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NUCLEAR DATA FOR STEEL-REINFORCED CONCRETE

by
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March 1979

NUCLEAR DATA

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NUCLEAR DATA FOR CTR RELATED PROJECTS

by

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NATIONAL NEUTRON CROSS SECTION CENTER

BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC.

UNDER CONTRACT NO. AT(30-1)-16 WITH THE
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ABSTRACT

This report describes the different types of nuclear cross-section information that has been supplied to CTR related projects and is available at the National Neutron Cross Section Center. This has included data from the ENDF/B and ENDF/A libraries as well as the results of calculations based on nuclear systematics.

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Introduction

The National Neutron Cross Section Center (NNCSC) has provided cross-section data for a large number of nuclei of interest to the Controlled Thermonuclear Research (CTR) Program in the past year. The data were supplied to a small number of laboratories actively engaged in the CTR program and had a limited distribution. This report summarizes this voluminous body of material by giving (a) sources of partial or complete evaluations of the data (b) calculational methods used where no evaluations or experimental data exist (c) list of nuclei for which the cross-sections were given and (d) other archival material available at the National Neutron Cross Section Center. It is hoped that this information would be of interest to a larger class of users and indicate the type of data available from the NNCSC.

2. Nuclear Cross-Sections for the CTR Program

There is at present a large amount of research activity connected with the CTR program as can be seen from the proceedings of a recent conference⁽¹⁾. Some of the areas of interest in this program are (1) tritium breeding (2) energy deposition (3) material activation (4) helium and hydrogen production (5) atomic displacement and materials damage (6) dosimetry and transmutation analysis (7) fission-fusion systems and (8) fission product burner systems. These studies need nuclear data of different types, degree of detail and accuracy. In some cases a rather reliable knowledge of nuclear cross-sections arrived at by a detailed evaluation of all the experimental data are needed. This could be supplied by the various evaluations in the ENDF/B Library, whose contents and emphasis have been mainly determined by the needs of the thermal and fast reactor research programs. In some other cases larger uncertainties in the cross-sections could be tolerated because all that one needs are order-of-magnitude estimates. In the latter case, one could use partial evaluations of the various nuclei where the data files are made up of a few reactions of immediate interest and the data files have not been tested against integral measurements. In addition, there are a few nuclei whose cross-sections have not been measured either because they are unstable or because of other special experimental difficulties. In such cases, the cross-sections have to be estimated from calculations based on nuclear models and or nuclear systematics. In satisfying requests for nuclear data for the CTR program, material obtained from these different sources or procedures has been used and these methods are described below.

2.1 ENDF/B Library

The origin and the general philosophy of this neutron cross-section data library have been described.⁽²⁾ It is meant to be a reference data library based on the best available microscopic experimental data and covers a neutron energy range from 1.0E-05eV to 20.0MeV. Though the earlier versions of this library contained only neutron cross-section data, Versions III and IV (the current version released Nov.-Sept.'74) also contain gamma production cross-sections for a few nuclei used as shielding materials. As mentioned earlier, since this data library was formed with the needs of thermal and fast reactor applications in mind, the energy region below a few MeV has perhaps received more emphasis than the higher energy at around 14 MeV which is of interest to CTR applications. This has been partly due to the fact that there are more reliable and larger number of measurements at lower energies than at higher energies except for the region in the immediate vicinity of 14 MeV. In addition, many of the evaluations are for an element rather than its individual isotopes; thus creating special problems in energy deposition and charged particle production calculations. However, attempts are being made to improve the data files in the high energy region guided by relevant integral measurements and to give isotopic information in the data files.^{*} In addition, the ENDF/B data files are well documented⁽³⁾ and have benefited from the results of benchmark experiments. Therefore, till evaluations specifically meant for CTR applications become available the data files in the ENDF/B system are the best available. As a result of this, in satisfying requests for the CTR programs the current ENDF/B Library list is scanned first and if the elements or isotopes whose cross-sections are requested are in *In Jan. 1974, NNCSC received the ENDF evaluations which emphasize the high energy region of CTR interest and which in some cases have been compared against pulsed sphere experiments²⁴.

the library, the corresponding data files are sent. The list of evaluations in the ENDF/B-IV Library are given in Appendix A.

2.2 ENDF/A Library

This data library consists of (i) earlier evaluations no longer in current use (ii) partial evaluations which deal with only a few reactions or (iii) complete or partial evaluations from other data libraries. As far as possible attempts are made to convert these data files to conform to the ENDF/B format, though in some cases they do not. In the latter case, they will have to be modified for use with the usual ENDF/B processing codes. In addition, the provenance of the evaluations in the ENDF/A library may not be known. However, some of these evaluations could be of use for preliminary calculations and feasibility studies. Therefore, if the evaluation for a particular nucleus is not found in the ENDF/B library, the contents of the ENDF/A library are searched. In addition to the earlier evaluations, the ENDF/A library contains the following:

- (1) UKNDL (Version 3) (United Kingdom) Received July 2, 1973

General cross-section data sets. There is no documentation on the data files; there is only an index listing the various reactions in the data files. It is titled "CCDN Index to the Aldermaston Nuclear Data Library Version: March 1973". ENDF format

- (2) UKNDL (Version 2) (United Kingdom) Received May 3, 1971

General cross-section data sets. Ref 4. ENDF format

- (3) ENDL (U.S.A.) Received Jan. 25, 1974

The Lawrence Livermore Laboratory Evaluated Nuclear Data Library (ENDL) translated into ENDF/B format. It includes photon production cross-sections. Ref 5. ENDF format

- (4) STANDARDS (U.S.A.) Received Jan. 25, 1973

ENDF/B-III cross-section measurement standards, Ref 6. ENDF format

- (5) CEN (France) Received August 7, 1973
Compilation of properties of fission product nuclei. Ref 7. ENDF format
- (6) SPENG (Sweden) Received Jan. 5, 1973
General cross-section data sets. This library which is in part based on UKNDL, ENDF and KEDAK libraries contains data for a number of materials not in ENDF/B-III. Ref 8
- (7) KEDAK (W. Germany) Received October 26, 1970
General cross-section data sets. Ref 9
- (8) SAND-II (U.S.A.) Received August 5, 1971
Dosimetry cross-sections. Ref 10
- (9) AAEC (Australia) Received Sept. 15, 1971
Also referred to as "Cook Library" cross-sections for fission product nuclides. Ref 11. ENDF format
- (10) OBNINSK (Nikolaev) (U.S.S.R.) Received May 30, 1974
Elastic Scattering and Legendre Coefficient fits to some 42 nuclides. No reference. ENDF format.
- (11) KONSHIN & NIKOLAEV (U.S.S.R.) Received Jan. 17, 1973
Fission cross-section for ^{235}U . Ref 23. ENDF format
- (12) BOYAD (U.S.S.R.) Received Sept. 11, 1972
 ^{238}U evaluation. No reference.
- (13) BENZ1 (Italy) Received Dec. 4, 1970
Fast neutron radiative capture cross-sections of nuclei. Ref 12.
- (14) LIVOLSI 1500 (U.S.A.) Received Nov. 1, 1971
These are based on the Cook library, with some improvements and modifications in the thermal and resonance regions. Ref 13. ENDF format
Further information on some of these data libraries may be found in Ref 14.
- A partial listing of the nuclides and their material numbers for identification may be found in Appendix B.

2.3 Calculations Based on Nuclear Systematics

(15)
These calculations are performed by using the code THRESH which has been described in detail. This code calculates some nineteen (n,particle) cross-sections induced by neutrons below 20.0 MeV in medium mass nuclei. The cross-sections for charged particle reactions as well as fission spectrum averages of the cross-sections can be calculated.

This code describes a particular cross-section and its variation with energy by a form given by the statistical model. Further, the various parameters such as peak height, its width, steepness with which it rises or falls are described by a set of parameters which are determined by existing experimental data and their variation for nuclei with different Z and N. Thus the only inputs needed for the code are the Z,N of the target nucleus and the Q-values for some nineteen nuclear reactions which could be calculated from the recent mass tables of Wapstra and Gove (16) or from an approximate mass formula built into the program. The reactions for which the cross-sections are calculated are (n,n'), (n,2n), (n,3n), (n,p), (n,d), (n,t), (n,³He), (n, α), (n,np), (n,nd), (n,nt), (n,n³He), (n,n α), (n,2p), (n,p α), (n,dn), (n,on), and (n,op). The code THRESH is being constantly updated to include the latest information on experimental data in the form of some 13 parameters in terms of which the cross-sections are calculated. Recently, it has also been extended to heavier nuclei to include the mass region up to A=83. In addition, similar procedures have been adopted in a code CHAPIN to calculate charged particle cross-sections. The calculated cross-sections are given both in the form of a line-printer output as well as in the standard ENDF/B format from which they can be plotted or can be processed further.

It is interesting to compare the results of this code with available experimental data. This is shown in Fig. 1 where the experimental data on the ⁵⁸Ni(n,2n) cross-section are shown from the threshold of the reaction

at 12.415 MeV to 20.0 MeV. Some of the available data sets have been left out as they were thought to be highly discrepant or fear of cluttering up the figure with too many points. The continuous curve drawn through the experimental points is thought to be the best representation of the available experimental data. The dashed curve shows the result of THRESH calculations. The average ratio of the values on the continuous curve to the corresponding ones on the dashed curve is 0.74 with the minimum and the maximum ratios in the whole energy range differing by only 10%.

The problems associated with the $(n,2n)$ cross-section of ^{93}Nb is another case where THRESH type calculations based on nuclear systematics have proved to be helpful. The activation measurements of the $^{93}\text{Nb}(n,2n)$ cross-section gave a value of about 450 mb at 14 MeV whereas nuclear systematics predicted⁽¹⁸⁾ a cross-section of 1281 mb at 14.1 MeV. This problem was solved⁽¹⁹⁾ with the realization that the ground state of ^{92}Nb populated in the $(n,2n)$ reaction has a very long half-life and that the measured activity corresponds to transitions to the first excited state with a relatively short half-life. Subsequently, experiments designed to measure the outgoing neutrons and the $(n,2n)$ cross-sections thus measured have given results in substantial agreement with the THRESH type calculations. Thus Mather et al⁽²⁰⁾ measured 1312 ± 83 mb at 14.3 MeV and Hwang et al⁽²¹⁾ obtained 1350 ± 250 mb at 14 MeV and Paulsen and Wiersma⁽²²⁾ got 1380 ± 179 mb at 16.8 MeV. However, these examples should not be construed to mean that the results of THRESH calculations for all the $(n,\text{particle})$ reactions for all the medium mass nuclei agree so well with experimental data - the differences between them are usually much larger. Therefore, in those cases where there are no experimental data, this code can supply cross-section values which are sometimes moderately reliable or at least can be trusted to give order-of-magnitude estimates.

3. List of CTR Requests

There have been mainly three sets of requests for nuclear data for CTR related programs. They are by (1) C. W. Maynard of Wisconsin University for energy desposition, charged particle production and radioactivity calculations (2) J. R. Powell of Brookhaven in connection with his studies of the minimum activity blankets and (3) W. C. Wolkenhauer for his calculations of the fission-product burner systems. The detailed lists of these requests and the different data sets sent in June - August 1973 are given in Appendix C. In each case, either the available evaluations and or the results of the THRESH calculations were sent to the requestor along with the plots of all the cross-sections. As such the data packages sent were voluminous and therefore are not given as part of this report. These data sets were also sent to some eight laboratories in the U.S. actively working in the CTR related programs. Similar requests for cross-sections can be satisfied in the future.

APPENDIX A
Contents of the ENDF/B-IV Library

ENDF/B VERSION-IV GENERAL PURPOSE FILE
1-NOV-74 PRESENT STATUS OF EVALUATIONS

SYMBOL	MAT	LAB	AUTHOR	REVIEWER	CAT	STATUS	COMMENTS	DIST	TAPE
1- H-	1	1209	LABL STEWART	HOWERTON	I			DIST, 23-MAY-74	484
1- H-	2	1128	BNH LEONARD	N.A.	E-III			DIST, 15-APR-74	482
1- H-	3	1149	LABL STEWART		I			DIST, 27-FEB-74	481
2- HE-	3	1126	LABL STEWART	N.A.	E-III			DIST, 15-APR-74	482
2- HE-	4	1278	LABL HISLEY		I			DIST, 27-FEB-74	481
3- LI-	6	1271	LABL LABAUVE	LEONARD	I			DIST, 23-MAY-74	484
3- LI-	7	1272	LABL LABAUVE	HOWERTON	I			DIST, 23-MAY-74	484
4- BE-	9	1289	LLL HOWERTON	WEISBIN	I			DIST, 23-MAY-74	484
5- B-	18	1273	LABL MALE	LEONARD	I			DIST, 23-MAY-74	484
5- B-	11	1188	GE,BNL CONAN	D.T.S.	E-III	EXTENDED TO 28 MEV (BNL),		DIST, 6-MAY-74	483
6- C-	12	1274	ORNL PEREY	LABAUVE	I	WITH ERROR FILES,		DIST, 15-JUL-74	488
7- N-	14	1275	LABL YOUNG	LABAUVE	I	WITH ERROR FILES,		DIST, 15-JUL-74	488
8- O-	16	1276	LABL YOUNG	LABAUVE	I	WITH ERROR FILES,		DIST, 15-JUL-74	488
9- F		1277	ORNL PEREY	GRIMESY	I			DIST, 21-SEP-74	411
11-NA-	23	1196	WARD PAIK	D.T.S.	E-III	EXTENDED TO 28 MEV (BNL)		DIST, 6-MAY-74	483
12-MG		1288	SAI DRAKE	FU	I			DIST, 29-MAY-74	485
13-AL-	27	1193	LABL YOUNG	ROUSSIN	I			DIST, 29-MAY-74	485
14-SI		1194	ORNL PEREY	BNAT	I			DIST, 29-MAY-74	485
17-CL		1149	GGA ALLEN	D.T.S.	E-III			DIST, 6-MAY-74	483
19- K		1128	GGA DRAKE	D.T.S.	E-III			DIST, 6-MAY-74	483
22-CA		1195	ORNL PEREY	HAERKER	I			DIST, 27-FEB-74	481
22-TI		1288	LLL HOWERTON	ROUSSIN	I			DIST, 4-SEP-74	489
23- V		1196	ORNL PENNY	YOUNG	I			DIST, 15-APR-74	482
24-CR		1191	BNL PRINCE	HAERKER	I			DIST, 6-JUN-74	486
25-MN-	25	1197	BNL TAKAHASHI	ROUSSIN	I			DIST, 4-SEP-74	489

ENDP/D VERSION-IV GENERAL PURPOSE FILE
1-NOV-74 PRESENT STATUS OF EVALUATIONS

SYMBOL	MAT	LAD	AUTHOR	REVIEWER	OAT	STATUS	COMMENTS	DIST	TAPE
86-FE	1192	ORNL	PEREY	STEWART	I			DIST, 8-JUN-74	486
87-CO-59	1199	BNL	KRIEGER	COBB	I			DIST, 22-AUG-74	488
88-NI	1198	BNL	BHAT	MAERKER	I			DIST, 8-JUN-74	486
89-CU	1235	SAI	DRAKE	CHENEY	I			DIST, 22-AUG-74	488
36-KR-78	1181	BNL	PRINCE	LIVOLSI	I			DIST, 13-APR-74	482
36-KR-88	1192	BNL	PRINCE	LIVOLSI	I			DIST, 13-APR-74	482
36-KR-82	1183	BNL	PRINCE	LIVOLSI	I			DIST, 13-APR-74	482
36-KR-83	1184	BNL	PRINCE	LIVOLSI	I			DIST, 13-APR-74	482
36-KR-84	1185	BNL	PRINCE	LIVOLSI	I			DIST, 13-APR-74	482
36-KR-86	1186	BNL	PRINCE	LIVOLSI	I			DIST, 13-APR-74	482
48-ZIAC-2	1284	BNH	LEONARD	COBB	I			DIST, 21-SEP-74	411
41-NB-93	1189	ANL	SMITH	NOIR	I			DIST, 21-SEP-74	411
42-MO	1287	LLL	HUMBERTON	ROUSSIN	I			DIST, 4-SEP-74	489
43-TC-99	1137	B-M	LIVOLSI	D.T.S.	E-III	EXTENDED TO 28 MEV, (BNL)		DIST, 8-MAY-74	483
43-RH-103	1185	B-M	LIVOLSI	D.T.S.	E-III	EXTENDED TO 28 MEV, (BNL)		DIST, 8-MAY-74	483
47-AC-107	1138	BNL	BHAT	D.T.S.	E-III	EXTENDED TO 28 MEV, (BNL)		DIST, 8-MAY-74	483
47-AC-109	1139	BNL	BHAT	D.T.S.	E-III	EXTENDED TO 28 MEV, (BNL)		DIST, 8-MAY-74	483
48-CD	1281	UK,BNL	PEARLSTEIN	WHEELER	I			DIST, 21-SEP-74	411
48-CD-113	1282	UK,BNL	PEARLSTEIN	WHEELER	I			DIST, 21-SEP-74	411
84-XE-124	1178	BNL	BHAT	SCHENTER	I			DIST, 13-APR-74	482
84-XE-126	1171	BNL	BHAT	SCHENTER	I			DIST, 13-APR-74	482
84-XE-128	1172	BNL	BHAT	SCHENTER	I			DIST, 13-APR-74	482
84-XE-129	1173	BNL	BHAT	SCHENTER	I			DIST, 13-APR-74	482
84-XE-130	1174	BNL	BHAT	SCHENTER	I			DIST, 13-APR-74	482
84-XE-131	1175	BNL	BHAT	SCHENTER	I			DIST, 13-APR-74	482

SYMBOL	NAI	LAB	AUTHOR	REVIEWER CAT	STATUS COMMENTS	DATE
34-44-132	1170	BNL	BNAT	SCHENTER	1	DIST, 15-APR-74
34-44-134	1177	BNL	BNAT	SCHENTER	1	DIST, 15-APR-74
34-44-135	1294	BNL	LEONARD	D.T.S. E-111		DIST, 23-MAY-74
34-44-136	1270	BNL	BNAT	SCHENTER	1	DIST, 15-APR-74
34-44-137	1351	BNL	BNAT	D.T.S. E-111	EXTENDED TO 28 MEV, (BNL)	DIST, 6-MAY-74
34-44-138	1027	BNL	LEONARD	D.T.S. E-111		DIST, 6-MAY-74
34-44-139	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-140	1292	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-141	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-142	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-143	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-144	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-145	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-146	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-147	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-148	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-149	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-150	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-151	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-152	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-153	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-154	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-155	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-156	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-157	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-158	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-159	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-160	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-161	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-162	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-163	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-164	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-165	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-166	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-167	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-168	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-169	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-170	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-171	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-172	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-173	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-174	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-175	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-176	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-177	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-178	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-179	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-180	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-181	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-182	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-183	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-184	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-185	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-186	1270	BNL	YANAKISHI	SCHENTER	1	DIST, 22-AUG-74
34-44-187						

APPENDIX B

Partial Contents of the ENDF/A Library

ENDF/A-701

AAEC Fission Product Data Library Received 9/15/71
Cook Library

<i>Isotope*</i>	AAEC #	ENDF FORMAT MAT #	# OF RECORDS ENDF FORMAT
Zn-72	1	7001	483
Ga-72	2	7002	"
Ge-72	3	7003	"
Ge-73	4	7004	"
Ge-74	5	7005	"
Ge-76	6	7006	"
Ge-77	7	7007	"
As-75	8	7008	"
As-76	9	7009	"
As-77	10	7010	"
Se-76	11	7011	"
Se-77	12	7012	"
Se-78	13	7013	"
Se-79	14	7014	"
Se-80	15	7015	"
Br-81	16	7016	"
Br-82	17	7017	"
Kr-82	18	7018	"
Kr-83	19	7019	"
Kr-84	20	7020	"
Kr-85	21	7021	"
Kr-86	22	7022	"
Rb-85	23	7023	"
Rb-86	24	7024	"
Rb-87	25	7025	"
Sr-86	26	7026	495
Sr-88	27	7027	483

(Cont'd)

ENDF/A-701 (cont'd)

Isotope*	AAEC #	ENDF FORMAT MAT #	# OF RECORDS ENDF FORMAT
Sr-89	28	7028	483
Sr-90	29	7029	"
Sr-91	30	7030	"
Y-89	31	7031	"
Y-90	32	7032	"
Y-91	33	7033	"
Y-93	34	7034	"
Zr-90	35	7035	"
Zr-91	36	7036	489
Zr-92	37	7037	501
Zr-93	38	7038	483
Zr-94	39	7039	501
			<u>18,891</u>
			TOTAL

* σ_T , σ_{nn} , σ_{ne} , $n\gamma$, σ_{Tr} are the reaction type given for each isotope.

ENDF/A-702

AAEC Fission Product Data Library Received 9/15/71
Cook Library

Isotope *	AAEC #	ENDF FORMAT MAT #	# OF RECORDS ENDF FORMAT
Zr-95	40	7040	483
96	41	7041	489
97	42	7042	483
Nb-95	43	7043	"
Mo-95	44	7044	"
96	45	7045	"
97	46	7046	"
98	47	7047	"
99	48	7048	"
100	49	7049	"
Tc-99	50	7050	"
Ru-100	51	7051	"
101	52	7052	"
102	53	7053	"
103	54	7054	"
104	55	7055	"
105	56	7056	"
106	57	7057	"
Rh-103	58	7058	"
105	59	7059	"
Pd-104	60	7060	"
105	61	7061	"
106	62	7062	"
107	63	7063	"
108	64	7064	"
109	65	7065	"
110	66	7066	"
112	67	7067	"
Ag-109	68	7068	"
111	69	7069	"

(cont'd)

ENDF/A-702 (cont'd)

Isotope*	AAEC #	ENDF FORMAT MAT #	# OF RECORDS ENDF FORMAT
Cd-110	70	7070	483
111	71	7071	"
112	72	7072	"
113	73	7073	"
114	74	7074	"
115	75	7075	"
116	76	7076	"
In-115	77	7077	"
Sn-115	78	7078	"
			<u>18,843</u>
			TOTAL

* σ_T , σ_{nn} , σ_{ne} , $n\gamma$, σ_{Tr} are the reaction type given for each isotope.

ENDF/A-703

AAEC Fission Product Data Library Received 9/15/71
Cook Library

Isotope *	AAEC #	ENDF FORMAT MAT #	# OF RECORDS ENDF FORMAT
Sn-116	79	7079	483
117	80	7080	"
118	81	7081	"
119	82	7082	"
120	83	7083	"
121	84	7084	"
122	85	7085	"
123	86	7086	"
124	87	7087	"
125	88	7088	"
126	89	7089	"
Sb-121	90	7090	"
122	91	7091	"
123	92	7092	"
124	93	7093	"
125	94	7094	"
126	95	7095	"
127	96	7096	"
128	97	7097	"
Te-122	98	7098	"
123	99	7099	"
124	100	7100	"
125	101	7101	"
126	102	7102	"
127	103	7103	"
128	104	7104	"

(cont'd)

ENDF/A-703 (cont'd)

Isotope*	AAEC #	ENDF FORMAT MAT #	# OF RECORDS ENDF FORMAT
Te-129	105	7105	483
130	106	7106	"
131	107	7107	"
132	108	7108	"
I-127	109	7109	"
129	110	7110	"
130	111	7111	"
131	112	7112	"
133	113	7113	"
135	114	7114	"
Xe-128	115	7115	"
130	116	7116	"
131	117	7117	"
			<u>18,837</u>

* σ_T , σ_{nn} , σ_{ne} , $n\gamma$, σ_{Tr} are the reaction type given for each isotope.

ENDF/A-704

AAEC Fission Product Data Library Received 9/15/71
Cook Library

Isotope*	AAEC #	ENDF FORMAT #	# OF RECORDS ENDF FORMAT
Xe-132	118	7118	483
133	119	7119	"
134	120	7120	"
135	121	7121	"
136	122	7122	"
Cs-133	123	7123	"
134	124	7124	"
135	125	7125	"
136	126	7126	"
137	127	7127	"
Ba-134	128	7128	"
136	129	7129	"
137	130	7130	"
138	131	7131	"
140	132	7132	"
La-139	133	7133	"
140	134	7134	"
Ce-140	135	7135	"
141	136	7136	"
142	137	7137	"
143	138	7138	"
144	139	7139	"
Pr-141	140	7140	489
142	141	7141	483
143	142	7142	"
145	143	7143	"

(cont'd)

ENDF/A-704 (cont'd)

Isotope*	AAEC #	ENDF FORMAT MAT #	# OF RECORDS ENDF FORMAT
Nd-142	144	7144	483
143	145	7145	"
144	146	7146	"
145	147	7147	"
146	148	7148	"
147	149	7149	"
148	150	7150	"
150	151	7151	"
Pm-147	152	7152	"
148	153	7153	"
149	154	7154	"
151	155	7155	"
Sm-147	156	7156	"
			<u>18,843</u> Total

* σ_T , σ_{nn} , σ_{ne} , $n\gamma$, σ_{Tr} are the reaction type given for each isotope.

ENDF/A-705

AAEC Fission Product Data Library Received 9/15/71
Cook Library

Isotope*	AAEC #	ENDF FORMAT MAT #	# OF RECORDS ENDF FORMAT
Sm-148	157	7157	483
149	158	7158	"
150	159	7159	"
151	160	7160	"
152	161	7161	"
153	162	7162	"
154	163	7163	"
156	164	7164	"
Eu-153	165	7165	"
154	166	7166	"
155	167	7167	"
156	168	7168	"
157	169	7169	"
Gd-155	170	7170	"
156	171	7171	"
157	172	7172	"
158	173	7173	"
159	174	7174	"
160	175	7175	"
Tb-159	176	7176	"
160	177	7177	"
161	178	7178	"
Dy-160	179	7179	"
161	180	7180	"

(cont'd)

ENDF/A-705 (cont'd)

Isotope*	AAEC #	ENDF FORMAT MAT #	# OF RECORDS ENDF FORMAT
Dy-162	181	7181	483
163	182	7182	"
164	183	7183	"
Ho-165	184	7184	"
Tc-799	185	7185	"
Cd-815	186	7186	"
Te-823	187	7187	"
825	188	7188	"
827	189	7189	"
829	190	7190	"
831	191	7191	"
Pm-848	192	7192	"
			<u>17,388</u> TOTAL

* σ_T , σ_{nn} , σ_{ne} , $n\gamma$, σ_{Tr} are the reaction type given for each isotope.

EXDP/A-702°

KENDR Data Library Received 09/26/70

Isotope	Reaction Type ^{ab}						KENDR #
	K	G	K	G	K	G	
Al-27	1 458	1 459	2 152	2 153	2 154	2 155	130027
	3 001	3 002	3 003	3 004	3 005	3 006	
	3 016	3 027	3 102	3 103	3 104	3 105	
	3 201	3 251	4 002*				
C-12	1 458	1 459	2 152	2 001	2 002	2 003	40012
	3 001	3 004	3 005	3 116	3 027	3 028	
	3 102	3 103	3 107	3 201	3 251		
	4 002*						
Cd	1 458	2 152	3 001	3 002	3 003	3 004	400000
	3 004	3 005	3 016	3 027	3 102	3 103	
	3 103	3 107	3 201	3 251			
Cr	1 458	1 459	1 460	2 152	2 001	2 002	260003
	3 002	3 003	3 004	3 005	3 016	3 017	
	3 019	3 027	3 102	3 103	3 107	3 108	
	3 201	3 206	3 207	3 251	3 452		
	3 461	4 002*					
Cr-50	1 458	1 459	2 152	2 153	2 154	2 155	260050
Cr-52	1 458	1 459	2 152	2 153	2 154	2 155	260052
Cr-53	1 458	1 459	2 152	2 153	2 154	2 155	260053
Cr-54	1 458	1 459	2 152	2 153	2 154	2 155	260054
Fe	1 458	1 459	1 460	2 152	2 001	2 002	260000
	3 002	3 003	3 004	3 005	3 016	3 017	
	3 019	3 027	3 102	3 103	3 107	3 108	
	3 201	3 206	3 207	3 251	3 452		
	3 461	4 002*					
Fe-54	1 458	1 459	2 152	2 153	2 154	2 155	260054
Fe-56	1 458	1 459	2 152	2 153	2 154	2 155	260056
Fe-57	1 458	1 459	2 152	2 153	2 154	2 155	260057
Fe-58	1 458	1 459	2 154				260058

(continued)

ENDF/A-200* (continued)

Isotope	Reaction Type**						KKBK #
	K	C	K	C	K	C	
H-2(2)	1 438	1 439	2 001	2 002	2 003	2 004	10002
	2 005	2 016	2 027	2 102	2 103	2 104	
	2 105	2 201	2 211	4 002*			
H in H-2	2 001	2 002	2 003	2 004	2 016		11001
	2 027	2 102	2 103	2 104	2 201		
	2 211						
H in H ₂ O	2 001	2 002	2 003	2 004	2 016		12001
	2 027	2 102	2 103	2 104	2 201		
	2 211						
He-3	2 001	2 002	2 003	2 004	2 016		20003
	2 027	2 102	2 103	2 104	2 211		
He-4	1 438	1 439	2 001	2 002	2 003		20004
	2 004	2 016	2 027	2 103	2 104		
	2 105	2 201	2 211	4 002*			
He	1 438	1 439	1 440	2 152	2 153		420000
	2 002	2 003	2 004	2 005	2 016		
	2 027	2 102	2 103	2 104	2 201		
	2 211	4 002*					
Na-22	1 438	1 439	2 152	2 153	2 154		420092
Na-24	1 438	1 439	2 152	2 153	2 154		420094
Na-25	1 438	1 439	2 152	2 153	2 154		420095
Na-26	1 438	1 439	2 152	2 153	2 154		420096
Na-27	1 438	1 439	2 152	2 153	2 154		420097
Na-28	1 438	1 439	2 152	2 153	2 154		420098
Na-100	1 438	1 439	2 152	2 153	2 154		420100
B	4 002*						70000

*ENDF/A Type No. assigned but data not converted to ENDF format.

**See KFK-880 for reaction type values.

*Center-of-Mass System.

ENDF/A-708*

KEDAK Data Library Received 10/26/70

Isotope	Reaction Type**						KEDAK #
	K	G	K	G	K	G	
Ni	1 458	1 459	1 460	2 152	3 001		280000
	3 002	3 003	3 004	3 005	3 016		
	3 019	3 027	3 102	3 103	3 107		
	3 201	3 206	3 207	3 251	3 452		
	3 461	4 002*					
Ni-58	1 458	1 459	2 152	2 153	2 154		280058
Ni-60	1 458	1 459	2 152	2 153	2 154		280060
Ni-61	1 458	1 459	2 154				280061
Ni-62	1 458	1 459	2 152	2 154			280062
Ni-64	1 458	1 459	2 154				280064
O-16	1 458	1 459	2 152	3 001	3 002		80016
	3 003	3 005	3 016	3 027	3 103		
	3 107	3 201	3 251	4 002*			
	3 004	3 102					
U-235	1 456	1 457	1 458	1 459	2 152		920235
	2 153	2 154	2 155	3 001	3 002		
	3 003	3 004	3 005	3 016	3 019		
	3 027	3 102	3 103	3 107	3 201		
	3 206	3 207	3 251	3 452	3 461		
	4 002*						

*ENDF/A Tape No. assigned but data not converted to ENDF format.

**See KFK-880 for reaction type values.

*Center-of-Mass System.

ENDF/A-709*

KEDAK Data Library Received 10/26/70

Isotope	Reaction Type**										KEDAK #
	K	G	K	G	K	G	K	G	K	G	
Na-23	1	458	1	459	2	152	2	153	2	154	110023
	3	001	3	002	3	003	3	004	3	005	
	3	016	3	027	3	102	3	103	3	107	
	3	201	3	251	4	002 ⁺					
Pu-239	1	456	1	457	1	458	1	459	2	152	940239
	2	153	2	154	2	155	3	001	3	002	
	3	003	3	004	3	005	3	016	3	019	
	3	027	3	102	3	103	3	107	3	201	
	3	206	3	207	3	251	3	452	3	461	
	4	002 ⁺									
Pu-240	1	456	1	457	1	458	1	459	2	152	940240
	2	153	2	154	2	155	3	001	3	002	
	3	003	3	004	3	005	3	016	3	019	
	3	027	3	102	3	201	3	206	3	207	
	3	251	3	452	4	002 ⁺					
Pu-241	1	456	1	457	1	458	1	459	2	152	940241
	2	153	2	154	2	155	3	001	3	002	
	3	003	3	004	3	005	3	016	3	019	
	3	027	3	102	3	201	3	206	3	027	
	3	251	3	452	4	002 ⁺					
Pu-242	1	456	1	457	1	458	1	459	2	152	940242
	2	153	2	154	3	001	3	002	3	003	
	3	004	3	005	3	016	3	019	3	027	
	3	102	3	201	3	206	3	207	3	251	
	3	452	4	002 ⁺							
U-238	1	456	1	457	1	458	1	459	2	152	920238
	2	153	2	154	3	001	3	002	3	003	
	3	004	3	005	3	016	3	019	3	027	
	3	102	3	103	3	107	3	201	3	251	
	3	452	3	461	4	002 ⁺					

*ENDF/A Tape No. assigned but data not converted to ENDF format.

**See KFK-880 for reaction type values

⁺Center-of-Mass System.

ENDF/A-801

UKNDL Data Library Received 5/5/71
Version 2

Isotope	Reaction Type ^a										UKNDL #	ENDF MAT #	# of RECORDS
	MF	MT	MF	MT	MF	MT	MF	MT	MF	MT			
Li	2	151	3	1	3	2	3	102	4	2	901	8001	331
D in D ₂ O	2	151	3	1	3	2	3	3	3	16	256	8002	1115
	3	102	4	2	4	16	5	16					
Be-9	2	151	3	1	3	2	3	3	3	24	511	8003	857
	3	102	3	105	3	107	4	2	4	24			
	5	24											
C-12	2	151	3	1	3	2	3	3	3	23	68	8004	1908
	3	51	3	102	3	107	4	2	4	23			
	4	51	5	23									
O-16	2	151	3	1	3	2	3	3	3	4	33	8005	1371
	3	51	3	52	3	54	3	55	3	57			
	3	58	3	59	3	60	3	91	3	102			
	3	103	3	104	3	107	4	2					
	4	51	4	52	4	53	4	54	4	55			
	4	56	4	57	4	58	4	59	4	60			
	4	91	5	91	3	53	3	56					
U-235	2	151	3	1	3	2	3	3	3	16	66	8006	4083
	3	17	3	18	3	51	3	52	3	53			
	3	54	3	55	3	56	3	91	3	102			
	4	2	4	16	4	17	4	18	4	51			
	4	52	4	53	4	54	4	55	4	56			
	4	91	5	16	5	17	5	18	5	91			
	1	452											
Pu-239	2	151	3	1	3	2	3	3	3	16	65	8007	3335
	3	17	3	18	3	51	3	52	3	53			
	3	54	3	55	3	56	3	57	3	91			
	3	102	4	2	4	16	4	17	4	18			
	4	51	4	52	4	53	4	54	4	55			
	4	56	4	57	4	91	5	16	5	17			
	5	18	5	91									
	1	452											
U-233	2	151	3	1	3	2	3	16	3	17	87	8008	1876
	3	18	3	91	3	102	4	2	4	16			
	4	17	4	18	4	91	5	16	5	17			
	5	18	5	91									
	1	452											
U-238	2	151	3	1	3	2	3	3	3	16	401	8009	5819
	3	17	3	18	3	51	3	52	3	53			
	3	54	3	55	3	56	3	57	3	58			
	3	59	3	60	3	91	3	102	4	2			
	4	16	4	17	4	18	4	51	4	52			
	4	53	4	54	4	55	4	56	4	57			
	4	58	4	59	4	60	4	91	5	16			
	5	17	5	18	5	91							
	1	452											
(continued)													

(continued)

ENDF/A-801 (continued)

Isotope	Reaction Type*						UKNDL #	ENDF MAT #	# of RECORDS
	MF	MT	ME	MT	MF	MT			
Pu-241	2	151	3	1	3	2	60	8010	1982
	3	17	3	18	3	91			
	4	16	4	17	4	18			
	5	17	5	18	5	91			
Na-23	3	102					224	8011	78
Mg-24	3	103					225	8012	57
Al-27	3	102	3	107			226	8013	81
Al-27	3	107					95	8014	39
Al-27	3	107					96	8015	39
Si-28	3	103					227	8016	39
P-31	3	103					228	8017	118
S-32	3	103					229	8018	55
S-32	3	103					97	8019	41
S-34	3	107					230	8020	65
Cl-35	3	107					231	8021	29
Se-45	3	16	3	26			207	8022	30
Mn-55	3	102					232	8023	102
Fe-54	3	103					63	8024	53
Fe-54	3	103					233	8025	37
Fe-56	3	103					62	8026	47
Fe-56	3	103					234	8027	34
Fe-56	3	103					98	8028	30
Co-59	3	102					235	8029	86
Ni-58	3	16	3	103			236	8030	57
Cu-63	3	16	3	102			237	8031	89
Cu-63	3	16					99	8032	25
Cu-65	3	16					100	8033	26
Y-89	3	16					208	8034	22
Zr-90	3	16					238	8035	27
Rh-103	3	16					204	8036	27

(continued)

ENDF/A-801 (continued)

Isotopes	Reaction Type*				UKNDL #	ENDF MAT #	# of RECORDS
	MF	MT	MF	MT			
Rh-103	3	51	4	51	94	8037	59
In-115	3	51			239	8038	42
I-127	3	16			240	8039	28
Gd	3	1	3	102	223	8040	40
Tm-169	3	16			209	8041	23
Lu-175	3	16			210	8042	23
Th-232	3	18	3	102	242	8043	186
							<u>24402</u>
							TOTAL

*See ENDF-102 Vol 1 for reaction type values.

ENDF/A-802

UKNDL Data Library Received 5/5/71
Version 2

Isotope	Reaction Type*										UKNDL #	ENDF MAT #	# of RECORDS
	MF	MT	MF	MT	MF	MT	MF	MT	MF	MT			
Pu-240	2	151	3	1	3	2	3	3	3	16	77	8044	1180
	3	17	3	18	3	51	3	52	3	53			
	3	91	3	102	4	2	4	16	4	17			
	4	18	4	51	4	52	4	53	4	91			
	5	16	5	17	5	18	5	91					
	1	452											
Th-232	2	151	3	1	3	2	3	3	3	16	22	8045	1045
	3	17	3	18	3	91	3	102	4	2			
	4	16	4	17	4	18	4	91	5	16			
	5	17	5	18	5	91							
	1	452											
U-234	2	151	3	1	3	2	3	3	3	16	74	8046	1170
	3	17	3	18	3	51	3	52	3	53			
	3	54	3	55	3	56	3	91	3	102			
	4	2	4	16	4	17	4	18	4	51			
	4	52	4	53	4	54	4	55	4	56			
	4	91	5	16	5	17	5	18	5	91			
U-236	2	151	3	1	3	2	3	3	3	16	75	8047	1025
	3	17	3	18	3	51	3	52	3	53			
	3	54	3	55	3	56	3	91	3	102			
	4	2	4	16	4	17	4	18	4	51			
	4	52	4	53	4	54	4	55	4	56			
	4	91	5	16	5	17	5	18	5	91			
U-238	2	151	3	1	3	2	3	3	3	16	76	8048	1069
	3	17	3	18	3	51	3	52	3	53			
	3	54	3	55	3	56	3	57	3	58			
	3	59	3	60	3	91	3	102	4	2			
	4	16	4	17	4	18	4	51	4	52			
	4	53	4	54	4	55	4	56	4	57			
Pu-238	4	58	4	59	4	60	4	91	5	16	216	8049	620
	5	17	5	18	5	91							
	1	452											
	2	151	3	1	3	2	3	3	3	16			
	3	17	3	18	3	91	3	102	4	2			
	4	16	4	17	4	18	4	91	5	16			
Pa-233	2	151	3	1	3	2	3	3	3	16	86	8050	981
	3	18	3	91	3	102	4	2	4	16			
	4	18	4	91	5	16	5	18	5	91			
	1	452											
Np-237	3	18									61	8051	86

(continued)

ENDF/A-802 (continued)

Isotope	Reaction Type*						UKNDL #	ENDF MAT #	# of RECORDS				
	MF	MT	MF	MT	MF	MT							
Na	2	151	3	1	3	2	3	3	3	16	182	8052	1762
	3	51	3	52	3	53	3	54	3	55			
	3	56	3	57	3	91	3	102	3	103			
	3	107	4	2	4	16	4	51	4	52			
	4	53	4	54	4	55	4	56	4	57			
	4	91	5	16	5	91							
K	2	151	3	1	3	2	3	3	3	4	84	8053	2804
	3	16	3	22	3	51	3	52	3	53			
	3	54	3	55	3	56	3	91	3	102			
	3	103	3	107	4	2	4	16	4	22			
	4	51	4	52	4	53	4	54	4	55			
	4	56	4	91	5	16	5	22	5	91			
Al	2	151	3	1	3	2	3	16	3	51	35	8054	1306
	3	52	3	53	3	54	3	55	3	56			
	3	57	3	58	3	59	3	91	3	102			
	3	103	3	107	4	2	4	16	4	51			
	4	52	4	53	4	54	4	55	4	56			
	4	57	4	58	4	59	4	91	5	16			
	5	91											
Zr	2	151	3	1	3	2	3	3	3	16	82	8055	1958
	3	51	3	52	3	53	3	54	3	55			
	3	56	3	57	3	58	3	91	3	102			
	3	103	4	2	4	16	4	51	4	52			
	4	53	4	54	4	55	4	56	4	57			
	4	58	4	91	5	16	5	91					
Fe	2	151	3	1	3	2	3	51	3	52	91	8056	2938
	3	53	3	54	3	55	3	56	3	57			
	3	58	3	59	3	60	3	91	3	102			
	3	103	3	107	4	2	4	51	4	52			
	4	53	4	54	4	55	4	56	4	57			
	4	58	4	59	4	60	4	91	5	91			
Cu	2	151	3	1	3	2	3	4	3	16	73	8057	3274
	3	51	3	52	3	53	3	54	3	55			
	3	56	3	57	3	58	3	59	3	91			
	3	102	3	103	3	107	4	2	4	16			
	4	51	4	52	4	53	4	54	4	55			
	4	56	4	57	4	58	4	59	4	91			
	5	16	5	91									
Mo	2	151	3	1	3	2	3	3	3	4	81	8058	1457
	3	16	3	17	3	22	3	51	3	52			
	3	53	3	54	3	91	3	102	3	103			
	4	2	4	16	4	17	4	22	4	51			
	4	52	4	53	4	54	4	91	5	16			
	5	17	5	22	5	91							

(continued)

ENDF/A-802 (continued)

Isotope	Reaction Type*								UKNDL #	ENDF MAT #	# of RECORDS			
	MF	MT	MF	MT	MF	MT	MF	MT						
W	2	151	3	1	3	2	3	3	3	16	213	8059	378	
	3	91	3	102	4	2	4	16	4	91				
	5	16	5	91										
Cr	2	151	3	1	3	2	3	3	3	16	45	8060	1085	
	3	51	3	52	3	53	3	54	3	55				
	3	56	3	57	3	58	3	91	3	102				
	3	103	4	2	4	16	4	51	4	52				
	4	53	4	54	4	55	4	56	4	57				
	4	58	4	91	5	16	5	91						
Ni	2	15	3	1	3	2	3	3	3	16	46	8061	1460	
	3	51	3	52	3	53	3	54	3	55				
	3	56	3	57	3	58	3	91	3	102				
	3	103	3	107	4	2	4	16	4	51				
	4	52	4	53	4	54	4	55	4	56				
	4	57	4	58	4	91	5	16	5	91				

*See ENDF-102 vol 1 for reaction type values.

ENDF/A-803

UKNDL Data Library Received 5/5/71
Version 2

<u>Isotope</u>	<u>MF</u>	<u>MT</u>	<u>MF</u>	<u>MT</u>	<u>MF</u>	<u>MT</u>	<u>MF</u>	<u>MT</u>	<u>MF</u>	<u>MT</u>	<u>MF</u>	<u>MT</u>	<u>UKNDL</u> <u>#</u>	<u>ENDF</u> <u>MAT</u> <u>#</u>	<u># of</u> <u>RECORDS</u>
Nb	2	151	3	1	3	2	3	3	3	4			79	8062	5669
	3	16	3	51	3	52	3	53	3	54					
	3	55	3	56	3	57	3	58	3	59					
	3	60	3	91	3	102	3	103	3	107					
	4	2	4	16	4	51	4	52	4	53					
	4	54	4	55	4	56	4	57	4	58					
	4	59	4	60	4	91	5	16	5	91					
Si	2	151	3	1	3	2	3	3	3	91			25	8063	399
	3	102	3	103	3	107	4	2	4	91					
	5	91													
Ph	2	151	3	1	3	2	3	3	3	16			26	8064	533
	3	91	3	102	4	2	4	16	4	91					
	5	16	5	91											
B-10	2	151	3	1	3	2	3	3	3	4			90	8065	608
	3	51	3	52	3	53	3	54	3	55					
	3	56	3	91	3	101	3	103	3	104					
	3	105	3	107	4	2	4	51	4	52					
	4	53	4	54	4	55	4	56	4	91					
	5	91													
B-11	2	151	3	1	3	2	3	51	3	52			49	8066	821
	3	53	3	91	3	102	3	103	3	105					
	3	107	4	2	4	51	4	52	4	53					
	4	91	5	91											
Cd	2	151	3	1	3	2	3	3	3	16			70	8067	2323
	3	51	3	52	3	53	3	54	3	91					
	3	101	3	102	3	103	3	107	4	2					
	4	16	4	51	4	52	4	53	4	54					
Cd-113	2	151	3	1	3	2	3	3	3	16			71	8068	1199
	3	51	3	52	3	53	3	91	3	101					
	3	102	3	103	3	107	4	2	4	16					
	4	51	4	52	4	53	4	91	5	16					
	5	91													
Xe-135	2	151	3	1	3	2	3	102	4	2			4	8069	103

(Continued)

ENDF/A-803 (continued)

Isotope	Reaction Type*										UKNDL #	ENDF MAT #	# of RECORDS
	MF	MT	MF	MT	MF	MT	MF	MT	MF	MT			
H-3(T)	2 4	151 2	3 4	1 16	3 5	2 16	3 3	3 3	3 3	16	252	8070	676
He-3	2 3	151 104	3 4	1 2	3 3	2 2	3 3	3 3	3 3	103	220	8071	243
He-4	2	151	3	1	3	2	4	2			221	8072	290
Li-6	2 3 4 5	151 24 2 24	3 3 4	1 51 22	3 3 4	2 102 24	3 3 4	3 103 51	3 3 5	22 107 22	214	8073	962
Li-7	2 3 4 5	151 22 2 16	3 3 4 5	1 24 16 22	3 3 4 5	2 51 22 24	3 3 4 5	3 102 24	3 3 4	16 104 51	215	8074	902
B	2 3	151 101	3 4	1 2	3 4	2 91	3 5	3 91	3 3	91	57	8075	367
N	2 3 4 5	151 51 104 16 91	3 3 3 4	1 52 105 51	3 3 3 4	2 91 107 52	3 3 3 4	3 102 108 91	3 3 4 5	16 103 2 16	259	8076	3664
F	2 3 5	151 91 16	3 3 5	1 101 91	3 4	2 2	3 4	3 16	3 4	16 91	23	8077	398
Cl	2 3 4	151 91 16	3 3 4	1 102 91	3 3 5	2 103 16	3 3 5	3 107 19	3 4	16 2	141	8078	563
Ca	2 3 5	151 102 91	3 3 3	1 103	3 3	2 107	3 4	3 2	3 4	91 91	138	8079	362
Ti	2 3 3 4 5	151 51 102 51 16	3 3 3 4 5	1 52 103 52 91	3 3 3 4	2 53 107 53	3 3 4 4	3 54 2 54	3 3 4 4	16 91 16 91	190	8080	1150

(continued)

ENDF/A-803 (continued)

Isotope	Reaction Type*										UKNDL #	ENDF MAT #	# of RECORDS
	MF	MT	MF	MT	MF	MT	MF	MT	MF	MT			
Cu-63	2	151	3	16	3	102	3	103	3	107	250	8081	84
Cu-65	2	151	3	16	3	102	3	103	3	107	251	8082	88
Ga	2	151	3	1	3	2	3	3	3	16	105	8083	366
	3	91	3	101	4	2	4	16	4	91			
	5	16	5	91									
Ta-181	2	151	3	1	3	2	3	4	3	16	328	8084	2204
	3	51	3	52	3	53	3	54	3	55			
	3	56	3	57	3	58	3	91	3	101			
	4	2	4	16	4	51	4	52	4	53			
	4	54	4	55	4	56	4	57	4	58			
	4	91	5	16	5	91							

*See ENDF-102 vol 1 for reaction type values.

ENDF/A-804

UKNDL Data Library Received 5/5/71

Isotope	Reaction Type*										UKNDL #	ENDF MAT #	# of RECORDS
	MF	MT	MF	MT	MF	MT	MF	MT	MF	MT			
Au-197	2	151	3	1	3	2	3	3	3	16	222	8085	968
	3	26	3	51	3	52	3	53	3	54			
	3	55	3	56	3	57	3	58	3	59			
	3	91	3	102	3	103	4	2	4	16			
	4	26	4	51	4	52	4	53	4	54			
	4	55	4	56	4	57	4	58	4	59			
	4	91	5	16	5	26	5	91					
Au-197	3	102									241	8086	111
Fp	3	1	3	2	3	3	3	16	3	91	106	8087	350
	3	101	4	2	4	16	4	91	5	16			
	5	91											
VAC	3	1	3	2	4	2					172	8088	39
I/V	3	1	3	2	3	102	4	2			55	8089	45
SCAT	3	1	3	2	4	2					56	8090	39
ABS	3	1	3	2	3	102	4	2			151	8091	45
												<u>1597</u>	Total

*See ENDF-102 vol 1 for reaction type values.

U.K. LIBRARY RECEIVED JULY 2, 1973

Version 3

<u>Nucleus</u>	<u>UK Library No.</u>	<u>No. of Cards</u>	<u>Tape No.</u>
H	923(A)	299	805
DIND20 (Deuterium in D ₂ O)	905(A)	789	"
T	252(A)	436	"
He-3	220(E)	195	"
He-4	221(D)	230	"
Li-6	914(A)	1080	"
Li-7	215(E)	496	"
Be-9	967(A)	351	"
B-10	90(B)	475	"
B-11	49(B)	725	"
C	902(B)	1317	"
N	259(A)	3534	"
O	933(A)	1037	"
F-19	23(E)	288	"
Na-23	182(E)	1582	"
Al-27	35(F)	905	"
Si	25(E)	296	"
Cl	141(E)	408	"
K	84(B)	2569	"
Ca	138(E)	253	"
Ti	190(B)	881	"
V	952(A)	804	"
Cr	45(E)	839	"
Fe	906(B)	7003	806
Fe	908(A)	7447	"
Ni	907(B)	3328	"
Cu	73(A)	3076	"
Cu-63	250(B)	54	"
Cu-65	251(B)	58	"
Ga	105(B)	292	"
Zr	82(B)	1742	"

U.K. Library (continued)

<u>Nucleus</u>	<u>UK Library No.</u>	<u>No. of Cards</u>	<u>Tape No.</u>
Nb-93	79(C)	5579	807
Mo	81(B)	1309	"
Ag-107	973(A)	1107	"
Ag-109	974(A)	1205	"
Cd	70(A)	2203	"
Cd-113	71(B)	1088	"
Xe-135	4(F)	66	"
Eu-151	921(A)	3458	"
Eu-153	922(A)	4055	"
Ta	328(B)	2069	"
W	213(B)	238	"
Au-197	222(E)	690	806
Pb	26(C)	545	"
Th-232	930	774	"
Pa-233	86(A)	900	"
U-233	87(B)	1835	"
U-234	953(A)	823	"
U-235	159(B)	4354	"
U-236	954(A)	749	"
U-238	160(A)	5886	"
U-239	276(A)	1119	"
U-240	277(A)	1060	"
Pu-238	274(A)	438	"
Pu-239	161(A)	3334	809
Pu-239	404(B)	4382	"
Pu-240	402(B)	2669	"
Pu-240	77(B)	1052	"
Pu-241	403(B)	1661	"
Pu-241	60(A)	2155	"
Pu-242	975(A)	1069	"
Am-241	956(A)	1213	"
Am-243	957(A)	574	"
Cm-244	976(A)	1649	"

The contents of the Speng Library are as follows:

Pu-239	Na-23	Pu-240
B-10	D-2	Al
B-11	F	Mn
Si	Zr	Ni
He	Mo	Cr
Li-6	(Fiss. P. 239)	U-235
Li-7	W-186	Cu
Ta	Au-197	H-1
Er	Fe	Pu-241
U-238	B	

LLL ENDL Data in ENDF/B Format

Received Jan. 25, 1974

<u>Material</u>	<u>MAT Number</u>	<u>N,xY Included</u>
Neutron	7000	---
Hydrogen	7001	Yes
Deuteron	7002*	Yes
Triton	7003	---
He ³	7004	Yes
He ⁴	7005	---
Li ⁶	7006	Yes
Li ⁷	7007	Yes
Be ⁹	7008	Yes
B ¹⁰	7009	Yes
B ¹¹	7010	Yes
C ¹²	7011	Yes
N ¹⁴	7012	Yes
O ¹⁶	7013	Yes
F ¹⁹	7014	Yes
Na ²³	7015	Yes
Mg ^{Nat}	7016	Yes
Al ²⁷	7017	Yes
Si ^{Nat}	7018	Yes
P ³¹	7019	Yes
S ³²	7020	Yes
Cl ^{Nat}	7021	Yes
Ar ^{Nat}	7022	Yes

*The energy-angle distribution of secondary neutrons from the n,2n reaction for D is represented by an energy-angle Legendre expansion in the ENDL system. No equivalent representation exists in the ENDF/B system. Consequently, the representation in the translated form is deficient.

LLL ENDL Data in ENDF/B Format

<u>Material</u>	<u>MAT Number</u>	<u>N,xY Included</u>
K ^{Nat}	7023	Yes
Ca ^{Nat}	7024	Yes
Ti ^{Nat}	7025	Yes
V ⁵¹	7026	No (Planned)
Cr ^{Nat}	7027	No (Planned)
Mn ⁵⁵	7028	Yes
Fe ^{Nat}	7029	Yes
Ni ⁵⁸	7030	Yes
Cu ^{Nat}	7031	Yes
Ga ^{Nat}	7032	Yes
Zr ^{Nat}	7033	No (Planned)
Nb ⁹³	7034	Yes
Mo ^{Nat}	7035	Yes
Ag ¹⁰⁷	7036	No (Planned)
Ag ¹⁰⁹	7037	No (Planned)
Cd ^{Nat}	7038	Yes
Sn ^{Nat}	7039	Yes
Ba ^{Nat}	7040	Yes
Eu ^{Nat}	7041	Yes
Gd ^{Nat}	7042	Yes
Ho ¹⁶⁵	7043	Yes
Ta ¹⁸¹	7044	Yes
W ^{Nat}	7045	Yes
Pt ^{Nat}	7046	Yes
Au ¹⁹⁷	7047	Yes
Pb ^{Nat}	7048	Yes
Th ²³²	7049	Yes
U ²³³	7050	Yes

LLL ENDL Data in ENDF/B Format

<u>Material</u>	<u>MAT Number</u>	<u>NuclY Included</u>
U ²³⁴	7051	Yes
U ²³⁵	7052	Yes
U ²³⁶	7053	Yes
U ²³⁷	7054	Yes
U ²³⁸	7055	Yes
U ²³⁹	7056	Yes
U ²⁴⁰	7057	Yes
Np ²³⁷	7058	Yes
Pu ²³⁸	7059	Yes
Pu ²³⁹	7060	Yes
Pu ²⁴⁰	7061	Yes
Pu ²⁴¹	7062	Yes
Am ²⁴²	7063	Yes
Sc ⁴⁵ (Partial)	7064	No
Fe ⁵⁴ (Partial)	7065	No
Fe ⁵⁶ (Partial)	7066	No
Fe ⁵⁸ (Partial)	7067	No
Re ¹⁸⁵ (Partial)	7068	No
Re ¹⁸⁷ (Partial)	7069	No
Ir ¹⁹¹ (Partial)	7070	No
Ir ¹⁹³ (Partial)	7071	No
Crude Fission Product	7072	No

Fig. 1. ^{58}Ni (n,2n) Cross-Section

APPENDIX G
Requests for CTR Related Projects

<u>Nucleus</u>	<u>Cook Library</u>	<u>Livolsi "1500" Series</u>	<u>UKNDL</u>	<u>Speng</u>	<u>ENDF/B III MAT NO</u>	<u>Any Other</u>	<u>THRESH Calculation</u>
H					1148		
He					1088		
³ He			8071		1146		
^{6,7} Li					1115 1116		
⁹ Be					1154		
¹⁰ B			8065		1155		
¹¹ B					1160		
¹² C					1165		
N					1133		
O					1134		
F			8077				
²³ Na					1156		
Mg					1014		
Al					1135		
²⁸ Si			8016				
²⁹ Si							
³⁰ Si							
P			8017				
³⁹ K					1150		
⁴¹ K							
⁴⁵ Sc							X
⁴⁶ Ti							X
⁴⁷ Ti							X
⁴⁸ Ti							X
⁴⁹ Ti							X
⁵⁰ Ti							X

<u>Nucleus</u>	<u>Cook</u> <u>Library</u>	<u>Livolsi</u> <u>"1500"</u> <u>Series</u>	<u>UKNDL</u>	<u>Speag</u>	<u>ENDF/B</u> <u>III</u> <u>MAT NO</u>	<u>Any</u> <u>Other</u>	<u>THRESH</u> <u>Calculation</u>
⁴⁹ V							X
⁶⁰ V							X
⁶¹ V							X
⁶⁰ Cr							X
⁶¹ Cr							X
⁶² Cr							X
⁶³ Cr							X
⁶⁴ Cr							X
⁶³ Mn							X
⁵⁴ Mn							X
⁵⁵ Mn					1019		
⁵⁴ Fe			8024				X
⁵⁵ Fe			8025				X
⁵⁶ Fe			8026				X
			8027				
			8028				
⁵⁷ Fe							X
⁵⁸ Fe							X
⁵⁷ Co							X
⁵⁸ Co					1118		
^{60m} Co							X
⁵⁸ Ni			8030				X
⁵⁹ Ni							X
⁶⁰ Ni							X
⁶¹ Ni							X
⁶² Ni							X

<u>Nucleus</u>	<u>Cook Library</u>	<u>Livolsi "1500" Series</u>	<u>UKNDL</u>	<u>Speng</u>	<u>ENDF/B III MAT NO</u>	<u>Any Other</u>	<u>THRESH Calculation</u>
⁶³ Ni							X
⁶⁴ Ni							X
⁶³ Cu					1085		
⁶⁵ Cu					1086		
⁶⁴ Zn							
⁶⁶ Zn							
⁸⁴ Kr	7020	1521					X
⁸⁶ Kr	7021	1522					X
⁸⁸ Sr	7027						X
⁸⁹ Sr	7028	1530					X
⁹⁰ Sr	7029	1531					X
⁸⁸ Y							X
⁸⁹ Y	7031		8034				X
^{90m} Y	7032						X
^{91m} Y	7033						X
⁹⁰ Zr	7035		8035				X
⁹¹ Zr	7036						X
⁹² Zr	7037						X
⁹³ Zr	7038						X
⁹⁴ Zr	7039						X
⁹⁵ Zr	7040				1202		X
⁹⁶ Zr	7041						X
⁹² Nb							X
^{93m} Nb							X

<u>Nucleus</u>	<u>Cook Library</u>	<u>Livolsi "1500" Series</u>	<u>UKNDL</u>	<u>Speng</u>	<u>ENDF/B III MAT NO</u>	<u>Any Other</u>	<u>THRESH Calculation</u>
⁹⁴ Nb							X
⁹⁸ Mo						573 Benzi	X
^{95m} Mo							X
⁹⁴ Mo						574 Benzi	X
⁹⁵ Mo	7044				1204		X
⁹⁶ Mo	7045						X
⁹⁷ Mo	7046				1205		X
⁹⁸ Mo	7047				1206		X
⁹⁸ Mo	7048				1207		X
¹⁰⁰ Mo	7049				1208		X
⁹⁷ Tc							X
⁹⁸ Tc							X
^{99m} Tc	7050				1137		X
¹¹² Sn						630 Benzi	X
¹¹⁴ Sn						631 Benzi	X
¹¹⁶ Sn	7078						X
¹¹⁶ Sn	7079						X
¹¹⁷ Sn	7080						X
¹¹⁸ Sn	7081						X
¹¹⁸ Sn	7082						X
¹²⁰ Sn	7083						X
¹²² Sn	7085						X
¹²⁴ Sn	7087						X
¹²¹ Sb	7090						X
¹²³ Sb	7092						X

<u>Nucleus</u>	<u>Cook Library</u>	<u>Livolsi "1500" Series</u>	<u>UKNDL</u>	<u>Speng</u>	<u>ENDF/B III MAT NO</u>	<u>Any Other</u>	<u>THRESH Calculation</u>
¹²⁹ I	7100	1614					X
¹³⁴ Cs	7124	1628					X
¹³⁵ Cs	7125	1629					X
¹³⁶ Cs	7126	1630					X
¹³⁷ Cs	7127	1631					X
¹³⁴ Ba	7128	1633					X
¹³⁵ Ba		1634					X
¹³⁶ Ba	7129	1635					X
¹³⁷ Ba	7130	1636					X
¹³⁸ Ba	7131	1637					X
¹⁸¹ Ta					1126		X
¹⁸² W					1060		X
¹⁸³ W					1061		X
¹⁸⁴ W					1062		X
¹⁸⁶ W					1063		X
²⁰⁴ Pb							X
²⁰⁶ Pb							X
²⁰⁷ Pb							X
²⁰⁸ Pb							X
²⁴¹ Am					1056		
²⁴² Am							
²⁴³ Am					1057		
²⁴⁴ Am							

<u>Nucleus</u>	<u>Cook</u> <u>Library</u>	<u>Livolsi</u> <u>"1500"</u> <u>Series</u>	<u>UKNDL</u>	<u>Speng</u>	<u>ENDF/B</u> <u>III</u> <u>MAT NO</u>	<u>Any</u> <u>Other</u>	<u>THRESH</u> <u>Calculation</u>
242 Cm							
243 Cm							
244 Cm					1162		
245 Cm							
246 Cm							
237 Np					1145		
238 Pu					1050		
239 Pu					1159		
240 Pu					1105		
241 Pu					1106		
242 Pu					1161		

References

1. G. R. Hopkins (Ed). Proceedings of the First Topical Meeting on the Technology of Controlled Nuclear Fusion, San Diego, April 1974, CONF-740402-P2
2. H. C. Honeck, ENDF/B-Specifications for an Evaluated Nuclear Data for Reactor Applications BNL-50066 (ENDF-102) May 1966; Revised July 1967 and July 1968 by S. Pearlstein.
3. O. Ozer and D. Garber (Ed). ENDF/B Summary Documentation. BNL-17541 (ENDF-201) May 1973 and its up-dates. See also more detailed reports on individual evaluations.
4. K. Parker, The Aldermaston Nuclear Data Library as at May 1963. AWRE O-70/63, 1963
5. R. J. Howerton, UCID-16376, Oct. 1973
6. M. K. Drake, BNL-17188 (ENDF-179) July 1972
7. C. Devillers, J. Blachot, M. Lott, B. Nimal, N'Guyen Van Dat, J. P. Noel, R deTourreil, IAEA-SM-170/63, March 1973
8. Report AE-RD-45 (1972)
9. D. Woll, KFK-880 Dec. 1968
10. R. L. Simons and W. N. McElroy, BNWL-1312, May 1970
11. J. L. Cook, AAEC/TM-549, See also
E. K. Rose, AAEC/TM-587, March 1971
12. V. Benzi and G. Reffo. CCDN-NW/10 Dec. 1969
13. A. Z. Livolsi, BAW-409, Nov. 1971
14. CCDN Newsletter; CCDN-NW/14, May 1972

15. S. Pearlstein, Jour. Nucl. Energy 27, 81, 1973
16. A. H. Wapstra & N. B. Gove, Nuclear Data Tables 9, 267 (1971)
17. S. Pearlstein, "Starter Evaluated Charged Particle Data Library"
May 1974. Available on request.
18. S. Pearlstein, Nuclear Data, 3A, 327, 1967, See also
Nucl. Sci. and Eng. 23, 238, 1965
19. S. Blow, Jour. Nucl. Energy 26, 9, 1972
20. D. S. Mather, P. F. Bampton, R. E. Coles, G. James and P. J. Nind,
AWRE O 72/72, 1972
21. M. Hhring, H. Vonach and E. J. Feicht, Z. Physik, 244, 352 (1971)
22. A. Paulsen and R. Widera, Z. Physik, 238, 23 (1970)
23. V. A. Konshin and M. N. Nikolaev, INDC(CCP)-26/U, 1972
24. E. F. Plechaty and R. J. Howerton, UCID-16372 (1973)