	0.0	2.770000E 03	3.126694E 00	2.773126E 03	4.553178E 01	2.815532E 03
21	8.072495E-02	0.0	5.600000E 02	3.126419E 00	5.631262E 02	4.553250E 01	6.055325E 02
22	7.999998E-02	0.0	5.760000E 02	3.106003E 00	5.791060E 02	4.558458E 01	6.215845E 02
23	6.000000E-02	0.0	1.290000E 03	2.498154E 00	1.292498E 03	4.708849E 01	1.337088E 03
24	5.000000E-02	0.0	2.140000E 03	2.158707E 00	2.142159E 03	4.789249E 01	2.187892E 03
25	4.000000E-02	0.0	3.910000E 03	1.792450E 00	3.911792E 03	4.873447E 01	3.958734E 03
26	3.000000E-02	0.0	8.490000E 03	1.396683E 00	8.491395E 03	4.961719E 01	8.539617E 03
27	2.000000E-02	0.0	2.490000E 04	9.683685E-01	2.490096E 04	5.054366E 01	2.495054E 04
28	1.500000E-02	0.0	5.330000E 04	7.409515E-01	5.330074E 04	5.102431E 01	5.335102E 04
29	1.436300E-02	0.0	5.970000E 04	7.113190E-01	5.970071E 04	5.108641E 01	5.975109E 04
30	1.435300E-02	0.0	5.140000E 04	7.108612E-01	5.140071E 04	5.108739E 01	5.145109E 04
31	1.374400E-02	0.0	5.790000E 04	6.823425E-01	5.790068E 04	5.114693E 01	5.795114E 04
32	1.373400E-02	0.0	4.190000E 04	6.819000E-01	4.190068E 04	5.114793E 01	4.195114E 04
33	1.192900E-02	0.0	6.020000E 04	5.966187E-01	6.020059E 04	5.132553E 01	6.025132E 04
34	1.191900E-02	0.0	2.270000E 04	5.961609E-01	2.270059E 04	5.132654E 01	2.275132E 04
35	9.999998E-03	0.0	3.630000E 04	5.041046E-01	3.630050E 04	5.151717E 01	3.635152E 04

ELEMENT ID NO. 44

MERCURY

ATOMIC NUMBER 80.0000

ATOMIC WEIGHT 200.5900

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.00000E 01	1.789999E 01	7.979995E-02	2.749790E 00	2.072957E 01	4.013777E 00	2.199355E 01
2	1.500000E 01	1.520000E 01	1.100000E-01	3.277829E 00	1.858781E 01	4.937217E 00	2.024719E 01
3	1.000000E 01	1.190000E 01	1.770000E-01	4.114648E 00	1.619164E 01	6.531606E 00	1.860858E 01
4	8.000000E 00	1.010000E 01	2.320000E-01	4.609714E 00	1.494171E 01	7.568550E 00	1.790054E 01
5	6.000000E 00	8.169999E 00	3.380000E-01	5.264632E 00	1.377263E 01	9.082260E 00	1.759026E 01
6	5.000000E 00	7.000000E 00	4.260000E-01	5.677917E 00	1.310392E 01	1.014689E 01	1.757288E 01
7	4.000000E 00	5.509999E 00	5.790000E-01	6.167655E 00	1.225665E 01	1.156136E 01	1.765034E 01
8	3.000000E 00	3.730000E 00	8.699999E-01	6.747756E 00	1.134776E 01	1.356326E 01	1.816325E 01
9	2.000000E 00	1.629999E 00	1.610000E 00	7.404875E 00	1.064487E 01	1.671294E 01	1.995291E 01
10	1.500000E 00	5.100000E-01	2.660000E 00	7.716711E 00	1.088671E 01	1.916837E 01	2.233835E 01
11	1.000000E 00	0.0	5.559999E 00	7.894645E 00	1.345464E 01	2.291748E 01	2.847748E 01
12	8.000000E-01	0.0	8.799999E 00	7.851883E 00	1.665187E 01	2.510997E 01	3.390996E 01
13	6.000000E-01	0.0	1.659999E 01	7.645370E 00	2.424536E 01	2.804338E 01	4.464337E 01
14	5.000000E-01	0.0	2.559999E 01	7.427322E 00	3.302731E 01	2.994382E 01	5.554381E 01
15	4.000000E-01	0.0	4.400000E 01	7.073105E 00	5.107310E 01	3.228294E 01	7.628294E 01
16	3.000000E-01	0.0	9.150000E 01	6.490723E 00	9.799072E 01	3.525870E 01	1.267587E 02
17	2.000000E-01	0.0	2.650000E 02	5.495712E 00	2.704956E 02	3.921007E 01	3.042100E 02
18	1.500000E-01	0.0	5.670000E 02	4.731659E 00	5.717314E 02	4.17111E 01	6.087290E 02
19	9.999996E-02	0.0	1.650000E 03	3.678375E 00	1.653678E 03	4.476460E 01	1.694764E 03
20	8.311194E-02	0.0	2.680000E 03	3.233307E 00	2.683233E 03	4.593637E 01	2.725936E 03
21	8.310199E-02	0.0	5.460000E 02	3.233032E 00	5.492329E 02	4.593707E 01	5.919370E 02
22	7.999998E-02	0.0	6.080000E 02	3.145325E 00	6.111453E 02	4.616161E 01	6.541614E 02
23	6.000000E-02	0.0	1.360000E 03	2.529770E 00	1.362530E 03	4.768454E 01	1.407684E 03
24	5.000000E-02	0.0	2.260000E 03	2.186020E 00	2.262186E 03	4.849872E 01	2.308499E 03
25	4.000000E-02	0.0	4.100000E 03	1.815140E 00	4.101813E 03	4.935136E 01	4.149348E 03
26	3.000000E-02	0.0	8.940000E 03	1.414368E 00	8.941414E 03	5.024525E 01	8.990242E 03
27	2.000000E-02	0.0	2.610000E 04	9.806366E-01	2.610098E 04	5.118346E 01	2.615118E 04
28	1.500000E-02	0.0	5.580000E 04	7.503357E-01	5.580075E 04	5.167018E 01	5.585167E 04
29	1.485200E-02	0.0	5.730000E 04	7.433929E-01	5.730074E 04	5.168478E 01	5.735168E 04
30	1.484200E-02	0.0	4.930000E 04	7.428894E-01	4.930074E 04	5.168575E 01	4.935168E 04
31	1.421900E-02	0.0	5.550000E 04	7.135315E-01	5.550071E 04	5.174731E 01	5.555175E 04
32	1.420900E-02	0.0	4.010000E 04	7.130280E-01	4.010071E 04	5.174829E 01	4.015175E 04
33	1.229300E-02	0.0	5.820000E 04	6.217041E-01	5.820062E 04	5.193883E 01	5.825194E 04
34	1.228300E-02	0.0	2.210000E 04	6.212158E-01	2.210062E 04	5.193982E 01	2.215194E 04
35	9.999998E-03	0.0	3.840000E 04	5.104980E-01	3.840051E 04	5.216928E 01	3.845217E 04

ATOMIC NUMBER 82.0000 ATOMIC WEIGHT 207.1900

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.870000E 01	8.779999E-02	2.818534E 00	2.160632E 01	4.114120E 00	2.290192E 01
2	1.500000E 01	1.580000E 01	1.210000E-01	3.359776E 00	1.928076E 01	5.060647E 00	2.098163E 01
3	1.000000E 01	1.240000E 01	1.960000E-01	4.217514E 00	1.681351E 01	6.694896E 00	1.929089E 01
4	8.000000E 00	1.050000E 01	2.580000E-01	4.724957E 00	1.548296E 01	7.757764E 00	1.851575E 01
5	6.000000E 00	8.540000E 00	3.730000E-01	5.396249E 00	1.430925E 01	9.309317E 00	1.822229E 01
6	5.000000E 00	7.330000E 00	4.780000E-01	5.819864E 00	1.362786E 01	1.040056E 01	1.820856E 01
7	4.000000E 00	5.790000E 00	6.470000E-01	6.321847E 00	1.275885E 01	1.185039E 01	1.828737E 01
8	3.000000E 00	3.940000E 00	9.700000E-01	6.916450E 00	1.182645E 01	1.390234E 01	1.881232E 01
9	2.000000E 00	1.719999E 00	1.799999E 00	7.590005E 00	1.111000E 01	1.713077E 01	2.065074E 01
10	1.500000E 00	5.480000E-01	2.950000E 00	7.909637E 00	1.140764E 01	1.964758E 01	2.314557E 01
11	1.000000E 00	0.0	6.200000E 00	8.092011E 00	1.429201E 01	2.349042E 01	2.969041E 01
12	8.000000E-01	0.0	9.799999E 00	8.048203E 00	1.784819E 01	2.573773E 01	3.553772E 01
13	6.000000E-01	0.0	1.850000E 01	7.836517E 00	2.633652E 01	2.874448E 01	4.724448E 01
14	5.000000E-01	0.0	2.829999E 01	7.613007E 00	3.591299E 01	3.069241E 01	5.899240E 01
15	4.000000E-01	0.0	4.839999E 01	7.249954E 00	5.564995E 01	3.309003E 01	8.149002E 01
16	3.000000E-01	0.0	9.950000E 01	6.652985E 00	1.061530E 02	3.614015E 01	1.356402E 02
17	2.000000E-01	0.0	2.900000E 02	5.633118E 00	2.956333E 02	4.019032E 01	3.301902E 02
18	1.500000E-01	0.0	6.200000E 02	4.849960E 00	6.248499E 02	4.277234E 01	6.627722E 02
19	9.999996E-02	0.0	1.800000E 03	3.770340E 00	1.803770E 03	4.588371E 01	1.845884E 03
20	8.801395E-02	0.0	2.510000E 03	3.452209E 00	2.513452E 03	4.672729E 01	2.556727E 03
21	8.800399E-02	0.0	5.190000E 02	3.451935E 00	5.224519E 02	4.672801E 01	5.657278E 02
22	7.999998E-02	0.0	6.780000E 02	3.223953E 00	6.812239E 02	4.731564E 01	7.253154E 02
23	6.000000E-02	0.0	1.510000E 03	2.593018E 00	1.512593E 03	4.887666E 01	1.558876E 03
24	5.000000E-02	0.0	2.480000E 03	2.240677E 00	2.482240E 03	4.971118E 01	2.529711E 03
25	4.000000E-02	0.0	4.540000E 03	1.860519E 00	4.541859E 03	5.058514E 01	4.590582E 03
26	3.000000E-02	0.0	9.810000E 03	1.449707E 00	9.811449E 03	5.150137E 01	9.861500E 03
27	2.000000E-02	0.0	2.860000E 04	1.005157E 00	2.860100E 04	5.246304E 01	2.865246E 04
28	1.587100E-02	0.0	5.280000E 04	8.108978E-01	5.280081E 04	5.287413E 01	5.285287E 04
29	1.586100E-02	0.0	4.540000E 04	8.104248E-01	4.540081E 04	5.287514E 01	4.545288E 04
30	1.521000E-02	0.0	5.090000E 04	7.791901E-01	5.090078E 04	5.294072E 01	5.095294E 04
31	1.520000E-02	0.0	3.690000E 04	7.787323E-01	3.690078E 04	5.294174E 01	3.695294E 04
32	1.500000E-02	0.0	3.800000E 04	7.691040E-01	3.800077E 04	5.296194E 01	3.805296E 04
33	1.304500E-02	0.0	5.430000E 04	6.741638E-01	5.430067E 04	5.316043E 01	5.435316E 04
34	1.303500E-02	0.0	2.100000E 04	6.736908E-01	2.100067E 04	5.316145E 01	2.105316E 04
35	9.999998E-03	0.0	4.280000E 04	5.232544E-01	4.280052E 04	5.347351E 01	4.285347E 04

ELEMENT ID NO. 46

POLONIUM

ATOMIC NUMBER 84.0000

ATOMIC WEIGHT 210.0000

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	1.950000E 01	9.629995E-02	2.887280E 00	2.248357E 01	4.214465E 00	2.381076E 01
2	1.500000E 01	1.670000E 01	1.339999E-01	3.441721E 00	2.027570E 01	5.184077E 00	2.201805E 01
3	1.000000E 01	1.290000E 01	2.200000E-01	4.320380E 00	1.744037E 01	6.858186E 00	1.997816E 01
4	8.000000E 00	1.100000E 01	2.900000E-01	4.840199E 00	1.613019E 01	7.946978E 00	1.923697E 01
5	6.000000E 00	8.940000E 00	4.209999E-01	5.527864E 00	1.488886E 01	9.536373E 00	1.889735E 01
6	5.000000E 00	7.660000E 00	5.350000E-01	5.961812E 00	1.415681E 01	1.065423E 01	1.884921E 01
7	4.000000E 00	6.080000E 00	7.200000E-01	6.476038E 00	1.327604E 01	1.213942E 01	1.893941E 01
8	3.000000E 00	4.190000E 00	1.080000E 00	7.085144E 00	1.235514E 01	1.424142E 01	1.951140E 01
9	2.000000E 00	1.849999E 00	2.000000E 00	7.775120E 00	1.162512E 01	1.754858E 01	2.139857E 01
10	1.500000E 00	5.850000E-01	3.299999E 00	8.102549E 00	1.198755E 01	2.012679E 01	2.401176E 01
11	1.000000E 00	0.0	6.929999E 00	8.289377E 00	1.521938E 01	2.406335E 01	3.099335E 01
12	8.000000E-01	0.0	1.090000E 01	8.244492E 00	1.914449E 01	2.636548E 01	3.726547E 01
13	6.000000E-01	0.0	2.079999E 01	8.027649E 00	2.882764E 01	2.944556E 01	5.024554E 01
14	5.000000E-01	0.0	3.150000E 01	7.798691E 00	3.929869E 01	3.144101E 01	6.294101E 01
15	4.000000E-01	0.0	5.379999E 01	7.426773E 00	6.122676E 01	3.389709E 01	8.769708E 01
16	3.000000E-01	0.0	1.100000E 02	6.815247E 00	1.168152E 02	3.702162E 01	1.470216E 02
17	2.000000E-01	0.0	3.180000E 02	5.770508E 00	3.237705E 02	4.117058E 01	3.591704E 02
18	1.500000E-01	0.0	6.720000E 02	4.968246E 00	6.769680E 02	4.381557E 01	7.158154E 02
19	9.999996E-02	0.0	1.950000E 03	3.862305E 00	1.953862E 03	4.700284E 01	1.997003E 03
20	9.311497E-02	0.0	2.350000E 03	3.678452E 00	2.353678E 03	4.749391E 01	2.397494E 03
21	9.310496E-02	0.0	4.930000E 02	3.678162E 00	4.966780E 02	4.749463E 01	5.404946E 02
22	7.999998E-02	0.0	7.560000E 02	3.302582E 00	7.593025E 02	4.846968E 01	8.044695E 02
23	6.000000E-02	0.0	1.670000E 03	2.656265E 00	1.672656E 03	5.006877E 01	1.720069E 03
24	5.000000E-02	0.0	2.750000E 03	2.295319E 00	2.752295E 03	5.092365E 01	2.800924E 03
25	4.000000E-02	0.0	5.010000E 03	1.905914E 00	5.011902E 03	5.181894E 01	5.061816E 03
26	3.000000E-02	0.0	1.089000E 04	1.485077E 00	1.080148E 04	5.275751E 01	1.085275E 04
27	2.000000E-02	0.0	3.120000E 04	1.029678E 00	3.120103E 04	5.374263E 01	3.125374E 04
28	1.694600E-02	0.0	4.860000E 04	8.831482E-01	4.860088E 04	5.405327E 01	4.865405E 04
29	1.693600E-02	0.0	4.180000E 04	8.826294E-01	4.180088E 04	5.405428E 01	4.185405E 04
30	1.625400E-02	0.0	4.680000E 04	8.494415E-01	4.680085E 04	5.412431E 01	4.685412E 04
31	1.624400E-02	0.0	3.390000E 04	8.489532E-01	3.390085E 04	5.412535E 01	3.395413E 04
32	1.500000E-02	0.0	4.100000E 04	7.878571E-01	4.100079E 04	5.425369E 01	4.105425E 04
33	1.382400E-02	0.0	5.070000E 04	7.295227E-01	5.070073E 04	5.437575E 01	5.075438E 04
34	1.381400E-02	0.0	1.990000E 04	7.290497E-01	1.990073E 04	5.437682E 01	1.995438E 04
35	9.999998E-03	0.0	4.760000E 04	5.360107E-01	4.760054E 04	5.477774E 01	4.765478E 04

ATOMIC NUMBER 90.0000		ATOMIC WEIGHT 232.0380				
ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	2.200000E 01	1.300000E-01	3.093513E 00	2.522350E 01	4.515498E 00
2	1.500000E 01	1.889999E 01	1.810000E-01	3.687558E 00	2.276854E 01	5.554369E 00
3	1.000000E 01	1.460000E 01	2.970000E-01	4.628979E 00	1.952597E 01	7.348056E 00
4	8.000000E 00	1.250000E 01	3.920000E-01	5.185927E 00	1.807793E 01	8.514619E 00
5	6.000000E 00	1.010000E 01	5.720000E-01	5.922711E 00	1.659470E 01	2.088953E 01
6	5.000000E 00	8.730000E 00	7.270000E-01	6.387656E 00	1.584466E 01	2.087224E 01
7	4.000000E 00	6.959999E 00	9.800000E-01	6.938612E 00	1.487861E 01	2.094652E 01
8	3.000000E 00	4.900000E 00	1.459999E 00	7.591226E 00	1.395122E 01	2.161865E 01
9	2.000000E 00	2.240000E 00	2.719999E 00	8.330494E 00	1.329049E 01	2.376204E 01
10	1.500000E 00	7.120000E-01	4.500000E 00	8.681312E 00	1.389331E 01	2.677641E 01
11	1.000000E 00	0.0	9.400000E 00	8.881485E 00	1.828148E 01	3.518216E 01
12	8.000000E-01	0.0	1.480000E 01	8.833374E 00	2.363336E 01	4.304871E 01
13	6.000000E-01	0.0	2.789999E 01	8.601059E 00	3.650105E 01	5.944881E 01
14	5.000000E-01	0.0	4.220000E 01	8.355728E 00	5.055573E 01	7.588680E 01
15	4.000000E-01	0.0	7.170000E 01	7.957245E 00	7.965724E 01	1.080183E 02
16	3.000000E-01	0.0	1.440000E 02	7.302063E 00	1.513021E 02	1.836660E 02
17	2.000000E-01	0.0	4.130000E 02	6.182678E 00	4.191826E 02	4.571113E 02
18	1.500000E-01	0.0	8.660000E 02	5.323105E 00	8.713230E 02	9.129451E 02
19	1.097510E-01	0.0	1.940000E 03	4.401520E 00	1.944440E 03	1.989640E 03
20	1.096510E-01	0.0	4.260000E 02	4.398911E 00	4.303987E 02	4.756472E 02
21	9.999996E-02	0.0	5.570000E 02	4.138184E 00	5.611382E 02	6.073601E 02
22	7.999998E-02	0.0	1.030000E 03	3.538498E 00	1.033538E 03	1.081932E 03
23	6.000000E-02	0.0	2.250000E 03	2.845993E 00	2.252846E 03	2.303645E 03
24	5.000000E-02	0.0	3.660000E 03	2.459274E 00	3.662459E 03	3.714561E 03
25	4.000000E-02	0.0	6.620000E 03	2.042053E 00	6.622039E 03	6.675520E 03
26	3.000000E-02	0.0	1.410000E 04	1.591156E 00	1.410159E 04	1.415652E 04
27	2.047600E-02	0.0	3.830000E 04	1.127304E 00	3.830113E 04	3.835753E 04
28	2.046600E-02	0.0	3.280000E 04	1.126831E 00	3.280113E 04	3.285753E 04
29	2.000000E-02	0.0	3.500000E 04	1.103210E 00	3.500110E 04	3.505758E 04
30	1.970300E-02	0.0	3.650000E 04	1.088104E 00	3.650109E 04	3.655761E 04
31	1.969300E-02	0.0	2.650000E 04	1.087616E 00	2.650109E 04	2.655761E 04
32	1.640000E-02	0.0	4.180000E 04	9.177399E-01	4.180091E 04	4.185797E 04
33	1.630000E-02	0.0	1.720000E 04	9.125061E-01	1.720091E 04	1.725798E 04
34	1.500000E-02	0.0	2.160000E 04	8.441315E-01	2.160084E 04	2.165813E 04
35	9.999998E-03	0.0	6.490000E 04	5.743103E-01	6.490057E 04	6.495869E 04

ELEMENT ID NO. 48

PROTACTINIUM

ATOMIC NUMBER 91.0000

ATOMIC WEIGHT 231.0300

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	2.250000E 01	1.370000E-01	3.127886E 00	2.576488E 01	4.565671E 00	2.720265E 01
2	1.500000E 01	1.920000E 01	1.900000E-01	3.728531E 00	2.311852E 01	5.616084E 00	2.500606E 01
3	1.000000E 01	1.690000E 01	3.099999E-01	4.680411E 00	1.989040E 01	7.429701E 00	2.263969E 01
4	8.000000E 00	1.270000E 01	4.110000E-01	5.243548E 00	1.835454E 01	8.609225E 00	2.172021E 01
5	6.000000E 00	1.030000E 01	5.990000E-01	5.988520E 00	1.688751E 01	1.033107E 01	2.123006E 01
6	5.000000E 00	8.929999E 00	7.620000E-01	6.458630E 00	1.615062E 01	1.154209E 01	2.123407E 01
7	4.000000E 00	7.110000E 00	1.030000E 00	7.015708E 00	1.515571E 01	1.315104E 01	2.129103E 01
8	3.000000E 00	5.009999E 00	1.540000E 00	7.675572E 00	1.422557E 01	1.542821E 01	2.197820E 01
9	2.000000E 00	2.299999E 00	2.832999E 00	8.423052E 00	1.356305E 01	1.901097E 01	2.415096E 01
10	1.500000E 00	7.399999E-01	4.679999E 00	8.777767E 00	1.419776E 01	2.180402E 01	2.722400E 01
11	1.000000E 00	0.0	9.849999E 00	8.980164E 00	1.863015E 01	2.606663E 01	3.591862E 01
12	8.000000E-01	0.0	1.550000E 01	8.931519E 00	2.443152E 01	2.856259E 01	4.406259E 01
13	6.000000E-01	0.0	2.909999E 01	8.696625E 00	3.779662E 01	3.189935E 01	6.099934E 01
14	5.000000E-01	0.0	4.400000E 01	8.448578E 00	5.244858E 01	3.406110E 01	7.806110E 01
15	4.000000E-01	0.0	7.459999E 01	8.045654E 00	8.264565E 01	3.672185E 01	1.113218E 02
16	3.000000E-01	0.0	1.500000E 02	7.383194E 00	1.573832E 02	4.010677E 01	1.901068E 02
17	2.000000E-01	0.0	4.300000E 02	6.251373E 00	4.362512E 02	4.460146E 01	4.746013E 02
18	1.500000E-01	0.0	9.000000E 02	5.382263E 00	9.053821E 02	4.746686E 01	9.474668E 02
19	1.127010E-01	0.0	1.880000E 03	4.527542E 00	1.884527E 03	4.997696E 01	1.929977E 03
20	1.126010E-01	0.0	4.160000E 02	4.524948E 00	4.205249E 02	4.998419E 01	4.659841E 02
21	9.999996E-02	0.0	5.870000E 02	4.184158E 00	5.911841E 02	5.091974E 01	6.379197E 02
22	7.999998E-02	0.0	1.090000E 03	3.577820E 00	1.093578E 03	5.250883E 01	1.142509E 03
23	6.000000E-02	0.0	2.360000E 03	2.877609E 00	2.362877E 03	5.424117E 01	2.414241E 03
24	5.000000E-02	0.0	3.840000E 03	2.486588E 00	3.842487E 03	5.516728E 01	3.895167E 03
25	4.000000E-02	0.0	6.910000E 03	2.064728E 00	6.912063E 03	5.613718E 01	6.966137E 03
26	3.000000E-02	0.0	1.470000E 04	1.608841E 00	1.470161E 04	5.715398E 01	1.475715E 04
27	2.115000E-02	0.0	3.680000E 04	1.172424E 00	3.680117E 04	5.809955E 01	3.685810E 04
28	2.110500E-02	0.0	3.160000E 04	1.171951E 00	3.160117E 04	5.810066E 01	3.165810E 04
29	2.032400E-02	0.0	3.510000E 04	1.132065E 00	3.510113E 04	5.818576E 01	3.515818E 04
30	2.031400E-02	0.0	2.540000E 04	1.131546E 00	2.540113E 04	5.818684E 01	2.545818E 04
31	2.000000E-02	0.0	2.640000E 04	1.115479E 00	2.640111E 04	5.822118E 01	2.645822E 04
32	1.674300E-02	0.0	4.050000E 04	9.460449E-01	4.050095E 04	5.858026E 01	4.055858E 04
33	1.673300E-02	0.0	1.680000E 04	9.454956E-01	1.680095E 04	5.858136E 01	1.685858E 04
34	1.500000E-02	0.0	2.260000E 04	8.535156E-01	2.260085E 04	5.877484E 01	2.265877E 04
35	9.999998E-03	0.0	6.800000E 04	5.806885E-01	6.800056E 04	5.934256E 01	6.805931E 04

ATOMIC NUMBER 92.0000 ATOMIC WEIGHT 235.0440

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.00000E 01	2.279999E 01	1.429999E-01	3.162258E 00	2.610522E 01	4.615843E 00	2.755881E 01
2	1.50000E 01	1.959999E 01	1.980000E-01	3.769504E 00	2.356749E 01	5.677799E 00	2.547578E 01
3	1.00000E 01	1.52000E 01	3.27000E-01	4.731844E 00	2.025883E 01	7.511346E 00	2.303833E 01
4	8.00000E 00	1.29000E 01	4.31000E-01	5.301170E 00	1.863216E 01	8.703833E 00	2.203482E 01
5	6.00000E 00	1.05000E 01	6.28000E-01	6.054327E 00	1.718231E 01	1.044460E 01	2.157259E 01
6	5.00000E 00	9.08000E 00	7.98000E-01	6.529604E 00	1.640759E 01	1.166892E 01	2.154691E 01
7	4.00000E 00	7.309999E 00	1.08000E 00	7.092804E 00	1.548280E 01	1.329556E 01	2.168553E 01
8	3.00000E 00	5.129999E 00	1.61000E 00	7.759919E 00	1.449992E 01	1.559775E 01	2.233772E 01
9	2.00000E 00	2.37000E 00	2.99000E 00	8.515609E 00	1.387561E 01	1.921988E 01	2.457986E 01
10	1.50000E 00	7.60000E-01	4.91000E 00	8.874223E 00	1.454422E 01	2.204362E 01	2.771361E 01
11	1.00000E 00	0.0	1.03000E 01	9.078842E 00	1.937883E 01	2.635510E 01	3.665509E 01
12	8.00000E-01	0.0	1.62000E 01	9.029663E 00	2.522966E 01	2.887646E 01	4.507646E 01
13	6.00000E-01	0.0	3.029999E 01	8.792175E 00	3.909216E 01	3.224989E 01	6.254988E 01
14	5.00000E-01	0.0	4.62000E 01	8.541412E 00	5.474141E 01	3.443539E 01	8.063539E 01
15	4.00000E-01	0.0	7.809999E 01	8.134064E 00	8.623405E 01	3.712538E 01	1.152254E 02
16	3.00000E-01	0.0	1.56000E 02	7.464325E 00	1.634643E 02	4.054750E 01	1.965475E 02
17	2.00000E-01	0.0	4.46000E 02	6.320068E 00	4.523201E 02	4.509158E 01	4.910916E 02
18	1.50000E-01	0.0	9.37000E 02	5.441406E 00	9.424414E 02	4.798846E 01	9.849883E 02
19	1.15706E-01	0.0	1.82000E 03	4.655121E 00	1.824655E 03	5.030774E 01	1.870308E 03
20	1.15606E-01	0.0	4.06000E 02	4.652557E 00	4.106523E 02	5.031496E 01	4.563149E 02
21	9.999996E-02	0.0	6.17000E 02	4.230133E 00	6.212300E 02	5.147929E 01	6.684792E 02
22	7.999998E-02	0.0	1.13000E 03	3.617126E 00	1.133617E 03	5.308585E 01	1.183086E 03
23	6.00000E-02	0.0	2.46000E 03	2.909225E 00	2.462909E 03	5.483722E 01	2.514837E 03
24	5.00000E-02	0.0	4.01000E 03	2.513931E 00	4.012514E 03	5.577353E 01	4.065773E 03
25	4.00000E-02	0.0	7.22000E 03	2.087418E 00	7.222086E 03	5.675407E 01	7.276754E 03
26	3.00000E-02	0.0	1.54000E 04	1.626526E 00	1.540163E 04	5.778204E 01	1.545778E 04
27	2.17690E-02	0.0	3.54000E 04	1.218872E 00	3.540122E 04	5.866621E 01	3.545866E 04
28	2.17590E-02	0.0	3.03000E 04	1.218384E 00	3.030121E 04	5.866733E 01	3.035866E 04
29	2.09580E-02	0.0	3.37000E 04	1.177261E 00	3.370118E 04	5.875529E 01	3.375875E 04
30	2.09480E-02	0.0	2.44000E 04	1.176743E 00	2.440118E 04	5.875639E 01	2.445875E 04
31	2.00000E-02	0.0	2.72000E 04	1.127716E 00	2.720113E 04	5.886096E 01	2.725886E 04
32	1.71800E-02	0.0	3.94000E 04	9.796600E-01	3.940098E 04	5.917493E 01	3.945917E 04
33	1.71700E-02	0.0	1.65000E 04	9.791412E-01	1.650098E 04	5.917607E 01	1.655918E 04
34	1.50000E-02	0.0	2.37000E 04	8.628845E-01	2.370086E 04	5.942072E 01	2.375942E 04
35	9.999998E-03	0.0	7.13000E 04	5.870667E-01	7.130056E 04	5.999467E 01	7.135994E 04

ELEMENT ID NO. 50

NEPTUNIUM

ATOMIC NUMBER 93.0000 ATOMIC WEIGHT 237.0000

	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	2.329999E 01	1.520000E-01	3.196630E 00	2.664861E 01	4.666015E 00	2.811798E 01
2	1.500000E 01	1.989999E 01	2.100000E-01	3.810476E 00	2.392046E 01	5.739514E 00	2.584949E 01
3	1.000000E 01	1.550000E 01	3.410000E-01	4.783278E 00	2.062427E 01	7.592991E 00	2.343398E 01
4	8.000000E 00	1.320000E 01	4.540000E-01	5.358791E 00	1.901279E 01	8.798439E 00	2.245242E 01
5	6.000000E 00	1.070000E 01	6.630000E-01	6.120135E 00	1.748312E 01	1.055813E 01	2.192111E 01
6	5.000000E 00	9.280000E 00	8.469999E-01	6.600578E 00	1.672757E 01	1.179576E 01	2.192273E 01
7	4.000000E 00	7.469999E 00	1.139999E 00	7.169899E 00	1.577990E 01	1.344008E 01	2.205006E 01
8	3.000000E 00	5.280000E 00	1.700000E 00	7.844265E 00	1.482427E 01	1.576729E 01	2.274728E 01
9	2.000000E 00	2.450000E 00	3.129999E 00	8.608166E 00	1.418816E 01	1.942879E 01	2.500877E 01
10	1.500000E 00	7.810000E-01	5.200000E 00	8.970686E 00	1.495168E 01	2.228323E 01	2.826422E 01
11	1.000000E 00	0.0	1.080000E 01	9.177536E 00	1.997752E 01	2.664157E 01	3.744156E 01
12	8.000000E-01	0.0	1.700000E 01	9.127823E 00	2.612782E 01	2.919035E 01	4.619035E 01
13	6.000000E-01	0.0	3.209999E 01	8.887741E 00	4.098773E 01	3.260043E 01	6.470042E 01
14	5.000000E-01	0.0	4.829999E 01	8.634262E 00	5.693425E 01	3.480969E 01	8.310968E 01
15	4.000000E-01	0.0	8.200000E 01	8.222504E 00	9.022250E 01	3.752893E 01	1.195289E 02
16	3.000000E-01	0.0	1.640000E 02	7.545471E 00	1.715455E 02	4.098824E 01	2.049882E 02
17	2.000000E-01	0.0	4.660000E 02	6.388779E 00	4.723887E 02	4.558171E 01	5.115815E 02
18	1.500000E-01	0.0	9.730000E 02	5.500549E 00	9.785005E 02	4.851009E 01	1.021510E 03
19	1.187699E-01	0.0	1.760000E 03	4.784332E 00	1.764784E 03	5.063214E 01	1.810632E 03
20	1.186700E-01	0.0	3.960000E 02	4.781799E 00	4.007817E 02	5.063936E 01	4.466392E 02
21	9.999996E-02	0.0	6.510000E 02	4.276108E 00	6.552759E 02	5.203885E 01	7.030388E 02
22	7.999998E-02	0.0	1.200000E 03	3.656448E 00	1.203656E 03	5.366287E 01	1.253663E 03
23	6.000000E-02	0.0	2.570000E 03	2.940857E 00	2.572941E 03	5.543329E 01	2.625433E 03
24	5.000000E-02	0.0	4.200000E 03	2.541260E 00	4.202539E 03	5.637976E 01	4.256379E 03
25	4.000000E-02	0.0	7.550000E 02	2.110107E 00	7.552109E 03	5.737096E 01	7.607367E 03
26	3.000000E-02	0.0	1.590000E 04	1.644196E 00	1.590164E 04	5.841011E 01	1.595841E 04
27	2.243700E-02	0.0	3.410000E 04	1.266602E 00	3.410127E 04	5.923001E 01	3.415923E 04
28	2.242700E-02	0.0	2.920000E 04	1.266068E 00	2.920127E 04	5.923111E 01	2.925923E 04
29	2.161000E-02	0.0	3.240000E 04	1.223907E 00	3.240122E 04	5.932152E 01	3.245932E 04
30	2.160000E-02	0.0	2.350000E 04	1.223389E 00	2.350122E 04	5.932263E 01	2.355932E 04
31	2.000000E-02	0.0	2.810000E 04	1.139984E 00	2.810114E 04	5.950076E 01	2.815950E 04
32	1.762300E-02	0.0	3.820000E 04	1.014053E 00	3.820101E 04	5.976799E 01	3.825977E 04
33	1.761300E-02	0.0	1.610000E 04	1.013519E 00	1.610101E 04	5.976912E 01	1.615977E 04
34	1.500000E-02	0.0	2.480000E 04	8.722687E-01	2.480087E 04	6.006659E 01	2.486007E 04
35	9.999998E-03	0.0	7.480000E 04	5.934448E-01	7.480056E 04	6.064679E 01	7.486063E 04

ELEMENT ID NO. 51

PLUTONIUM

ATOMIC NUMBER	94.0000	ATOMIC WEIGHT	242.0000	ENERGY (MEV)	PAIR PROD.	PHOTO ELEC	COMPTON ABS.	ABSORPTION	COMPTON SCAT	TOTAL
1	2.000000E 01	2.370000E 01	1.600000E -01	3.231003E 00	2.709099E 01	4.716187E 00	2.857617E 01			
2	1.500000E 01	2.039999E 01	2.200000E -01	3.851449E 00	2.447142E 01	5.801229E 00	2.642120E 01			
3	1.000000E 01	1.580000E 01	3.609999E -01	4.834710E 00	2.099570E 01	7.674636E 00	2.383562E 01			
4	8.000000E 00	1.350000E 01	4.790000E -01	5.416413E 00	1.939540E 01	8.893046E 00	2.287202E 01			
5	6.000000E 00	1.090000E 01	6.980000E -01	6.185944E 00	1.778394E 01	1.067166E 01	2.226365E 01			
6	5.000000E 00	9.480000E 00	8.850000E -01	6.671552E 00	1.703654E 01	1.192260E 01	2.228758E 01			
7	4.000000E 00	7.620000E 00	1.190000E 00	7.246995E 00	1.605699E 01	1.358459E 01	2.239458E 01			
8	3.000000E 00	5.400000E 00	1.780000E 00	7.928614E 00	1.510861E 01	1.593683E 01	2.311582E 01			
9	2.000000E 00	2.520000E 00	3.299999E 00	8.700739E 00	1.452074E 01	1.963771E 01	2.545769E 01			
10	1.500000E 00	8.099999E -01	5.450000E 00	9.067149E 00	1.532715E 01	2.252284E 01	2.878284E 01			
11	1.000000E 00	0.0	1.140000E 01	9.276215E 00	2.067621E 01	2.692804E 01	3.832803E 01			
12	8.000000E -01	0.0	1.779999E 01	9.225983E 00	2.702597E 01	2.950423E 01	4.730421E 01			
13	6.000000E -01	0.0	3.370000E 01	8.983307E 00	4.268330E 01	3.295097E 01	6.665097E 01			
14	5.000000E -01	0.0	5.100000E 01	8.727097E 00	5.972710E 01	3.518399E 01	8.618399E 01			
15	4.000000E -01	0.0	8.529999E 01	8.310913E 00	9.361090E 01	3.793246E 01	1.232325E 02			
16	3.000000E -01	0.0	1.710000E 02	7.626602E 00	1.786266E 02	4.142897E 01	2.124290E 02			
17	2.000000E -01	0.0	4.820000E 02	6.457474E 00	4.884573E 02	4.607184E 01	5.280718E 02			
18	1.500000E -01	0.0	1.000000E 03	5.559692E 00	1.005560E 03	4.903169E 01	1.049031E 03			
19	1.218070E -01	0.0	1.710000E 03	4.912903E 00	1.714913E 03	5.095641E 01	1.760956E 03			
20	1.217970E -01	0.0	3.870000E 02	4.912628E 00	3.919126E 02	5.095712E 01	4.379570E 02			
21	9.999996E -02	0.0	6.800000E 02	4.322098E 00	6.843220E 02	5.259840E 01	7.325984E 02			
22	7.999998E -02	0.0	1.250000E 03	3.695755E 00	1.253696E 03	5.423988E 01	1.304240E 03			
23	6.000000E -02	0.0	2.700000E 03	2.972488E 00	2.702972E 03	5.602934E 01	2.756029E 03			
24	5.000000E -02	0.0	4.390000E 03	2.568573E 00	4.392566E 03	5.698599E 01	4.446984E 03			
25	4.000000E -02	0.0	7.870000E 03	2.132797E 00	7.872129E 03	5.798785E 01	7.927984E 03			
26	3.000000E -02	0.0	1.650000E 04	1.661865E 00	1.650166E 04	5.903816E 01	1.655904E 04			
27	2.311900E -02	0.0	3.280000E 04	1.315598E 00	3.280131E 04	5.979089E 01	3.285979E 04			
28	2.310900E -02	0.0	2.810000E 04	1.315063E 00	2.810131E 04	5.979201E 01	2.815979E 04			
29	2.228000E -02	0.0	3.120000E 04	1.272034E 00	3.120127E 04	5.988441E 01	3.125988E 04			
30	2.227000E -02	0.0	2.260000E 04	1.271515E 00	2.260127E 04	5.988553E 01	2.265988E 04			
31	2.000000E -02	0.0	2.920000E 04	1.152237E 00	2.920115E 04	6.014055E 01	2.926014E 04			
32	1.807300E -02	0.0	3.710000E 04	1.049271E 00	3.710105E 04	6.035928E 01	3.716036E 04			
33	1.806300E -02	0.0	1.580000E 04	1.048706E 00	1.580105E 04	6.036043E 01	1.586036E 04			
34	1.500000E -02	0.0	2.600000E 04	8.816376E -01	2.600088E 04	6.071246E 01	2.606071E 04			
35	9.999998E -03	0.0	7.820000E 04	5.998230E -01	7.820056E 04	6.129890E 01	7.826125E 04			