BNL-NCS-17541
[ENDF-201]
4th EDITION [ENDF/B-VI] SUPPLEMENT I

ENDF-201

ENDF/B-VI SUMMARY DOCUMENTATION SUPPLEMENT I

ENDF/HE-VI SUMMARY DOCUMENTATION

Victoria McLane

and Members of the

Cross Section Evaluation Working Group

December 1996

NATIONAL NUCLEAR DATA CENTER
BROOKHAVEN NATIONAL LABORATORY
UPTON, NEW YORK 11973-5000

DISCLAIMER

Table of Contents

INTRODUCTION

The National Nuclear Data Center (NNDC) provides coordination for and serves as the secretariat to the Cross Section Evaluation Working Group (CSWEG). CSEWG is responsible for the oversight of the ENDF/B Evaluated Nuclear Data File. All data are checked and reviewed by CSEWG, and the file is maintained at the NNDC. For a description of the ENDF/B-VI file, see the ENDF-102 Data Formats and Procedures for the Evaluated Nuclear Data File ENDF-6 [1]

The purpose of this addendum to the ENDF/B-VI Summary Documentation[2] is to provide documentation of Releases 1, 2, 3, and 4 for the ENDF/B-VI and ENDF/HE-VI evaluated nuclear data libraries. These releases contain many new and revised evaluations for the neutron, photo-atomic interaction, radioactive decay data, spontaneous fission product yield, neutron-induced fission product yield, thermal neutron scattering, proton, deuteron, and triton sublibraries.

The summaries have been extracted mainly from the ENDF/B-VI File 1 comments (MT=451), which have been checked, edited, and may also include supplementary information. Some summaries have been provided by the evaluators in electronic format, while others are extracted from reports on the evaluations. All references have been checked[3] and corrected, or updated where appropriate.

A list of the laboratories which have contributed evaluations used in ENDF/B-VI is given on the following page.

Appendix A contains a history of all materials issued in ENDF/B-VI. Appendix B contains a listing of the present content of the ENDF/B-VI library.

Release 1	distributed in September, 1991
Release 2	distributed in June, 1993
Release 3	distributed in May, 1995
Release 4	distributed December, 1996

---

[1] CSEWG, *ENDF-102 Formats and Procedures for the Evaluated Nuclear Data File ENDF-6*, **BNL-NCS-44945** (1995), edited by V. McLane, C. L. Dunford, and P. F. Rose, National Nuclear Data Center, Brookhaven National Laboratory.

[2] *ENDF-201, ENDF/B-VI Summary Documentation*, **BNL-NCS-17541** (1991), Edited by P. F. Rose, National Nuclear Data Center, Brookhaven National Laboratory.

[3] If possible, *e.g.*, private communications could not be checked and some references were not available.

List of Laboratories

Following is the list of laboratories who have contributed to the evaluations cited in this document.

AI ..... Atomics International (now Rockwell Int., Energy Systems) Canoga Park, CA
ANC ..... Aerojet Nuclear Corp. (see INEL)
ANL ..... Argonne National Laboratory, Argonne, IL
AWRE ..... Atomic Weapons Research Laboratory, Aldermaston, U.K.
BAPL ..... Bettis Atomic Power Laboratory, Pittsburg, PA
BAW ..... Babcock and Wilcox, Lynchburg, VA
BNL ..... Brookhaven National Laboratory, Upton, NY
BNW .... Batelle Northwest (now Pacific Northwest National Laboratories) Richland, WA
BRC ..... Centre d'Etudes Nucleaires, Bruyere-le-Chatel, FRANCE
CNDC ..... Chinese Nuclear Data Center, Institute of Atomic Energy, Beijing, CHINA
GA ..... General Atomic (see GGA)
GGA ..... Gulf General Atomic, San Diego, CA
HEDL ..... Hanford Engineering Development Laboratory, Richland, WA
INEL ..... Idaho Nuclear Engineering Laboratory, Idaho Falls, ID
JAERI ..... Japan Atomic Energy Research Institute, Tokai, JAPAN
JNDC ..... Japanese Nuclear Data Committee, JAPAN
KAPL ..... Knolls Atomic Power Laboratory, Schenectady, NY
LANL ..... Los Alamos National Laboratory, Los Alamos, NM
LLNL ..... Lawrence Livermore National Laboratory, Livermore, CA
MAPI ..... Mitsubishi Atomic Power Industries, Minato, JAPAN
ORNL ..... Oak Ridge National Laboratory, Oak Ridge, TN
PTB ..... Physikalisch-Technische Bundesanstalt, Braunschweig, GERMANY
RCN ..... Energy Research Foundation, Petten, THE NETHERLANDS
SAI ..... Scientific Applications Inc., La Jolla, CA
SRL ..... Savannah River Laboratory, Aiken, GA
UI ..... University of Illinois, Urbana-Champaign, IL

Part I

Incident Neutron Sublibrary (NSUB=10)

The documentation is organized by material. Each page contains a header giving the material and release number(s).

Evaluation: **^{1}H Incident Neutron Library, Release 1 (MAT 125)**
Energy Range: 10^{-5} eV to 100 MeV
Files (MF): 1, 2, 3, 4, 12, 14
Evaluators: G. M. Hale, D. C. Dodder, E. R. Siciliano, W. B. Wilson (LANL)

ENDF/B-VI MOD 2 REVISION 1 (G. Hale, LANL, July 1991)

The following comments on the standards covariances were added.

STANDARDS COVARIANCES

Phase 1 reviewers of the ENDF/B-VI standards cross sections have expressed the concern that the uncertainties resulting from the combination of R-matrix and simultaneous evaluations might have led to uncertainties that are too small. As a result, the Standards Subcommittee produced (at the May, 1990, CSEWG meeting) a set of expanded covariance estimates for the standard cross section reactions. These uncertainties are estimates such that if a modern day experiment were performed on a given standard cross section using the best techniques, approximately 2/3 of the results should fall within these expanded uncertainties. The expanded uncertainties for the n+^{1}H total cross section are, for the energy range 0.01 eV to 20 MeV, 0.2%.

ENDF/B-VI MOD 1 NEW EVALUATION (G. Hale, D. Dodder, E. Siciliano, W. Wilson, LANL, October 1989)

See ENDF-201 Summary Documentation, 4th Edition (1991), page 7, for documentation of the ENDF/B-VI MOD 1 evaluation.

Evaluation: **^{2}H Incident Neutron Library, Release 3, 4 (MAT 128)**
Files (MF): 1, 2, 3, 4, 6, 8, 9, 12, 14
Energy Range: 10^{-5} eV to 100 MeV
Evaluators: P. G. Young, L. Stewart,, A. Horsley(LANL)

ENDF/B-VI MOD 3, REVISION 2 (P.G. Young, LANL, November 1996)
A missing subsection was added to File 6, MT=16.

ENDF/B-VI MOD 2, REVISION 1 (P.G. Young, LANL, August 1994)
This evaluation is a revision of the ENDF/B-V evaluation by Stewart and Horsley [1]. The evaluation was extended to 100 MeV based on experimental total, elastic, and (n,2n) cross section measurements and elastic scattering angular distribution measurements. Additionally, the total cross section and the elastic cross section were revised between 3 and 8 MeV on the basis of newer data, and similarly the (n,2n) cross section was revised above 10 MeV.

REFERENCE
1. L. Stewart, A. Horsley, **LA-3271** (1968) Los Alamos National Laboratory

ENDF/B-VI MOD 0 (R. MacFarlane, LANL, December 1989)
ENDF/B-V MAT 1302 was converted to ENDF-6 format. For documentation of the ENDF/B-V evaluation, see ENDF-201 Summary Documentation, 4th Edition (1991), page 13.

Evaluation: **^{3}He Incident Neutron Library, Release 1 (MAT 225)**
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4
Evaluators: G. Hale, D. Dodder, P. Young (LANL)

ENDF/B-VI MOD 2 REVISION 1 (G. Hale, LANL, July 1991)

The following comments on the standards covariances were added.

STANDARDS COVARIANCES

Phase 1 reviewers of the ENDF/B-VI standards cross sections have expressed the concern that the uncertainties resulting from the combination of R-matrix and simultaneous evaluations might have led to uncertainties that are too small. As a result, the Standards Subcommittee produced (at the May, 1990, CSEWG meeting) a set of expanded covariance estimates for the standard cross section reactions. These uncertainties are estimates such that if a modern day experiment were performed on a given standard cross section using the best techniques, approximately 2/3 of the results should fall within these expanded uncertainties. The expanded uncertainties for the ^{3}He(n,p) cross section are as follows:

Energy Range (keV)	Estimated Uncertainty %
10^{-08} - 0.1	0.3
0.1 - 1.0	0.7
1.0 - 10.	2.0
10. - 50.	5.0

ENDF/B-VI MOD 1 NEW EVALUATION (G. Hale, D. Dodder, P. Young, LANL, May 1990)

See ENDF-201 Summary Documentation, 4th Edition (1991), page 15, for documentation of the ENDF/B-VI evaluation.

Evaluation: **^{6}Li Incident Neutron Library, Release 1 (MAT 325)**
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 14
Evaluators: G. Hale, P. Young
Laboratory: LANL

ENDF/B-VI MOD 2 REVISION 1 (G. Hale, LANL, July 1991)

The following changes were made:

1. The comments, below, on the standards covariances were added.
2. File 3, MT=53: LF flag and Q-value corrected.

STANDARDS COVARIANCES

Phase 1 reviewers of the ENDF/B-VI standards cross sections have expressed the concern that the uncertainties resulting from the combination of R-matrix and simultaneous evaluations might have led to uncertainties that are too small. As a result, the Standards Subcommittee produced (at the May, 1990, CSEWG meeting) a set of expanded covariance estimates for the standard cross section reactions. These uncertainties are estimates such that if a modern day experiment were performed on a given standard cross section using the best techniques, approximately 2/3 of the results should fall within these expanded uncertainties. The expanded uncertainties for the ^{6}Li(n,t) cross section are given in the following table and are compared to values from the combined output of the standards covariance analysis:

Energy Range (keV)	Estimated Uncertainty %	Combined Analysis %
0.1 - 1.0	0.5	
1.0 - 10.	0.7	0.14
10. - 50.	0.9	
50. - 90.	1.1	0.25
90. - 150.	1.5	
150. - 450.	2.0	0.29
450. - 650.	5.0	
650. - 800.	2.0	0.36
800. - 1000.	5.0	

ENDF/B-VI MOD 1 NEW EVALUATION (G. Hale, P. Young, LANL, April 1989)

See ENDF-201 Summary Documentation, 4th Edition (1991), page 18, for documentation of the ENDF/B-VI evaluation.

Evaluation: **^{10}B Incident Neutron Library, Release 1 (MAT 525)**
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 12, 13, 14
Evaluators: G. Hale, P. Young (LANL)

ENDF/B-VI MOD 2 REVISION 1 (G. Hale, LANL, July 1991)

The following changes were made:

1. The comments below on the standards covariances were added.
2. File 3, MT=55,57,62,64,65,68,70,71,73,74,76-81,83,84: LF flag and Q-value corrected.

STANDARDS COVARIANCES

Phase 1 reviewers of the ENDF/B-VI standards cross sections have expressed the concern that the uncertainties resulting from the combination of R-matrix and simultaneous evaluations might have led to uncertainties that are too small. As a result, the Standards Subcommittee produced (at the May, 1990, CSEWG meeting) a set of expanded covariance estimates for the standard cross section reactions. These uncertainties are estimates such that if a modern day experiment were performed on a given standard cross section using the best techniques, approximately 2/3 of the results should fall within these expanded uncertainties. The expanded uncertainties for the $^{10}B(n,\alpha_0)$ and $^{10}B(n,\alpha_1)$ cross sections are given in the following tables and are compared to values from the combined output of the standards covariance analysis:

Energy Range (keV)	Estimated Uncertainty %	Combined Analysis %
$^{10}B(n,\alpha_0)$ Cross Section		
10^{-08} - 0.1	0.5	0.21
0.1 - 5.0	1.5	
5.0 - 30	3.0	0.38
30 - 90	5.0	
90 - 150	10.0	0.86
150 - 200	12.0	
200 - 250	15.0	0.79
$^{10}B(n,\alpha_1)$ Cross Section		
10^{-08} - 0.1	0.2	0.16
0.1 - 5.0	0.4	
5.0 - 30	0.6	0.20
30 - 90	1.0	
90 - 150	1.5	0.48
150 - 200	2.0	
200 - 250	2.5	0.62

ENDF/B-VI MOD 1 NEW EVALUATION (G. Hale, P. Young, LANL, November 1989)

See ENDF-201 Summary Documentation, 4th Edition (1991), page 48, for documentation of the ENDF/B-VI evaluation.

Evaluation: **^{nat}C Incident Neutron Library, Release 1 (MAT 600)**
Energy Range: 10^{-5} eV to 32 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 14, 33
Evaluators: C. Y. Fu, E. J. Axton, F. G. Perey (ORNL)

ENDF/B-VI MOD 2 REVISION 1 (C. Y. Fu, ORNL, July 1991)

The following changes were made for Revision 1 of ENDF/B-VI:

1. The comments below on the standards covariances were added.
2. References were updated, see below.

STANDARDS COVARIANCES

Following concerns expressed at the Standards Subcommittee meeting, May, 1990, about the seemingly small standards uncertainties, the Standards Subcommittee has provided expanded uncertainties. These uncertainties are estimates such that if a modern day experiment were performed today on a given standard using the best techniques, those results would fall within these expanded uncertainties (2/3 of the time). They take into account data inconsistencies and concerns about R-matrix parameters. Note that it is not assumed that the uncertainties are totally correlated within the energy ranges given. It is recommended that these expanded uncertainties be put in File 1 and in the documentation for the standards.

C(n,n) total elastic scattering cross section

Energy (keV)	Uncertainty (%)
1 - 500	0.46
500 - 1500	0.53
1500 - 1800	0.60

REFERENCES

Ax88 E. J. Axton, An Evaluation of Kerma in Carbon and the Carbon Cross Sections, NBS, to be published (1988)

Fu90 C. Y. Fu, ***Nucl. Sci. Eng.*** **106**, 494 (1990)

ENDF/B-VI MOD 1 NEW EVALUATION (C. Y. Fu, E. Axton, F. Perey, ORNL, August 1989)

See ENDF-201 Summary Documentation, 4th Edition (1991), page 78, for documentation of the ENDF/B-VI evaluation.

Evaluation: **^{14}N Incident Neutron Library, Release 2, 3 (MAT 725)**
Energy Range: 10^{-5} eV to 40 MeV
Files: 1, 2, 3, 4, 6, 12, 13, 14, 15
Evaluators: P. G. Young, G. Hale, M. Chadwick (LANL)

ENDF/B-VI MOD 3 REVISION 2 (P. Young, LANL, August 1994)

The elastic and inelastic cross sections (MT=63-90) at incident neutron energies above 13.5 MeV given in Revision 2 of ENDF/B-VI were corrected. This correction was made to improve agreement with elastic scattering measurements up to 25 MeV. The elastic neutron angular distributions above 20 MeV were also improved over the earlier data distributed in Release 2, based upon fits to experimental data.

ENDF/B-VI MOD 2 REVISION 1 (P. G. Young, LANL, September 1992)

The modified version of the ENDF/B-VI evaluation created for the Defense Nuclear Agency is extended in energy to 40 MeV. This extension was accomplished using experimental data and the September 1992 version of the GNASH code [1], which was updated for higher energy calculations. More details will be given in a later progress report.

The ENDF/B-VI evaluation was modified for DNA use to include results from Hale's R-Matrix analysis that include Harvey's new total cross section measurement [2]. These results are interim until the new ORNL scattering data can be incorporated. The ORNL preliminary scattering results confirm the parity of the first resonance as being positive, as used in the R-Matrix analysis.

REFERENCES

1. P. G. Young, E. D. Arthur, and M. B. Chadwick, **LA-12343-MS** (1992) Los Alamos National Laboratory
2. J. A. Harvey, et al., **Nuclear Data for Science and Technology**, Proceedings Conference, Jülich, 1991 (Springer-Verlag, 1992) p. 729

ENDF/B-VI MOD 1 NEW EVALUATION (P. Young, G. Hale, M. Chadwick, LANL, May 1990)

See ENDF-201 Summary Documentation, 4th Edition (1991), page 82, for documentation of the ENDF/B-VI evaluation.

Evaluation: **^{23}Na Incident Neutron Library, Release 1 (MAT 1125)**
Energy Range: 10^{-5} eV to 40 MeV
Files: 1, 2, 3, 4, 5, 8, 9, 12, 13, 14, 15, 32, 33
Evaluators: D. C. Larson (ORNL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, July 1991)

The number of energy ranges in File 32, MT = 151 was corrected to be 1.

ENDF/B-VI MOD 0 (NNDC, January 1990)

ENDF/B-V MAT 1125 was converted to ENDF-6 format by NNDC.

ENDF/B-V NEW EVALUATION (D. C. Larson, ORNL, December 1977)

RESONANCE PARAMETERS (File 2)

Resonance region is 600 eV to 500 keV. The thermal neutron capture cross section is in agreement with the experimental results of 526.9±4.5 mb [Ry71], as well as earlier results summarized in [Ry71]. Using resonance parameters Γ_n=376 eV and Γ_γ=0.353 eV for the large 2.81 keV resonance gives the correct thermal capture value using a Breit-Wigner shape, and this form is used to calculate the capture cross section from 1.0×10^{-5} to 600 eV. The capture width Γ_γ=0.353 eV is consistent with a recent result by Wilson, et al. [Wi77] where they find $0.24<\Gamma_\gamma<0.4$ eV with a 90% confidence level, and with a recent preliminary result of Macklin [Ma76] where he found Γ^γ=0.385±0.04 eV. The Γ_n and E_{res} values are taken from Seltzer and Firk [Se74]. From 600 eV to 500 keV, the capture cross section is generated from resonance areas reported by Musgrove, et al. [Mu77], and neutron widths and spins obtained from a multilevel analysis of the transmission data of Larson and Hill [La76].

Thermal neutron capture cross section = 528 mb.

SMOOTH CROSS SECTION (File 3)

Elastic cross section calculated as total - nonelastic.

Nonelastic calculated as sum (n,n′) + (n,2n) + (n,γ) + (n,p) + (n,α).

Inelastic calculated as the sum of the inelastic to discrete levels (MT=51-68), plus the continuum (MT=91).

Capture cross section, as discussed above, the shape from 10^{-5} eV to 600 eV was taken from a single-level Breit-Wigner form; from 600 eV to 500 keV, File 3 gives no contribution. From 500 keV to 20 MeV, the capture file is the same as the ENDF/B-IV file by Pitterle & Paik [Pi72].

(n,p) taken from ENDF/B-IV modified above 8 MeV based on 2 step Hauser-Feshbach calculations.

(n,α) taken from ENDF/B-IV.

ANGULAR DISTRIBUTIONS (File 4)

Elastic taken mainly from [Ki76], ENDF-IV and Optical Model calculations.
All other angular distributions are assumed isotropic.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (file 5)

(n,2n) taken from ENDF-IV.

For the continuum (MT=91), temperatures were adjusted to fit neutron production data of Hermsdorf [He75].

RADIOACTIVITY (File 8)

Data from ENDF/B-V (Reich), and Endt and VanderLeun.

PHOTON PRODUCTION (Files 12, 13, 14, 15)

MF=12 Capture data taken from ENDF-IV.
MF=13 Nonelastic: (n,xγ) data taken from Larson and Morgan [La77].
MF=14 All angular distributions are assumed isotropic.
MF=15 Nonelastic: (n,xγ) data are taken from Larson and Morgan.

COVARIANCES (Files 32, 33)

MF=32 Uncertainty files for the resonance parameters below 32 keV are estimated from the literature for the 2.81 keV resonance, and an area analysis for the 7.6 keV resonance. Results from the multilevel analysis, capture areas, and area analysis form the basis for the remainder of the resonance parameter uncertainties. The uncertainties in the resonance parameters are most useful in self-shielding work.

MF=33 Uncertainty files for the capture cross section are estimated from the literature, and the spread of the various data sets.

REFERENCES

He75 H. Hermsdorf, et al., **ZFK-277** (1975) Zentralinst. Kernforschung, Rossendorf bei Dresden, Germany

Ki76 W. E. Kinney and F. G. Perey, private communication

La76 D. C. Larson, J. A. Harvey, and J. W. Hill, **ORNL-TM-5614** (1976) Oak Ridge National Laboratory

La77 D. C. Larson and G. L. Morgan, to be published

Ma76 R. L. Macklin, private communication (1976)

Mu77 A. R. del Musgrove, B. J. Allen, R. L. Macklin, **Neutron Physics and Nuclear Data**, Int. Conference, Harwell, 25-29 Sept. 1978 (O. E. C. D., 1978) p. 426

Pi72 T. A. Pitterle and N. C.Paik, **WARD 3045T4B-2**, Appendix A (1972) Westinghouse Advanced Reactor Division

Ry71 T. B. Ryves, **Chemical Data, Measurements & Applications**, Conference, Canterbury, 1991 (Inst. of Civil Engineers, U. K., 1991) p. 139

Se74 J. Seltzer and F. W. K. Firk, ***Nucl. Sci. Eng.* 53**, 415 (1974)

Wi77 W. M. Wilson, H. E. Jackson, and G. E. Thomas, ***Nucl. Sci. Eng.* 63**, 55 (1977)

Evaluation: **^{27}Al Incident Neutron Library, Release 3, 4 (MAT 1325)**
Energy Range: 10^{-5} eV to 40 MeV
Files: 1, 2, 3, 4, 6, 8, 9, 12, 14, 15
Evaluators: P. G. Young (LANL)

ENDF/B-VI MOD 2 REVISION 1 (P. G. Young (LANL), V. McLane (NNDC) August 1996)

File 1: The thermal cross section were added to MT=451.

File 3: The interpolation code on the first 3 points of MT=1 and the first 10 points on MT=102 was changed to 5.

ENDF/B-VI MOD 1 NEW EVALUATION (P. G. Young, LANL)

GENERAL COMMENTS

This evaluation is based on a theoretical analysis that utilizes Hauser-Feshbach statistical theory, with corrections for preequilibrium and stripping processes. Spherical optical model calculations are used to obtain particle transmission coefficients for the Hauser-Feshbach calculations, as well as for the elastic neutron angular distributions. Some data from ENDF/B-VI (MOD=0), are retained, in particular, the neutron total cross section below 20 MeV and the radiative capture cross section and photon multiplicities below about 100 keV.

Cross sections and spectra for individual reactions are included for reactions that exceed a cross section of approximately 1 mb at any energy. Multiplicities and emission energy spectra are given for gamma rays, particles, and recoil nuclei emitted in each reaction. Energy-angle-correlated spectra are given for all outgoing particles.

2200 m/sec Cross Sections
Total = 1.58 barns
Elastic = 1.348 barns
Capture = 0.232 barns

Capture resonance integral = 0.13377 barns

HAUSER-FESHBACH STATISTICAL THEORY CALCULATIONS

The GNASH code [Yo92] was used for all Hauser-Feshbach statistical theory calculations. Preequilibrium corrections were performed in the course of the GNASH calculations using the exciton model of Kalbach [Ka77,Ka85]. Discrete level data from nuclear data sheets were matched to continuum level densities using the formulation of Ignatyuk [Ig75] and pairing and shell parameters from the Cook [Co67] analysis. Neutron and charged-particle transmission coefficients were obtained from the optical potentials, as discussed below. Gamma-ray transmission coefficients were calculated using the Kopecky-Uhl model [Ko90]. Calculations were performed for all significant reactions producing neutrons, protons, deuterons, tritons, α particles, and γ rays for incident neutrons between 10^{-11} and 40 MeV. At the highest energies, approximately 30 compound nuclei had to be included, leading to ~180 reaction paths. The angular distribution systematics by Kalbach [Ka88] were used to describe the angular distributions for all continuum particles.

OPTICAL MODEL POTENTIALS

For incident and exiting neutrons, the phenomenological optical potential by Petler, et al. [Pe85], based on a microscopic optical model analysis of experimental data, was utilized at all energies. A modified version of Perey's potential [Pe63] was used to calculate transmission coefficients for protons below 44 MeV, switching to the Madland potential [Ma88] at higher energies. The potential by Perey and Perey [Pe63] was utilized to calculate deuteron transmission coefficients for deuterons at all energies. Similarly, a triton potential by Becchetti and Greenlees [Be71] and an alpha potential determined by Arthur and Young [Ar80] for n + ^{56}Fe reactions were used at all energies for those particles.

DIRECT REACTIONS

Energy-dependent cross sections of inelastic neutrons from ^{27}Al(n,n′) direct reactions were calculated using the DWUCK code [Ku70], normalized to values of the angle-integrated cross sections in ENDF/B-VI at 14 MeV.

ENDF/B-V CARRYOVERS

The following reactions/data were carried over unchanged from ENDF/B-V:

MF=2, MT=151: Resonance Parameters: effective scattering radius = 0.32752×10^{-12} cm. (Resonance parameters not given.)

CALCULATIONAL RESULTS

The MF=3 cross sections and MF=6 energy/angle distributions based completely on calculations are:

MT = 11, (n,2nd)
MT = 16, (n,2n)
MT = 17, (n,3n)
MT = 22, (n,nα)
MT = 24, (n,2nα)
MT = 28, (n,np)
MT = 29, (n,n2α)
MT = 32, (n,nd)
MT = 33, (n,nt)
MT = 41, (n,2np)
MT = 42, (n,3np)
MT = 44, (n,n2p)
MT = 45, (n,npα)
MT = 64-89, (n,n′) Discrete Levels
MT = 91, (n,n′) Continuum
MT = 103, (n,p) (MF=6 only)
MT = 104, (n,d)
MT = 105, (n,t)
MT = 107, (n,α) (MF=6 only)
MT = 108, (n,2α)
MT = 111, (n,2p)
MT = 112, (n,pα)
MT = 115, (n,pd)
MT = 116, (n,pt)
MT = 117, (n,dα)
MT = 649, (n,p) Continuum
MT = 650-669, (n,d) Discrete Levels
MT = 699, (n,d) Continuum
MT = 700-710, (n,t) Discrete Levels
MT = 749, (n,t) Continuum
MT = 849, (n,α) Continuum

Kalbach systematics [Ka88] are used to specify all continuum particle angular distributions. All continuum photon angular distributions are assumed isotropic.

Additionally, the radioactive nuclei formation data in MF = 8 and 9 were obtained directly from the GNASH calculations.

OTHER REACTIONS

The following reactions are based on combinations of experimental data and theoretical calculations or other techniques:

SMOOTH CROSS SECTIONS (File 3)

Total Cross Section: Below 20 MeV, carried over from ENDF/B-V. At higher energies based on data of Perey [Pe72] and optical model calculation.

Elastic Cross Section: Obtained by subtracting sum of nonelastic cross sections from the total. Mainly results from the optical model calculations above 14 MeV. At lower energies the nonelastic cross sections are a combination of experimental data (ENDF/B-V evaluations) and the theoretical calculations.

Inelastic Cross Section: Summation of MT=51-91.

Inelastic Cross Section to Discrete States: Combination of experimental data below 14 MeV, (especially the (n,n′) data of Kinney and Perey [Ki70], the (n,xγ) data of Orphan and Hoot [Or71] and Dickens, et al. [Di71,Di73]), and calculated excitation functions, with a rough match to the ENDF/B-V evaluation near 14 MeV.

(n,γ) Cross Section: Below 1 keV, ENDF/B-V was adopted. At higher energies, calculations from GNASH code used, including a semidirect model.

(n,p) and (n,α) Cross Section: Taken directly from the International Reactor Dosimetry File IRDF-90 of the IAEA, obtained by Wagner, et al. (IRK) [Wa90]. At higher energies, calculated excitation function were used, normalized to the IRK data at 20 MeV.

ANGULAR DISTRIBUTIONS (File 4)

Elastic Angular Distributions: ENDF/B-V adopted below 6 MeV. At higher energy optical model calculations used (see above). Tabulated distributions given in the center-of-mass system.

ENERGY-ANGLE DISTRIBUTIONS (File 6)

Inelastic Level Neutron & Photon Distributions: For MT=51-62, neutron angular distributions are combination of experimental data and calculated shapes below 14 MeV and are represented by Legendre expansions in the center-of-mass system. At higher energies, calculated shapes are used. For MT=63-89, calculated angular distributions are used at all energies. Photon multiplicities based on experimental branching ratios and GNASH calculations. Photon angular distributions assumed isotropic.

PHOTON PRODUCTION (Files 12, 15)

Radiative Capture Photon Multiplicities: Below 1 keV, ENDF/B-V adopted. At higher energies, based on GNASH calculations.

Radiative Capture Photon Energy Distributions: Below 1 keV, ENDF/B-V adopted. At higher energies, based on GNASH calculations.

REFERENCES

Ar80 E. D. Arthur and P. G. Young, **BNL-NCS-51245**, Vol. II, p. 731 (1980) Brookhaven National Laboratory

Be92 O. Bersillon, **Computation and Analysis of Nuclear Data Relevant to Nuclear Energy and Safety**, ICTP Workshop, 10 February-13 March, 1992, Trieste, Italy, to be published, World Scientific Press

Be71 F. D. Becchetti, Jr., and G. W. Greenlees, **Polarization Phenomena in Nuclear Reactions**, Proc. Symposium, Madison, WI, 1971 (The University of Wisconsin Press, 1971) p.682

Co67 J. L. Cook, H. Ferguson, and A. R. del Musgrove, ***Aust.J.Phys.* 20**, 477 (1967)

Di71 J. K. Dickens **ORNL-TM-3284** (1971) Oak Ridge National Laboratory

Di73 J. K. Dickens, T. A. Love, and G. L. Morgan, **ORNL-TM-4232** (1973) Oak Ridge National Laboratory

Ig75 A. V. Ignatyuk, G. N. Smirenkin, and A. S. Tishin, ***Sov. J. Nucl. Phys.* 21**, 255 (1975); translated from ***Yad. Fiz.* 21**,485 (1975).

Ka77 C. Kalbach, ***Z. Phys. A* 283**, 401 (1977)

Ka85 C. Kalbach, **LA-10248-MS** (1985) Los Alamos National Laboratory

Ka88 C. Kalbach, ***Phys.Rev.C* 37**, 2350 (1988); see also, C. Kalbach and F. M. Mann, ***Phys.Rev.C* 23**, 112 (1981)

Ki70 W. E. Kinney and F. G. Perey, **ORNL-4516** (1970) Oak Ridge National Laboratory

Ko90 J. Kopecky and M. Uhl, ***Phys.Rev.C* 41**, 1941 (1990)

Ku70 P. D. Kunz, *DWUCK - A Distorted Wave Born Approximation Program*, (1970) unpublished

Ma88 D. G. Madland, **IAEA-TECDOC-483**, page 80 (1988) International Atomic Energy Agency

Or71 V. J. Orphan and C. G. Hoot, **GULF-RT-A10743** (1971) Gulf General Atomic

Pe63a F. G. Perey, ***Phys. Rev.* 131**, 745 (1963)

Pe63b C. M. Perey and F. G. Perey, ***Phys. Rev.* 132**, 755 (1963)

Pe72 F. G. Perey, T. A. Love, and W. E. Kinney, **ORNL-4823** (1972) Oak Ridge National Laboratory

Pe85 J. S. Petler, et al., ***Phys. Rev. C* 32**, 673 (1985)

Wa90 M. Wagner, H. Vonach, A. Pavlik, B. Strohmaier, S. Tagesen, and J. Martinez-Rico, ***Physics Data* 13-5** (1990) Fachinformationszentrum Karlsruhe

Yo92 P. G. Young, E. D. Arthur, and M. B. Chadwick, **LA-12343-MS** (1992) Los Alamos National Laboratory

Evaluation: **^{45}Sc Incident Neutron Sublibrary, Release 2 (MAT 2125)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: A. B. Smith (ANL), R. J. Howerton (LLNL)

ENDF/B-VI MOD 1 NEW EVALUATION (A. B. Smith (ANL), R. J. Howerton (LLNL), July 1992)

This evaluation provides a reasonable basic scandium evaluated data file; no equivalent file was previously available. The available experimental data is far from definitive, thus, considerable reliance had to be placed on calculational extrapolation. See Smith, et al. [1] for detailed information.

RESONANCE PARAMETERS (File 2)

Resonance parameters taken from Mughabghab, et al. [2]; no adjustments were made to these parameters.

SMOOTH CROSS SECTIONS (File 3)

The total and elastic scattering cross section evaluation relies primarily upon the model calculations of Smith and Guenther [3], slightly adjusted to improve agreement with the measured values of Barnard, et al. [4].

The capture cross section evaluation uses the results calculated using ABAREX [5], slightly adjusted at ≈ 100 keV to match the resonance region.

(n,p) cross sections modified as per P. Young and D. Muir (LANL). Thermal value may be large.

REFERENCES

1. A. B. Smith, J. W. Meadows, and R. J. Howerton, **ANL/NDM-126** (1992) Argonne National Laboratory
2. S. F. Mughabghab, M. Divadeenam, and N. E. Holdon, **Neutron Cross Sections, Vol. 1, Neutron Resonance Parameters and Thermal Cross Sections**, Part A (Academic Press, 1981)
3. A. B. Smith and P. T. Guenther, **ANL/NDM-125** (1992) Argonne National Laboratory
4. E. Barnard, et al., ***Z. Phys.* 245**, 36 (1971)
5. P. A. Moldauer, computer Code ABAREX, private communication (1980); as modified by R. D. Lawson (1991)

Evaluation: **Chromium Isotopes Incident Neutron Sublibrary, Release 1**
MAT 2425 (^{50}Cr), 2431 (^{52}Cr), 2434 (^{53}Cr), 2437 (^{54}Cr)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, D. C. Larson, N. M. Larson, C. Y. Fu (ORNL)

ENDF/B-VI MOD 2 REVISION 1

The elastic transformation matrix was removed.

The secondary particle distributions for File 6, ^{50}Cr MT=51-56, ^{53}Cr MT=51-62, and ^{54}Cr MT=51-54, were corrected to center-of-mass coordinates (from laboratory coordinates).

ENDF/B-VI MOD 1 NEW EVALUATION

See ENDF-201 Summary Documentation, 4th Edition (1991), page 131, for documentation of the ENDF/B-VI evaluation.

Evaluation:	**Iron Isotopes Incident Neutron Sublibrary, Release 1**
	MAT 2625 (^{54}Fe), 2631 (^{56}Fe), 2634 (^{57}Fe), 2637 (^{58}Fe)
Energy Range:	10^{-5} eV to 20 MeV
Files:	1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators:	D. M. Hetrick, C. Y. Fu, N. M. Larson (ORNL)

ENDF/B-VI MOD 2 REVISION 1 (D. Hetrick, C. Fu, N. Larson, ORNL, July 1991)

The elastic transformation matrix was removed.

The secondary particle distributions for File 6, for ^{57}Fe MT=51-55 and ^{58}Fe MT=51-52, were corrected to center-of-mass coordinates (from laboratory coordinates).

ENDF/B-VI MOD1 NEW EVALUATION (D. Hetrick, C. Fu, N. Larson, ORNL, November 1989)

See ENDF-201 Summary Documentation, 4th Edition (1991), page 149, for documentation of the ENDF/B-VI evaluation.

Evaluation: **^{59}Co Incident Neutron Sublibrary, Release 2 (MAT 2725)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 13, 14, 15, 33
Evaluators: A. B. Smith, ET AL. (ANL), G. DeSaussure, et al. (ORNL), R. Howerton (LLNL), M.Sugimoto (JAERI)

ENDF/B-VI MOD 2 REVISION 1 (G. de Saussure, N. M. Larson, J. A. Harvey, N. W. Hill, ORNL, June 1992)

Resonance parameters reevaluated by analyzing six ORELA transmission measurements (described in [1]) using a Reich-Moore approximation and the resonance analysis code SAMMY. See reference [1] for complete documentation.

REFERENCES

1. G. deSaussure, N. M. Larson, J. A. Harvey, N. W. Hill, ***Ann. Nucl. Energy*** **19**, 393 (1992)

ENDF/B-VI MOD1 NEW EVALUATION (A.Smith, D.Smith, P. Guenther, J. Meadows, R. Lawson (ANL), R. Howerton (LLNL), M. Sugimoto (JAERI), July 1989)

See ENDF-201 Summary Documentation, 4th Edition (1991), page 174, for documentation of the ENDF/B-VI evaluation.

Evaluation:	**Nickel Isotopes Incident Neutron Sublibrary, Release 1** **MAT 2825 (^{58}Ni), 2831 (^{60}Ni), 2834 (^{61}Ni), 2837 (^{62}Ni), 2843 (^{64}Ni)**
Energy Range:	10^{-5} eV to 20 MeV
Files:	1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators:	D. C. Larson, C. M. Perey, D. M. Hetrick, C. Y. Fu (ORNL)

ENDF/B-VI MOD 2 REVISION 1 (D. C. Larson, C. M. Perey, D. M. Hetrick, C. Y. Fu, ORNL, July 1991)

^{58}Ni Capture widths corrected for 58.7 and 439.52 keV resonances. The elastic transformation matrix was removed.

^{60}Ni The resonance region from 10 eV to 450 keV has been changed, based on SAMMY analysis by F. G. Perey [1] of the ^{60}Ni ORELA data up to 100 keV of Harvey, et al. (described in [1]). This work reproduces the thermal cross sections and includes the small resonances inadvertently left out in the original file. No Background cross sections are required in File 3 in the resonance region. The elastic transformation matrix was removed.

REFERENCES

1. C. M. Perey, et al., **Nuclear Data for Science and Technology** Proceedings Conference, Jülich, 1991 (Springer-Verlag, 1992) p. 41

^{61}Ni The secondary particle distributions for File 6 MT=51-58 were corrected to center-of-mass, not laboratory coordinates. The elastic transformation matrix was removed.

^{62}Ni The secondary particle distributions for File 6 MT=51-54 were corrected to center-of-mass, not laboratory coordinates. The elastic transformation matrix was removed.

^{64}Ni The secondary particle distributions for File 6 MT=51-52 were corrected to center-of-mass, not laboratory coordinates. The elastic transformation matrix was removed.

ENDF/B-VI MOD 1 NEW EVALUATION (D. C. Larson, C. M. Perey, D. M. Hetrick, C. Y. Fu, ORNL, October 1989)

See ENDF-201 Summary Documentation, 4th Edition (1991), page 181, for documentation of the ENDF/B-VI evaluation.

Evaluation: **^{63,65}Cu Incident Neutron Sublibrary, Release 2**
MAT 2925 (^{63}Cu) , 2931 (^{65}Cu)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, C. Y. Fu, D. C. Larson (ORNL)

ENDF/B-VI MOD 3 REVISION 2 (D. M. Hetrick, C. Y. Fu, D. C. Larson, ORNL, July 1992)

^{63}Cu The following changes were made:
1) Corrections to MF=6, MT=65 at 17.0 MeV to prevent negative values in the angular distribution.
2) Corrections to MF=33, MT=102

^{65}Cu Corrections to MF=6, MT=63 at 17.5 MeV to prevent negative values in the angular distribution.

ENDF/B-VI MOD 1 NEW EVALUATION (D. M. Hetrick, C. Y. Fu, D. C. Larson, ORNL, November 1989)

This work employed several nuclear model codes including the Optical-Model code GENOA [1], the Distorted-Wave Born Approximation (DWBA) program DWUCK [2], and the Hauser-Feshbach code TNG [3,4]. The TNG code provides energy and angular distributions of particles emitted in the compound and pre-compound reactions, ensures consistency among all reactions, and maintains energy balance.

See ENDF-201 Summary Documentation, 4th Edition (1991), page 198, and Hetrick, et al. [5] for complete documentation of the ENDF/B-VI evaluation.

REFERENCES

1. F. G. Perey, *Computer Code GENOA*, unpublished (1967) Oak Ridge National Laboratory
2. P.D. Kunz, *Distorted Wave Code DWUCK72*, unpublished (1972) Univ. of Colorado
3. C. Y. Fu, **ORNL/TM-7042** (1980) Oak Ridge National Laboratory
   C. Y. Fu, **BNL-NCS-51425**, Vol. II, p. 675 (1980) Brookhaven National Laboratory
4. K. Shibata and C. Y. Fu, **ORNL/TM-10093** (1986) Oak Ridge National Laboratory
5. D. M. Hetrick, C. Y. Fu, and D. C. Larson, **ORNL/TM-9083 [ENDF-337]** (1984) Oak Ridge National Laboratory

Evaluation: **^{73}Ge Incident Neutron Sublibrary, Release 2 (MAT 3234)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. E. Schenter and F. Schmittroth (HEDL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, February 1993)
Q-value for MT=53 corrected from 98.6 keV to 68.75 keV.

ENDF/B-VI MOD 0 (NNDC, February 1993)
ENDF/B-V MAT 9051 translated to ENDF/B-VI format.

ENDF/B-V NEW EVALUATION (R. E. Schenter, F. Schmittroth, HEDL, April 1974)
Evaluated for ENDF/B-IV, MAT 49. Translated to ENDF/B-V format by NNDC, July, 1980.

RESONANCE PARAMETERS (File 2)
Resonance parameters taken from Mughabghab, et al. [3].

2200 m/sec capture cross section (barns)

(from resonance parameters)	= 6.066
(from 1/v component)	= 8.934
Total	= 15.000

Computed capture resonance integral= 69.915

SMOOTH CROSS SECTIONS (File 3)
Total cross sections, above the resonance region, calculated using Moldauer Potential [4], elastic cross section from $\sigma_{total} - \sigma_{n,\gamma} - \sigma_{inl}$.
Inelastic cross sections calculated using COMNUC-3 [5].
Neutron capture evaluated using methods (NCAP code) in Refs.[1,2] for energies above the resonance region. A 1/v component was added in the resonance region to give the 2200 m/sec cross section of Mughabghab [3].

ANGULAR DISTRIBUTIONS (File 4)
The elastic angular distribution were assumed to be isotropic.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)
For MT= 91 the evaporation spectrum (LF=9) parameters obtained using NCAP code [2].

REFERENCES

1. F. Schmittroth and R. E. Schenter, **HEDL TME 73-63** (1973) Hanford Engineering and Development Laboratory
2. F. Schmittroth, **HEDL TME 73-79** (973) Hanford Engineering and Development Laboratory
3. S. F. Mughabghab and D. I. Garber, **BNL 325** ,3rd Ed., Vol.1 (1973) Brookhaven National Laboratory
4. P. A. Moldauer, ***Nucl. Phys.* 47** , 65 (1963)
5. C. L. Dunford, **AI-AEC-12931** (1970) Atomics International, and private communication

Evaluation: **^{89}Y Incident Neutron Sublibrary, Release 4 (MAT 3925)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 13, 14, 15, 33
Evaluators: A. B. Smith, D. L. Smith, P. Rousset, R. D. Lawson (ANL), R. J. Howerton (LLNL)

ENDF/B-VI MOD 2 REVISION 1 (V. McLane, NNDC, October 1996)

Changes included:

File 1: Update of comments; thermal values added.

File 5, MT=91: Last energy range modified to fix problem of outgoing neutron having an energy greater than incoming neutron.

ENDF/B-VI MOD 0 (NNDC, January 1990)

Converted from ENDF/B-V MAT 9202 to ENDF-6 format. The ENDF/B-V evaluation is fully documented in reference [1]. .

2200n/sec cross sections (barns)

Total	= 8.992
Elastic	= 7.707
Capture	= 1.285

Capture resonance integral = 10.917

REFERENCE

1. A.B. Smith, D.L. Smith, P. Rousset, R.D. Lawson, and R. J. Howerton, **ANL/NDM-94** (1986) Argonne National Laboratory

Evaluation: **^{nat}Zr Incident Neutron Sublibrary, Release 1 (MAT 4000)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: M. Drake, D. Sargis, T. Maung (SAI); P. Rose (BNL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, August 1991)

An error in the parameter U for the continuum inelastic energy distribution (MF=5,MT=91) has been corrected.

ENDF/B-VI MOD 0 (NNDC, January 1990)

ENDF/B-V MAT 4000 converted to ENDF-6 format by NNDC.

ENDF/B-V EVALUATION

For complete summary of ENDF/B-V evaluation. See Summary Documentation, 3rd Edition, Supplement 1 (1985), and Drake, et al. [33].

RESONANCE REGION (Re-evaluated by P.F. Rose, BNL for revision 2)

Resolved resonance parameters were taken from the output of BNLNDF [34] which is based on the recommended values given Mughabghab, et al. [1]. The upper boundary of the resonance region = 90 keV.

2200 m/sec capture cross sections and resonance parameters

Material	MAT #	$\sigma_{n,\gamma}$ (barns)	I_{res} (barns)
^{90}Zr	1385	0.011	0.179
^{91}Zr	1386	1.188	4.913
^{92}Zr	1387	0.221	0.655
^{94}Zr	1388	0.049	0.311
^{96}Zr	1389	0.023	5.629
^{nat}Zr	1340	0.186	0.965

Unresolved parameters given for ^{91}Zr only.

SMOOTH CROSS SECTIONS (File 3)

The total cross section was smoothly joined to the resonance region cross sections for the individual isotopes. Between 90 keV and 500 keV, the data of Seth [3] were used. Between 500 keV and 2 MeV, the evaluated data were based on the measurements of Green and Mitchell [4], and Stooksberry and Anderson [5]. Above 2 MeV, the measurements of Green and Mitchell [4], Foster and Glasgow [6], Carlson and Barschall [7], and Peterson, et al. [8] were used.

The (n,2n) cross section was based on estimates for the separated isotopes. Except for ^{90}Zr, the results from a statistical model were used. The (n,2n) cross section for ^{90}Zr was based on measurements by Prestwood and Bayhurst [9], Nethaway [10], and several measurements near 14 MeV.

The (n,α) cross section was based on estimates for the separated isotopes. The energy dependent measurements by Bayhurst and Prestwood [11], statistical model calculations, and several measurements at 14 MeV were used.

The (n,p) cross section for ^{90}Zr was based on measurements by Carroll and Stooksberry [12] and Bayhurst and Prestwood [11]; for ^{91}Zr, on measurements by Carroll and Stooksberry [12], Reed [13], and Levkovskii [14]; for ^{92}Zr and ^{94}Zr, on measurements by Carroll and Stooksberry (12), Reed (13), Bramlitt and Fink [15], Lu, et al. [16] Levkovskii [14], Prasad and Sarkar [16], and Paul and Clarke [17].

For the (n,γ) cross section the data recommended by Benzi (18) were used.

For inelastic scattering, 19 level excitation cross sections and a continuum cross section have been given. The cross sections were based on a previous evaluation by KAPL and the experimental data of Tessler, et al [19], Day [20], McDaniel, et al. [21], Brandenberger and Glasgow, Smith and Whalen [22], Lind and Day [23], Tessler and Glickstein [24], Guenther, et al. [22], and Glazkov [25].

The elastic scattering cross section was taken, basically, as the difference between the total cross section and the non-elastic cross section. The experimental data used includes Engelbrecht and Smith [26], Hans and Snowdon [27], Kent, et al. [28], Walt and Beyster [29], Walt and Barschall [30], Gilboy and Towle [31], and Clark and Cross [32].

REFERENCES

1. S. F. Mughabghab, M. Divadeenam, and N. E. Holden, **Neutron Cross Sections, Volume I, Neutron Resonance Parameters and Thermal Cross Sections**, Part A (Academic Press, 1981)
2. H. W. Newson, et al., ***Annals Phys.* 8**, 211 (1959)
3. K. K. Seth, ***Phys. Letters* 16**, 306 (1965)
4. L. Green and J. A. Mitchell, **WAPD-TM-1073** (1973) Bettis Atomic Power Laboratory
5. R. W.Stooksberry and J. H. Anderson, ***Nucl. Sci. Eng.* 51**, 235 (1973)
6. D. C. Foster, Jr., and D. W. Glasgow, ***Phys. Rev. C* 3**, 576 (1971)
7. A. D. Carlson and H. H. Barschall, ***Phys. Rev.* 158**, 1142 (1967)
8. J. M. Peterson, A. Bratenahl, and J. P. Stoering, ***Phys. Rev.* 120**, 521 (1960)
9. R. J. Prestwood and B. P. Bayhurst, ***Phys. Rev.* 121**, 1438 (1961)
10. D. R. Nethaway, ***Nucl. Phys. A* 190**, 635 (1972)
11. B. P. Bayhurst and R. J. Prestwood, ***J. Inorg. Nucl. Chem.* 23**, 173 (1961)
12. E. E. Carroll and R. W. Stooksberry, ***Nucl. Sci. Eng.* 25**, 285 (1966)
13. C. H. Reed, **TID-11929** (1960) Thesis
14. V. N. Levkovskii, ***Sov. Phys. JETP* 18**, 213 (1964); translation from ***Zhur. Eksp. i Teor. Fiz.* 45**, 305 (1963)
15. E. T. Bramlitt and R. W. Fink, ***Phys. Rev.* 131**, 2649 (1963)
16. R. Prasad and D. C. Sarkar ***Nuovo cim.* 3A**, 467 (1971)
17. E. B. Paul and R. L. Clarke, ***Can. J. Phys.* 31**, 267 (1953)
18. V. Benzi, et al., **CEC(71) 9** (1971) CNEN, Bologna, Italy
19. G. Tessler, et al., ***Phys. Rev. C* 2**, 2390 (1970)
20. R. B. Day, private communication (1965)
21. F. D. McDaniel, et al., ***Phys. Rev C* 10**, 1087 (1974)
22. P. Guenther, A. Smith, and J. Whalen, **ANL/NDM-4** (1974) Argonne National Laboratory

23. D. A. Lind and R. B. Day, ***Annals Phys.*** **12**, 485 (1961)
24. G. Tessler and S. Glickstein, ***Bull. Am. Phys. Soc.*** **20**, 174, Abst. IB22 (1975)
25. N. P. Glazkov, ***Sov. At. En.*** **15**, 1173 (1964); translated from ***At. En.*** **15**, 416 (1963)
26. D. Reitmann, C. A. Engelbrecht, and A. B. Smith, ***Nucl. Phys.*** **48**, 593 (1963)
27. H. S. Hans and S. C. Snowdon, ***Phys. Rev.*** **108**, 1028 (1957)
28. D. W. Kent, et al., ***Phys. Rev.*** **125**, 331 (1962)
29. M. Walt and J. R. Beyster, ***Phys. Rev.*** **98**, 677 (1955)
30. M. Walt and H. H. Barschall, ***Phys. Rev.*** **93**, 1062 (1954)
31. W. H. Gilboy and J. H. Towle, ***Nucl. Phys.*** **42**, 86 (1963)
32. R. L. Clarke and W. G. Cross, ***Nucl. Phys. A*** **95**, 320 (1967)
33. M. K. Drake, D. A. Sargis and T. Maung, **EPRI-NP-250** (1976) Electric Power Research Institute
34. S. F. Mughabghab, private communication (1981)

Evaluation: **^{93}Nb Incident Neutron Sublibrary, Release 1 (MAT 4125)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 10, 12, 13, 14, 15, 33, 40
Evaluators: A. B. Smith, D. L. Smith, L. P. Gerardo (ANL); R. J. Howerton (LLNL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC August 1991)
The section MOD numbers have been corrected in the directory.

ENDF/B-VI MOD 1 NEW EVALUATION (A. Smith, D. Smith, L. Gerardo, ANL, R. Howerton, LLNL, March 1990)
For complete summary of ENDF/B-V evaluation, see Summary Documentation, 4th Edition, Supplement 1 (1991), page 216.

Evaluation: **^{101}Ru Incident Neutron Sublibrary, Release 2 (MAT 4440)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN)

ENDF/B-VI, REVISION 1 (R. Q. Wright, ORNL, October 1991))

RESONANCE PARAMETERS (File 2)

The resolved resonance range is revised and extended to 1 keV using the MLBW formalism. The highest energy resonance included is 1035 eV. The resolved resonance parameters are taken from Mughabghab, et al. [1]. For resonances for which the value of Γ_γ is not specified in [1], the value 0.180 eV is used. The thermal capture cross section is 3.41 barns and is 10% higher than the ENDF/B-V value. The thermal capture is computed from the positive resonances; a bound level is not included. The capture resonance integral of 111.68 barns is about 11 barns higher than the ENDF/B-V value, and is in good agreement with the value given by Anufriev, et al. [2] of 108±15 barns and with the Mughabghab, et al., value of 100±20 barns.

Unresolved resonance parameters have been added for the range 1 to 100 keV. The unresolved range fit is based on the average capture cross sections from Macklin, et al. [3], see Table 1, following page. The parameters are based on:

$D_0 = 20.42$ eV, $S_0 = 0.59\times10^{-4}$, $S_1 = 6.0\times10^{-4}$, $S_2 = 2.0\times10^{-4}$
$D_1 = 8.75$ eV, $S_{\gamma 0} = 8.815\times10^{-4}$, $S_{\gamma 1} = 20.57\times10^{-4}$

2200 m/sec capture cross section (barns)
(from resonance parameters) = 3.41

Computed capture resonance integral (barns)

(0.5 eV - 1 keV)	= 102.63
(above 1 keV)	= 9.05
Total	= 111.68

SMOOTH CROSS SECTIONS (File 3)

Total, elastic, and capture are set to zero in the resolved and unresolved resonance ranges (10^{-5} eV to 100 keV). The capture cross section is also revised for energies above 100 keV. The total cross section is unchanged from ENDF/B-V and elastic is revised to reflect the change in the capture cross section. The revised capture cross section follows the data of Macklin [3] between 3 and 700 keV. The capture cross section at 30 keV is about 1007 mb. The revised capture is also compared to the data of Macklin and with ENDF/B-V in Table 1. Macklin's data have been multiplied by a factor of 0.985 to correct for a processing code error. Shown in Table 1 is the change for the new evaluation relative to ENDF/B-V (%DIFF.).

TABLE 1. ^{101}Ru Capture (barns)

E (keV)	Macklin	MAT 4440	ENDF/B-V	% DIFF.
3 - 4	2.612	2.427	2.462	-1.42
4 - 6	2.043	2.110	2.217	-4.83
6 - 8	1.852	1.861	1.993	-6.62
8 - 10	1.720	1.699	1.840	-7.66
10 - 15	1.498	1.506	1.624	-7.27
15 - 20	1.280	1.308	1.404	-6.84
20 - 30	1.111	1.109	1.196	-7.27
30 - 40	0.919	0.926	1.003	-7.68
40 - 60	0.751	0.755	0.820	-7.92
60 - 80	0.601	0.613	0.670	-8.51
80 -100	0.518	0.525	0.574	-8.54
100 -150	0.434	0.441	0.467	-5.57
150 -200	0.337	0.352	0.370	-4.86
200 -300	0.273	0.275	0.296	-7.09
300 -400	0.1940	0.1982	0.2164	-8.41
400 -500	0.1469	0.1523	0.1507	+1.06
500 -600	0.1215	0.1229	0.1119	+9.83
600 -700	0.1001	0.1009	0.0877	+15.05

REFERENCES

1. S. F. Mughabghab, M. Divadeenum, and N. E. Holden, **Neutron Cross Sections, Volume I, Neutron Resonance Parameters and Thermal Cross Sections**, Part A, (Academic Press, NY, 1981)
2. V. A. Anufriev, et al., ***Sov. Atomic Energy* 58**, 326 (1985); translated from ***At. En.* 58**, 279 (1985)
3. R. L. Macklin, R. R. Winters, and J. Halperin, **RIT/LDN(80)1** (NEANDC(E)209) , p. 103 (1980) C.N.E.A. Bologna, Italy

ENDF/B-VI MOD 0 (NNDC, January 1990)
Converted from ENDF/B-V MAT 9330, Fission Product Special Purpose Library.

ENDF/B-V EVALUATION (R. Schenter, F. Schmittroth, F. Mann, et al., HEDL, RCN, February 1980)

SMOOTH CROSS SECTIONS (File 3) (for energy region above resonance region)
Total cross section calculated using Moldauer potential [3] .
Elastic cross section calculated as $\sigma_{tot} - \sigma_{n,\gamma} - \sigma_{inl}$.
Inelastic cross section calculated using COMNUC-3 [4].

Neutron capture evaluated using methods (NCAP code) of Schmittroth [1,2], updated by combining available integral and differential data using the generalized least squares adjustment code FERRET [5].

ANGULAR DISTRIBUTIONS (File 4)

Elastic angular distributions were calculated from Moldauer potential. Nonelastic angular distribution assumed to be isotropic.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

The evaporation spectrum (LF=9) parameters were obtained using NCAP code [2].

REFERENCES

1. F. Schmittroth and R. E. Schenter, **HEDL TME 73-63** (1973) Hanford Engineering Development Laboratory
2. F. Schmittroth, **HEDL TME 73-79** (1973) Hanford Engineering Development Laboratory
3. P. A. Moldauer, ***Nucl. Phys.* 47**, 65 (1963)
4. C. L. Dunford, **AI-AEC-12931** (1970) Atomics International, and private communication.
5. F. Schmittroth, **HEDL-TME 77-51** (1978) Hanford Engineering Development Laboratory

Evaluation: **^{102}Ru Incident Neutron Sublibrary, Release 2 (MAT 4443)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN)

ENDF/B-VI MOD 2 Revision 1 (R. Q. Wright, ORNL, October 1991)

RESONANCE PARAMETERS (File 2)

Resolved resonance range is revised and extended to 13.4 keV using the MLBW formalism; the highest resonance included is 13.446 keV. The resolved resonance parameters are taken from Mughabghab, et al. [1] and from Table V of Macklin and Halperin [2]. 42 s-wave and 107 p-wave resonances are assigned. The bound level at -146 eV has Γ_n^0 of 55 meV and Γ_γ of 112 meV and accounts for about 92% of the thermal capture cross section. The following data has been used:

0 - 1700 eV	14 levels from Anufriev [3]
1700-2660 eV	Parameters are fictitious
2.66-13.4 keV	Based on data of Macklin and Halperin [2], Tables V and VI.

The unresolved resonance region (13.4 to 100 keV) fit is based on the average capture cross sections and strength functions from Macklin and Halperin. The parameters are based on:

$D_0 = 360$ eV, $S_0 = 0.45\times10^{-4}$, $S_1 = 5.0\times10^{-4}$, $S_2 = 0.94\times10^{-4}$

$D_1 = 116$ eV, $S_{\gamma 0} = 2.917\times10^{-4}$, $S_{\gamma 1} = 9.91\times10^{-4}$

2200 m/sec cross sections (barns)

Total	= 6.793
Elastic	= 5.565
Capture	= 1.228

Computed capture resonance integral= 4.316 barns

SMOOTH CROSS SECTION (File 3)

Total, elastic, and capture are set to zero in the resolved and unresolved resonance regions (10^{-5} eV to 100 keV). The cross sections above 100 keV are unchanged from the previous evaluation.

The average capture cross sections from the revised evaluation are compared with the previous evaluation and with the data of Macklin and Halperin in Table I.

Table I. Ru-102 Average Capture (mb)

E (keV)	Macklin [2]	ENDF/B-VI MOD 0	ENDF/B-VI MOD 2	% change Macklin	% change MOD 0
3- 4	683.5	561.6	829.2	21.3	47.6
4- 6	501.3	522.8	501.7	0.08	-4.04
6- 8	445.6	443.2	432.7	-2.89	-2.37
8-10	464.9	418.6	457.3	-1.63	9.25
10-15	349.9	347.3	379.0	8.32	9.13
15-20	265.8	278.2	276.5	4.03	-0.61
20-30	218.8	219.2	218.0	-0.37	-0.55
30-40	157.6	172.5	171.4	8.76	-0.64
40-50	131.9	144.5	143.3	8.64	-0.83
50-60	122.0	127.0	125.1	2.54	-1.50
60-80		111.5	109.2		-2.06
80-100		98.9	96.7		-2.22

% change Macklin = % difference for revised evaluation relative to Macklin values.
% Change MOD 0 = % difference for revised evaluation relative to previous evaluation.

REFERENCES

1. S. F. Mughabghab, M. Divadeenum, and N. E. Holden, **Neutron Cross Sections, Volume I, Neutron Resonance Parameters and Thermal Cross Sections**, Part A (Academic Press, NY, 1981).
2. R. L. Macklin and Halperin, ***Nucl. Sci. Eng.* 73**, 174 (1980).
3. V. A. Anufriev, et al., ***Sov. Atomic Energy* 58**, 326 (1985); translated from ***At. En.* 58**, 279 (1985).

ENDF/B-VI MOD 0 (NNDC, January 1990)
Converted from ENDF/B-V t 9331 Fission Product Special Purpose Library.

ENDF/B-V EVALUATION (R. Schenter, F. Schmittroth, F. Mann, et al., HEDL, RCN, February 1980)

SMOOTH CROSS SECTIONS (File 3) (for energy region above resonance region)
Total cross sections were calculated using Moldauer potential [3] .
Elastic cross sections were calculated as $\sigma_{tot} - \sigma_{n,\gamma} - \sigma_{inl}$.
Inelastic cross sections were calculated using COMNUC-3 [4].
Neutron capture was evaluated using methods (NCAP code) of Schmittroth [1,2], updated by combining available integral and differential data using the generalized least squares adjustment code FERRET [5].

ANGULAR DISTRIBUTIONS (File 4)

Elastic angular distribution were calculated from Moldauer potential. The nonelastic angular distributions were assumed to be isotropic.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

Evaporation spectrum (LF=9) parameters were obtained using NCAP code [2].

REFERENCES

1. F. Schmittroth and R. E. Schenter, **HEDL TME 73-63** (1973) Hanford Engineering Development Laboratory
2. F. Schmittroth, **HEDL TME 73-79** (1973) Hanford Engineering Development Laboratory
3. P. A. Moldauer, ***Nucl. Phys.* 47**, 65 (1963)
4. C. L. Dunford, **AI-AEC-12931** (1970) Atomics International, and private communication.
5. F. Schmittroth, **HEDL-TME 77-51** (1978) Hanford Engineering Development Laboratory

Evaluation: **Cadmium Isotopes Incident Neutron Library, Release 2, 3, 4**
MAT 4825 (^{106}Cd) , 4831 (^{108}Cd), 4837 (^{110}Cd), 4840 (^{111}Cd), 4843 (^{112}Cd), 4846 (^{113}Cd), 4849 (^{114}Cd), 4855 (^{116}Cd)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: J. McCabe, A. B. Smith,[1] J. W. Meadows (ANL); R. Q. Wright (ORNL)

ENDF/B-VI MOD 4, Revision 2 (R. Q. Wright, ORNL, and V. McLane, NNDC)

The File 1 comments for the even isotopes were updated.

^{112}Cd An obsolete code was deleted in File 3, MT=4.

^{114}Cd The unresolved resonance range scattering width was changed to 6.19 fm in order to eliminate a discontinuity in the total cross section at 100 keV.

^{116}Cd The unresolved resonance parameters were revised in order to eliminate a discontinuity in the total cross section at 100 keV. The s- and p-wave strength functions were increased to 0.2E-4 and 3.4E-4, respectively, for both the resolved and unresolved resonance regions. The calculated resolved resonance thermal scattering cross section is 5.806 barns. The revised evaluation has higher total and elastic cross sections between 9 and 100 keV, but the capture is almost identical (within +1.2 to -2.0%) to the previous evaluation.

ENDF/B-VI MOD 3 Evaluation (J. McCabe, A. B. Smith, J. W. Meadows, ANL, August 1994)

Comprehensive neutronic evaluated data files for the naturally-occurring isotopes of cadmium are deduced from the experimental data and nuclear models. Particular attention is given to those processes relevant to fuel-cycle and fission-product applications. Comparisons are made with prior evaluations of the cadmium isotopes, and discrepancies and consistencies cited. Some discrepancies are very large (*e.g.*, as much as 100%), and the differences have the potential for a pronounced impact on applications usage. The present files are comprehensive, including many important processes that are not represented in the previous ENDF/B-VI evaluation.

The resonance region evaluation was carried over from the MOD 2 update to the ENDF/B-V evaluations, R. Q. Wright [2]. See McCabe, et al. [1] for complete documentation.

REFERENCES

1. J. McCabe, A. B. Smith, and J. W. Meadows, Report **ANL/NDM-129** (1993) Argonne National Laboratory.
2. R. Q. Wright, ***Trans. Am. Nucl. Soc.* 68**, Part A, 468 (1993).

ENDF/B-VI MOD 2 NEW EVALUATION, R. Q. Wright (December 1991)
This evaluation is a modification of the ENDF/B-V evaluation.

RESOLVED RESONANCE RANGE

The MLBW formalism is used for this evaluation. The resolved resonance parameters are taken from Mughabghab [1] and Musgrove, et al. [2].

[1] Also at the University of Arizona, Tempe, AZ.

^{106}Cd The upper limit of the resolved resonance range is 6.0 keV; the highest energy resonance included is 5881 eV. In Mughabghab [1] there is a gap between about 700 and 2500 eV where no resolved resonance data is available. 14 fictitious s-wave resonances were inserted in this region. Above 2500 eV, 25 resonances were assigned as s-wave and 27 were assigned as p-wave. Also 4 fictitious s-wave resonances were inserted above 6 keV. For s-wave resonances the average gamma width is 0.1612 eV; the average level spacing is 142.6 eV; the s-wave strength function is 0.834×10^{-4}. The p-wave capture width is set to 0.175 eV for all 27 resonances.

^{108}Cd The upper limit of the resolved resonance range is 6.1 keV; the highest energy resonance included is 5970 eV. In Mughabghab [1] there is a gap between about 500 and 2500 eV where no resolved resonance data is available. 18 fictitious s-wave resonances were inserted in this region. Above 2500 eV, 31 resonances were assigned as s-wave and 29 were assigned as p-wave. For s-wave resonances the average gamma width is 0.1055 eV; the average level spacing is 119.6 eV; the s-wave strength function is 1.446×10^{-4}. The p-wave capture width is set to 0.125 eV for all 29 resonances.

^{110}Cd The upper limit of the resolved resonance range is 7.1758 keV; the highest energy resonance included is 9860 eV. 55 resonances were assigned as s-wave (including 11 s-wave resonances above 7175.8 eV) and 48 were assigned as p-wave. The bound level at -110 eV has a Γ_n^0 of 304.44 meV[2] and accounts for about 92% of the thermal capture cross section. The total cross section at thermal is 29.24 barns.

^{112}Cd The upper limit of the resolved resonance range is increased to 7.35 keV; the highest energy resonance included is 11455 eV. 64 s-wave and 54 p-wave resonances were assigned including 24 s-wave resonances above 7350 eV. The bound level at -125 eV has a Γ_n^0 of 93.91 meV and Γ_γ of 83 meV (Mughabghab [1]), and accounts for about 95% of the thermal capture cross section. The elastic cross section at thermal is 6.31 barns.

^{114}Cd The upper limit of the resolved resonance range is increased to 8.0 keV; the highest energy resonance included is 10088 eV. 40 s-wave and 45 p-wave resonances were assigned including 5 s-wave resonances above 8000 eV. The bound level at -225 eV has a Γ_n^0 of 34.53 meV and Γ_γ of 53.0 meV, and accounts for about 43% of the thermal capture cross section. The elastic cross section at thermal is 4.461 barns.[3]

^{116}Cd The upper limit of the resolved resonance range is increased to 9.0 keV; the highest energy resonance included is 8825 eV. 27 s-wave and 21 p-wave resonances are assigned. The bound level at -550 eV has Γ_n^0 of 101 meV and Γ_γ of 48 meV, and accounts for about 90% of the thermal capture cross section. The elastic cross section at thermal is 5.39 barns.

---

[2] Note that the Mughabghab [1] reduced neutron width of the bound level should be half the quoted value (302.5 meV), see page D-2 of Mughabghab [4]. Also the calculated capture resonance integral is 42 barns. In addition, one of the double entries of the 89.5 eV resonance should be deleted.

[3] Note that the value of the capture resonance integral given on page 48-22 of Mughabghab [1] should read 13±2 barns (see Mughabghab [4]).

UNRESOLVED RESONANCE RANGE

The unresolved resonance range fit is based on the average capture cross sections from page 449 of Musgrove, et al. [3]. The unresolved resonance parameters are based on:

	D_0 (eV)	S_0 (10^{-4})	S_1 (10^{-4})	S_2 (10^{-4})	D_1 (eV)	$S_{\gamma 0}$ (10^{-4})	$S_{\gamma 1}$ (10^{-4})
106Cd	110.	1.0	5.0	0.5	42.	14.09	41.67
108Cd	100.	1.44	4.4	0.5	46.67.	10.5	25.71
110Cd	155.	0.5	3.0	1.0	53.33.	4.58	15.0
112Cd	190.	0.5,	4.4	1.5	75.	4.05	12.0
114Cd	235.	0.64	3.5	1.0	90.	2.26	7.78
116Cd	390.	0.16	2.8	1.0	150.	1.205	4.67

FILE 3 CHANGES:

Total, elastic, and capture are set to zero in the resolved and unresolved resonance ranges (1.0×10^{-5} eV to 100 keV). For ^{106,108,110,112}Cd, the cross sections are unchanged from the previous evaluation for energies above 100 keV. The capture cross section is reduced by about 40% for ^{114}Cd and 20% for ^{116}Cd between 100 keV and 5 MeV. The elastic cross section is increased by a small amount in this range such that the total cross section is unchanged.

	^{106}Cd	^{108}Cd	^{110}Cd	^{112}Cd	^{114}Cd	^{116}Cd
2200 m/s Capture cross section (barns) (from resonance parameters)	1.12	1.10	11.01	2.195	0.336	0.075
Computed resonance integral (barns)	14.20	16.98	41.36	13.50	13.15	1.735

REFERENCES

1. S.F. Mughabghab, M. Divadeenam, and N.E. Holden, **Neutron Cross Sections, Volume I, Neutron Resonance Parameters and Thermal Cross Sections**, Part A (Academic Press, NY, 1981)
2. A. Musgrove et al., ***J. of Physics*, G 4**, 771 (1978)
3. A. Musgrove et al., **Neutron Physics and Nuclear Data**, Conference, Harwell, UK (1978) Table V, page 449. (1978). Values are multiplied by a factor of 0.985 (see ***Nucl. Sci. Eng.* 82**, p. 230)
4. S.F. Mughabghab, **Neutron Cross Sections, Volume I, Neutron Resonance Parameters and Thermal Cross Sections**, Part B (Academic Press, NY, 1981)

ENDF/B-VI MOD 0 EVALUATION (NNDC, January, 1990)

Converted to ENDF-6 format from ENDF/B-V: ^{106}Cd (MAT 9440), ^{108}Cd (MAT 9442), ^{110}Cd (MAT 9444), ^{112}Cd (MAT 9447), ^{114}Cd (MAT 9450), ^{116}Cd (MAT 9453).

Evaluation: **^{112,114}Sn Incident Neutron Library, Release 1**
MAT 5025 (^{112}Sn), MAT 5031 (^{112}Sn)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: F. M. Mann (HEDL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, August 1991)

The low energy interpolation code changed to log-log for the total and capture cross section (MF=3, MT=1,102).

ENDF/B-VI MOD 0 (NNDC, January 1990)

ENDF/B-V MAT 9513 (^{112}Sn) and MAT 9516 (^{114}Sn) converted to ENDF-6 format.

ENDF/B-V EVALUATION (F. Mann, HEDL, February 1980)

File 2 resonance parameters taken from Mughabghab [1].

File 3 cross sections are from Hauser-Feshbach calculations using the Moldauer potential. Low energy data determined from thermal cross section using a 1/v tail.

File 4 angular distributions assumed isotropic.

File 5 evaporation temperatures from $3.2*\sqrt{E/AWR}$.

REFERENCE

1. S. F. Mughabghab and D. L. Garber, **BNL-325**, Third Ed., Vol. 1, Resonance Parameters (1973) Brookhaven National Laboratory

Evaluation: **^{127}I Incident Neutron Sublibrary, Release 2 (5325)**
Energy Range: 10^{-5} eV to 30 MeV
Files: 1, 2, 3, 4, 6, 8, 9, 12, 14, 15
Evaluators: P. G. Young, R. E. Macfarlane (LANL)

ENDF/B-VI MOD 1 NEW EVALUATION (P. Young, R. MacFarlane, LANL, March 1991)

GENERAL COMMENTS

Resolved resonance parameters from an analysis of Mughabghab [Mu81] were used with a multi-level Breit-Wigner representation to represent the total, elastic, and capture data up to an incident neutron energy of 1 keV.

The evaluation above the resonance region (E>1 keV) is based on a theoretical analysis using the SCAT2 optical model code [Be81] the COMNUC [Du70] and GNASH [Yo77, Ar88] Hauser-Feshbach statistical theory codes, the DWUCK [Ku70] distorted-wave Born approximation code, and the ECIS [Ra70] coupled-channel deformed optical model code.

OPTICAL MODEL POTENTIAL

The spherical optical model potential of Yamamuro [Ya90] which utilizes Walter's [Wa85] potential above 20 MeV, was utilized with slight modification at low energies, similar to Yamamuro [Ya88]. For protons, the potential of Perey [Pe63] was modified to include an energy-dependent term in the surface imaginary potential. The alpha potential used by Arthur and Young in Fe calculations [Ar80] was adopted for alpha particles. The above potentials were used to supply transmission coefficients for neutrons, protons, and alpha particles in the Hauser-Feshbach statistical calculations. Of course, all the neutron cross sections depend on the potentials through the transmission coefficients. It was necessary only to adjust the neutron total and capture cross sections to improve agreement with experimental data. The neutron potential was used to obtain all the shape elastic components of the neutron elastic scattering angular distributions, as well as the compound elastic and inelastic scattering angular distribution components.

DIRECT REACTION ANALYSIS

The coupled-channel calculations of Matoba [Ma75] for ^{126}Te were repeated with ECIS in order to verify the importance of vibrational states and to confirm the validity of using simple DWBA calculations. The deformation parameters beta(l=2,J=2+) and beta(l=3,J=3-) from Matoba, together with B(E2) and B(E3) values for ^{127}I in Nuclear Data Sheets [Ha82], were used to infer deformation parameters for ^{127}I levels. The E2 strength was distributed among known levels in ^{127}I; the E3 strength was distributed among 5 arbitrarily assumed negative parity levels between E_x=1.3 and 2.1 MeV in ^{127}I. The deformation parameters from the above analysis were used in DWBA calculations with DWUCK to provide cross section and angular distributions for the discrete ^{127}I(n,n′) reactions to relevant levels in ^{127}I. The compound nucleus reaction cross section was decreased appropriately for the direct reaction components.

HAUSER-FESHBACH STATISTICAL CALCULATIONS

The GNASH code was used for all Hauser-Feshbach statistical theory calculations between 0.001 and 30 MeV. Width fluctuation corrections were obtained from the COMNUC code [Du70], which utilizes the model of Moldauer [Mo76]. Preequilibrium corrections are carried out in GNASH with the exciton model of Kalbach [Ka77,Ka85]. Discrete level data were obtained from Nuclear Data Sheets [Ha82]; continuum level densities were represented with the Gilbert-Cameron [Gi65] model using the Cook parameters [Co67]. Particle transmission coefficients were obtained from the optical model calculations described above. Transmission coefficients for γ rays were calculated using the Brink-Axel model [Br55,Ax62]. Normalization of the γ-ray strength function was carried out using the compilation of Mughabghab [Mu81]. Calculations were carried out for all reactions that produce neutrons, protons, α particles, or γ rays for incident neutron energies between 1 keV and 30 MeV. The RECOIL code by MacFarlane [Ma84] was used to analyze and unfold the GNASH output for representation in ENDF/B MF=6 format. Angular distribution systematics by Kalbach [Ka88] were used to describe angular distributions for continuum particles, as well as discrete reactions where direct reaction data were lacking.

RESONANCE PARAMETERS (File 2)

Resolved Resonance Parameters: Zero to 1 keV, MLBW representation used with the resonance parameters of Mughabghab [Mu81]. Smooth cross section background included for the capture cross section to improve agreement with experimental data in range 20 to 1000 eV.

2200 m/sec cross sections (barns)

Total	= 10.9821
Capture	= 6.23164
Elastic	= 4.75044

SMOOTH CROSS SECTIONS (File 3)

Total Cross Section: From 1 keV to 14 MeV, the optical model calculation was adjusted to agree with bulk of experimental data. Below 100 keV, the cross section was smoothly joined with resonance range. From 0.1 to 3 MeV, the data of Tabony, et al., [Ta68], Miller, et al. [Mi52], Bockelman, et al. [Bo49] was emphasized. From 3 to 14 MeV, mainly Foster and Glasgow [Fo71] was used. Near 30 MeV, experimental data of Deconninck [De61] was used to adjust optical model calculations.

Elastic Scattering Cross Section: The cross section was obtained by subtracting all nonelastic cross sections from total. It is essentially equal to combination of shape elastic cross section from SCAT2 and compound elastic cross section from COMNUC calculation. Optical model potential and other parameters were taken from the analysis described above.

Inelastic Scattering Cross Section: Sum of MT=51-91 Cross Sections.

MT=16,17,22,28,37,649,849: Based on GNASH calculations.

(n,n') Discrete Inelastic Cross Sections: Based on compound nucleus calculations using GNASH code, with DWBA direct reaction components added for E2 vibrational contributions in MT= 51-58,60,63-65 and E3 contributions in MT=67-71. Note that MT=67-71 are assumed levels for the purpose of including the E3 strength, which must be present.

(n,n') Cross Section to Continuum States: Based on GNASH calculations.

Capture Cross Section: From 1 to 100 keV, essentially GNASH calculation, with small adjustment for data, especially [Gi61]. From 100 keV to 3.5 MeV, calculated values adjusted significantly to match data, especially [St61]. From 3.5 to 30 MeV, based on GNASH calculations, in agreement with experimental data.

(n,p) and (n,α) Cross Section Sum of MT=600-649 and MT=800-849, respectively.

(n,p) and (n,α) to Discrete States: Based on GNASH calculations. Note that, for (n,α), data for first 29 levels lumped into a single level (MT=801) due to small cross sections. Decay scheme of thirteenth excited state assumed.

(n,alpha) Cross Section to Continuum States: Based on GNASH calculations.

ANGULAR DISTRIBUTIONS (File 4)

Elastic angular distributions were obtained by combining shape elastic calculations using the SCAT2 code [Be81] with compound elastic contributions calculated with COMNUC [Du70]. Optical model and other parameters were taken from the analysis described above. Legendre polynomial representation used.

CORRELATED ENERGY-ANGLE DISTRIBUTIONS (File 6)

Continuum energy distributions for MT=16, 17, 22, 28, 37, 91, 649, and 849 were calculated with the GNASH reaction theory code (see above). Energy-angle correlations are given using the updated angular distribution systematics of Kalbach [Ka88]. Recoil angular distributions are given as P1 Legendre expansions. Multiplicities angular (and implicit energy) distributions are also provided for discrete reactions in MT=51-71, 600-622, and 800-829. Data are given for outgoing particles, gamma rays, and recoil nuclei.

MT=16,17,22,28,37,649,849: GNASH Hauser-Feshbach statistical/preequilibrium calculations. Energy-angle distributions are given for secondary neutrons and recoil nuclei.

(n,n′) Discrete Inelastic Cross Sections: Discrete data taken from compound nucleus and pre-equilibrium calculations with GNASH, and from DWBA calculations with DWUCK. MT=51-54,56-58,60,63-65 include direct components with compound nucleus and preequilibrium, MT=55,59,61,62,66 include compound nucleus and preequilibrium, and MT=67-71 are pure direct reaction data. Angular distributions are given as Legendre expansions.

(n,n′) Cross Section to Continuum States: GNASH Hauser-Feshbach statistical/ preequilibrium calculations. Energy-angle distributions are given for secondary neutrons and recoil nuclei.

(n,p) and (n,α) to Discrete States: Discrete data taken from compound nucleus and preequilibrium calculations with GNASH. Angular distributions assumed isotropic because of very small cross sections. Note that, for (n,α), data for first 29 levels lumped into a single level (MT=801) due to small cross sections. Decay scheme of thirteenth excited state assumed. Energy-angle distributions are given for secondary alphas and recoil nuclei.

RADIOACTIVE NUCLIDE DATA

(n,p) Information on ground and 88-keV isomeric states.

(n,α) Information on ground, 11-, and 37-keV isomeric states.

MULTIPLICITIES FOR RADIOACTIVE NUCLIDES (File 9)

Branching ratios obtained from GNASH calculations. NOTE: Isomeric transition contributions are not included in γ cascades so that multiplicities add to unity.

PHOTON PRODUCTION (Files 12, 13, and 15)

Photon multiplicities from radiative capture. Note that γ rays from (n,γn′) reactions are included so that multiplicities become nonphysically large above neutron energies of a few hundred keV.

Photon angular distributions are from radiative capture; assumed isotropic.

Photon gamma-ray energy distributions are obtained from GNASH calculations.

REFERENCES

Ar80 E. D. Arthur and P. G. Young, **LA-8626-MS** (1980) Los Alamos National Laboratory

Ar88 E. D. Arthur, **LA-UR-88-382** (1988) Los Alamos National Laboratory

Ax62 P. Axel, ***Phys.Rev.* 126**, 671 (1962)

Be81 O. Bersillon, **CEA-N-2227**, (1981) Centre d'Etudes de Bruyeres-le-Chatel

Bo49 C. K. Bockelman, et al., ***Phys.Rev.* 76**, 277(1949)

Br55 D. M. Brink, *Some Aspects of the Interaction of Fields with Matter*, PhD Thesis (1955) Oxford University

Co67 J. Cook, et al., ***Aust. J. Phys.* 20**, 477 (1967)

De61 G. Deconninck, et al., ***J. Phys. Rad.* 22**, 652 (1961)

Du70 C. L. Dunford, **AI-AEC-12931** (1970) Atomics International

Fo71 D. G. Foster, Jr. and D.W.Glasgow, ***Phys. Rev. C* 3**, 576 (1971)

Gi61 J. H. Gibbons, et al., ***Phys. Rev.* 122**, 182 (1961)

Gi65 A. Gilbert and A. Cameron, ***Can. J. Phys.* 43**, 1446 (1965)

Ha82 A. Hashizume, et al., ***Nucl. Data Sheets* 35**, 181 (1982)

Ka77 C. Kalbach, ***Z. Phys. A* 283**, 401 (1977)

Ka85 C. Kalbach, ***Phys. Rev. C* 32**, 1157 (1985)

Ka88 C. Kalbach, ***Phys. Rev. C* 37**, 2350 (1988)

Ku70 P. D. Kunz, *DWUCK: A Distorted-Wave Born Approximation Program*, unpublished report (1970) Univ. of Colorado

Ma75 M. Matoba, et al., ***Nucl. Phys. A* 237**, 260 (1975)

Ma84 R. E. MacFarlane and D. G. Foster, Jr., ***J. Nucl. Mat.* 122 & 123**, 1047 (1984)

Mi52 D. W. Miller, et al., ***Phys. Rev.* 88**, 83 (1952)

Mo76 P. A. Moldauer, ***Phys. Rev.* C 14**, 764 (1976)

Mu81 S. Mughabghab, et al., **Neutron Cross Sections, Volume I, Neutron Resonance Parameters and Thermal Cross Sections**, Part A (Academic Press, NY, 1981)

Pe63 F. G. Perey, ***Phys. Rev.* 131**, 745 (1963)

Ra70 J. Raynal, **Computing as a Language of Physics**, Conference, Vienna, Austria, 1970, (International Atomic Energy Agency, 1972), p. 281

St61 Y. Stavisskii, et al., ***Sov. At. En.* 10,** 153 (1961); translated from ***Atomnaya En.* 10**, 158 (1961)

Ta68 R. H. Tabony, et al., ***Annals of Phys.* 46**, 401 (1968)

Wa85 R. Walter and P. Guss, **Nucl. Data for Basic & Applied Science**, Santa Fe, NM, 1985 (Gordon & Breach, U. S., 1986) p.1079

Ya88 N. Yamamuro, **Nucl. Data for Science & Technology**, Mito, Japan, 1988 (Saikon Publishing, Japan, 1988) p.489

Ya90 N. Yamamuro, **JAERI-M 90-006** (1990) Japan Atomic Energy Research Institute

Yo77 P. G.Young and E. D. Arthur, **LA-6947** (1977) Los Alamos National Laboratory

Evaluation: **^{138}Ba Incident Neutron Library, Release 3 (MAT 5649)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: R. Q. Wright (ORNL), R. Howerton (LLNL)

ENDF/B-VI MOD 1 NEW EVALUATION (R. Q. Wright, ORNL, December 1994)

RESONANCE REGION

Resolved resonance parameters were added in the range from 0.4 to 198 keV using the MLBW formalism; the highest resonance included is 194.78 keV. The principal source for the resolved resonance parameters in this evaluation is the data of Brusegan, et al. [1] which has 11 s-wave and 29 p-wave resonances. An additional 20 p-wave resonances have been included from Musgrove, et al. [2].

The average Γ_γ for s-wave is 0.089 eV, D_0 = 18.7 keV, and $S_0 = 0.73\times10^{-4}$.
The average Γ_γ for p-wave is 0.066 eV, D_1 = 3.95 keV, and $S_1 = 1.07\times10^{-4}$.
The scattering radius, R = 5.083 fm.

2200 m/sec cross sections (barns)

Total	= 3.342
Elastic	= 2.982
Capture	= 0.360

Capture Resonance Integral = 0.267 barns

FILE 3 CHANGES

File 3 Cross Sections are revised below 400 eV. The low energy total cross section is based on the measured data of Koester, et al. [3]. The low energy capture is 1/v up to 400 eV with a thermal value of 0.36 barns taken from Mughabghab, et al. [4]. The elastic cross section has been set to zero in the resolved resonance range but for capture a small 1/v background has been used.

(n,p) and (n,α) were revised to be the same as the JENDL3.2 evaluation.

AVERAGE CAPTURE CROSS SECTIONS

The average capture cross sections, flat weighting, calculated with NJOY, using this evaluation are compared with the measured values from Musgrove, et al. [2] for the energy range 0.1 to 100 keV in Table 1, below.

Table 1. ^{138}Ba Average Capture (mb)

Energy (keV)	Measured	Calculated
0.1-0.4		3.82
0.4-1.0		51.38
1 - 3		34.74
3 - 4		0.97
4 - 5	13.9 ±1.8	15.63
5 - 6		0.79
6 - 8	13.0 ± 2.0	13.66
8 - 10	5.5 ± 0.8	9.21
10 - 15	2.7 ± 0.4	3.00
15 - 20	5.6 ± 0.7	5.86
20 - 30	3.0 ± 0.6	2.69
30 - 40	3.3 ± 0.7	3.77
40 - 50	2.1 ± 0.7	2.54
50 - 60	6.4 ± 1.3	6.39
60 - 80	3.3 ± 1.0	2.99
80 - 100	2.5 ± 1.0	2.50

REFERENCES

1. A. Brusegan, E. Macavero, and C. Van der Vorst, **Nuclear Data for Science and Technology**, International Conference, Gatlinburg, TN, May 9-13, 1994.
2. A. R. del Musgrove, B. J. Allen, and R. L. Macklin, ***Aust. Journal Phys.* 32**, 213 (1979).
3. Koester, et al., ***Z. Phys.* A 322**, 105 (1985)
4. S. F. Mughabghab, M. Divadeenam, and N. E. Holden, **Neutron Cross Sections, Volume I, Neutron Resonance Parameters and Thermal Cross Sections**, Part A, (Academic Press, NY, 1981)

ENDF/B-VI MOD 0 (NNDC, January 1990)

Originally evaluated by R. Howerton [1] for ENDL. Converted to ENDF/B-V then to ENDF/B-VI format by NNDC.

REFERENCE

1. R. W. Howerton, **UCRL-50400**, Vol. 15, Part D, Rev. 1, p. 234 (1978) Lawrence Livermore National Laboratory

Evaluation: **^{140}Ba Incident Neutron Library, Release 3 (MAT 5655)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)

ENDF/B-VI MOD RELEASE 3 (NNDC, May 1995)
Minor correction to File 1 comments.

ENDF/B-VI MOD 0 (NNDC, January 1990)
ENDF/B-V material converted to ENDF-6 format by NNDC.

ENDF/B-V EVALUATION (R. Schenter, F. Schmittroth, HEDL, April 1974)

RESONANCE PARAMETERS (File 2)
No resonance parameters given except AP.

2200m/s capture cross section (barns)

(from resonance parameters)	=	0.000
(from 1/v component)	=	1.600
total	=	1.600

Computed resonance integral = 12.740

SMOOTH CROSS SECTIONS (File 3)
Total cross section calculated using Moldauer potential [4] for energies above the resonance region.
Elastic cross section above resonance region calculated from $\sigma_{tot} - \sigma_{n,\gamma} - \sigma_{inel}$.
Inelastic cross sections calculated using COMNUC-3 [5].
Neutron capture evaluated using methods (NCAP code) [1,2] for energies above the resonance region. A 1/v component was added to give the 2200 m/s cross section of Mughabghab [3] for lower energies. The calculated resonance integral agrees (to within 1 σ) with the value given in Mughabghab.

ANGULAR DISTRIBUTIONS (File 4)
Angular distribution assumed isotropic.

SECONDARY ENERGY DISTRIBUTIONS (File 5)
Evaporation spectrum (LF=9) parameters obtained using NCAP code [2].

REFERENCES
1. F. Schmittroth, R. E. Schenter, **HEDL TME 73-63** (1973) Hanford Engineering Development Laboratory
2. F. Schmittroth, **HEDL TME 73-79** (1973) Hanford Engineering Development Laboratory
3. S. F. Mughabghab and D. I. Garber, **BNL 325**, 3rd ed., Vol. 1 (1973) Brookhaven National Laboratory
4. P. A. Moldauer, ***Nucl. Phys.* 47**, 65 (1963)
5. C. L. Dunford, **AI-AEC-12931** (1970) Atomics International, and private communication

Evaluation: **^{139}La Incident Neutron Library, Release 1 (MAT 5728)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 9
Evaluators: R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, July 1991)
Converted MAT 9707 from ENDF/B-V to ENDF-6 format and added to evaluation.

ENDF/B-VI MOD 0 (NNDC, July 1991)
Converted from ENDF/B-V MAT 7579 to ENDF-6 format.

ENDF/B-V EVALUATION (R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN), February 1980)

RESONANCE PARAMETERS (File2)
Taken from Mughabghab [3].

SMOOTH CROSS SECTIONS (File 3)
Calculated using potential of Moldauer [4] above resonance region.
Elastic cross section above resonance region calculated from σ_{tot}- $\sigma_{n,\gamma}$- σ_{inel}.
Inelastic cross sections calculated using COMNUC-3 [5].
Neutron capture evaluated above the resonance region using methods (NCAP code) [1,2]. A 1/v component was added to give the 2200 m/s cross section of Mughabghab. Energy region above the resonance region was updated by combining available integral and differential data using the generalized least squares adjustment code FERRET [6].
Average logarithmic energy decrement for elastic scattering of neutrons calculated from $\bar{\mu}$ (MT 251).

ANGULAR DISTRIBUTIONS (File 4)
Angular distribution assumed to be isotropic.

SECONDARY ENERGY DISTRIBUTIONS (File 5)
Evaporation spectrum (LF=9) parameters obtained using NCAP code[2].

REFERENCES
1. F. Schmittroth and R. E. Schenter, **HEDL TME 73-63** (1973) Hanford Engineering Development Laboratory
2. F. Schmittroth, **HEDL TME 73-79** (1973) Hanford Engineering Development Laboratory
3. S. F. Mughabghab and D. I. Garber, **BNL 325**, 3rd ed., Vol. 1 (1973) Brookhaven National Laboratory
4. P. A. Moldauer, ***Nucl. Phys.* 47**, 65 (1963)
5. C. L. Dunford, **AI-AEC-12931** (1970) Atomics International, and private communication
6. F. Schmittroth, **HEDL-TME 77-51** (1978) Hanford Engineering Development Laboratory

Evaluation: **^{143}Nd Incident Neutron Sublibrary, Release 2 (MAT 6028)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, January 1992)

RESONANCE PARAMETERS (File 2)

The resolved resonance region is revised and extended 5285 eV using the MLBW formalism; the highest energy resonance included is 5503 eV. The resolved resonance parameters are taken from Mughabghab, et al. [1]. For resonances for which a value of Γ_γ is not specified, the value 0.080 eV is used. The s-wave strength function, as determined by PSYCHE, is 3.36×10^{-04} compared to $(3.2\pm0.3)\times10^{-04}$ in [1].

The thermal capture cross section is slightly lower than ENDF/B-V. The capture resonance integral is in good agreement with the value given in [1], 128±30 barns, which is calculated from the resonance parameters, and agrees with the ENDF/B-V value of about 129.5 barns. Negative scattering cross sections encountered in the ENDF/B-V evaluation are eliminated.

Unresolved resonance parameters have been added in the unresolved range of 5.285 to 100 keV. The unresolved range fit is based on the average capture cross sections from Nakajima, et al. [2] and Musgrove, et al. [3].

The unresolved parameters are based on (in eV):

$$D_0 = 32.48,\ S_0 = 3.5,\ S_1 = 0.8,\ S_2 = 1.0$$
$$D_1 = 18.41,\ S_{\gamma 0} = 24.63,\ S_{\gamma 1} = 43.45$$

2200 m/sec cross sections (barns)

Total	= 402.90
Elastic	= 79.83
Capture	= 323.07

Computed capture resonance integral (barns) = 129.56

SMOOTH CROSS SECTIONS (File 3)

Elastic, and capture are set to zero in the resolved resonance range (1.0×10^{-5} eV to 5285 eV). The capture is also revised by small amounts at 130 and 160 keV and above 1 MeV. The energy mesh for the capture above 1 MeV is revised to be the same as for the total cross section. The total is small but non-zero due to small cross sections for (n,α) and (n,nα).

The inelastic cross section is also revised.

TABLE 1. ^{143}Nd Capture Cross Section (mb)

E (keV)	Nakajima [2]	Musgrove [3]	MAT 6028
4 - 6	870	936	869
6 - 8	770	818	738
8 - 10	645	665	619
10 - 15	514	504	500
15 - 20	364	380	400
20 - 30	345	309	257
40 - 60	212	174	206
60 - 80	164	114	168
80 -100	168	86	146

REFERENCES

1. S. F. Mughabghab, M. Divadeenum, and N. E. Holden, **Neutron Cross Sections, Volume I, Neutron Resonance Parameters and Thermal Cross Sections**, Part A (Academic Press, NY, 1981)
2. Nakajima, et al., **Neutron Physics and Nuclear Data for Reactors and Other Applied Purposes**, Conference, AERE Harwell, 25-29 Sept. 1978 (O.E.C.D., 1978) p. 438
3. Musgrove, et al., **Neutron Physics and Nuclear Data for Reactors and Other Applied Purposes**, Conference, AERE Harwell, 25-29 Sept. 1978 (O.E.C.D., 1978) p. 449

ENDF/B-VI MOD 0 (NNDC, January 1990)

The ENDF/B-V MAT 9764 evaluation was translated to ENDF-6 format.

ENDF/B-V EVALUATION (R. Schenter, F. Schmittroth, F. Mann, et al. (HEDL); H. Gruppelaar (RCN), A. Prince (BNL), February 1980)

SMOOTH CROSS SECTIONS (File 3) (for energy region above resonance region)

Total cross sections calculated using Moldauer potential [3].

Elastic cross sections from $\sigma_{tot} - \sigma_{n,\gamma} - \sigma_{inl}$.

Inelastic cross sections calculated using COMNUC-3 [4]. Level scheme data taken from Nuclear Data Tables and Igarasi [5].

(n,2n), (n,3n), (n,nd), (N,np), (n,p), (n,d), (n,t), (n,^{3}He), (n,α) calculated using the THRESH code [6]

Neutron capture evaluated using COMNUC-3 and (NCAP code) of Schmittroth [1,2]; updated by combining available integral and differential data using the generalized least squares adjustment code FERRET [7].

ANGULAR DISTRIBUTIONS (File 4)

Elastic angular distribution calculated from Moldauer potential. Nonelastic angular distribution assumed isotropic.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

Energy distributions of secondary neutrons given as histogram using calculations of nuclear temperature from Gilbert and Cameron [8].

REFERENCES

1. T. Tamura, **ORNL-4152** (1967) Oak Ridge National Laboratory
2. F. Schmittroth, **HEDL TME 73-79** (1973) Hanford Engineering Development Laboratory
3. P. A. Moldauer, ***Nucl. Phys.* 47**, 65 (1963)
4. C. L. Dunford, **AI-AEC-12931** (1970) Atomics International, and private communication
5. S. Igarasi, private communication.
6. S. Pearlstein, ***J. Nucl. En.* 27**, 81 (1973)
7. A. Gilbert and A. G. W. Cameron, ***Can. J. Phys.* 43**, 1446 (1965)
8. F. Schmittroth, **HEDL-TME 77-51** (1978) Hanford Engineering Development Laboratory

Evaluation: **^{145}Nd Incident Neutron Sublibrary, Release 2 (MAT 6034)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, January 1992))

RESONANCE PARAMETERS (File 2)

The resolved resonance region is revised and extended from 1457 to 4140 eV using the MLBW formalism; the highest energy resonance included is 4637 eV. The resolved resonance parameters are taken from Mughabghab, et al. [1]. For resonances for which a value of Γ_γ is not specified, the value 0.075 eV is used. The s-wave strength function, as determined by PSYCHE, is 4.27×10^{-04} compared to $(4.4\pm0.4)\times10^{-04}$ in Mughabghab.

The thermal capture cross section is slightly lower than ENDF/B-V. The revised capture resonance integral is about 1.1% lower than the ENDF/B-V value of 232.3 barns, and is in good agreement with the value given in Mughabghab of 1240±35 barns. The negative scattering cross sections encountered in the ENDF/B-V evaluation were eliminated.

Unresolved resonance parameters have been added in the unresolved range of 4.140 to 50 keV. The unresolved range fit is based on the average capture cross sections from Nakajima, et al. [2] and Musgrove, et al. [3]. Average capture cross sections computed from the evaluation are compared with the average values from these references in Table I.

For the energy range 3 to 30 keV, the revised capture is fairly close to the Musgrove values; for 30 to 100 keV, the evaluation is higher than Musgrove but lower than the Nakajima data, and is also fairly close to the ENDF/B-V evaluation for the energy range 4.140 to 100 keV.

The unresolved parameters are based on (in eV):

$D_0 = 17.32$, $S_0 = 4.0$, $S_1 = 0.8$, $S_2 = 1.0$

$D_1 = 8.66$, $S_{\gamma 0} = 43.29$, $S_{\gamma 1} = 86.58$

2200 m/s cross sections (barns)

Total	= 59.08
Elastic	= 17.19
Capture	= 41.89

Computed resonance integral (barns)

0.5 - 4140 eV	= 227.07
Above 4140 eV	= 2.59
Total	= 229.66

SMOOTH CROSS SECTIONS (File 3)

Elastic, and capture are set to zero in the resolved resonance range (1.0×10^{-5} eV to 50 keV). The total is small but non-zero due to small cross sections for (n,α) and (n,nα).

The revised total and elastic cross sections are slightly lower than ENDF/B-V between 50 and 100 keV. All other cross sections are unchanged above 50 keV.

TABLE I. ^{143}Nd Capture Cross Section (mb)

E (keV)	Nakajima [2]	Musgrove [3]	MAT 6034
3 - 4		1.901	2.032
4 - 5	1.360	1.436	1.506
5 - 6	1.420	1.360	1.367
6 - 8	1.335	1.236	1.143
8 - 10	1.010	0.970	0.952
10 - 15	1.052	0.799	0.765
15 - 20	0.774	0.642	0.614
20 - 30	0.655	0.475	0.494
30 - 40	0.525	0.361	0.402
40 - 50	0.440	0.295	0.345
50 - 60	0.390	0.280	0.298
60 - 80	0.380	0.162	0.256
80 -100	0.405	0.124	0.218

REFERENCES

1. S. F. Mughabghab, M. Divadeenum, and N. E. Holden, **Neutron Cross Sections, Volume I, Neutron Resonance Parameters and Thermal Cross Sections**, Part A (Academic Press, NY, 1981)
2. Nakajima, et al., **Neutron Physics and Nuclear Data for Reactors and Other Applied Purposes**, Conference, AERE Harwell, 25-29 Sept. 1978 (O.E.C.D., 1978) p. 438
3. Musgrove, et al., **Neutron Physics and Nuclear Data for Reactors and Other Applied Purposes**, Conference, AERE Harwell, 25-29 Sept. 1978 (O.E.C.D., 1978) p. 449

ENDF/B-VI MOD 0 (NNDC, January 1990)
Converted from ENDF/B-V MAT 9766 to ENDF-6 format.

ENDF/B-V EVALUATION (R. Schenter, F. Schmittroth, F. Mann, et al., HEDL; H. Gruppelaar, RCN, February 1980)

SMOOTH CROSS SECTIONS (File 3) (for energy region above resonance region)

Total cross sections calculated using the Moldauer potential [3].

Elastic cross sections from $\sigma_{tot} - \sigma_{n,\gamma} - \sigma_{inl}$.

Inelastic cross sections calculated using COMNUC-3 [4]. Level scheme data taken from Nuclear Data Tables and Igarasi [5].

(n,2n), (n,3n), (n,nd), (N,np), (n,p), (n,d), (n,t), (n,^{3}He), (n,α) calculated using the THRESH code [6]

Neutron capture evaluated using COMNUC-3 and (NCAP code) of Schmittroth [1,2]; updated by combining available integral and differential data using the generalized least squares adjustment code FERRET [7].

ANGULAR DISTRIBUTIONS (File 4)

Elastic angular distribution calculated from Moldauer potential. Nonelastic angular distribution assumed isotropic.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

Energy distributions of secondary neutrons given as histogram using calculations of nuclear temperature from Gilbert and Cameron [8].

REFERENCES

1. T. Tamura, **ORNL-4152** (1967) Oak Ridge National Laboratory
2. F. Schmittroth, **HEDL TME 73-79** (1973) Hanford Engineering Development Laboratory
3. P. A. Moldauer, ***Nucl. Phys.* 47**, 65 (1963)
4. C. L. Dunford, **AI-AEC-12931** (1970) Atomics International, and private communication
5. S. Igarasi, private communication.
6. S. Pearlstein, ***J. Nucl. En.* 27**, 81 (1973)
7. A. Gilbert and A. G. W. Cameron, ***Can. J. Phys.* 43**, 1446 (1965)
8. F. Schmittroth, **HEDL-TME 77-51** (1978) Hanford Engineering Development Laboratory

Evaluation: **^{147}Nd Incident Neutron Library, Release 1 (MAT 6040)**
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. Schenter, F. Schmittroth (HEDL)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, August 1991)
Illegal J-values in file 2 corrected.

ENDF/B-VI MOD 1 NEW EVALUATION (R. Q. Wright, ORNL, December 1988)
This evaluation is an update of the ENDF/B-V evaluation of Schenter and Mann.

Resolved resonance parameters have been added to define the total, elastic, and capture cross sections below 35 eV; above 35 eV, the evaluation is unchanged from ENDF/B-V. The resolved resonance parameters are taken from Mughabghab [1]. The MLBW representation was used with the smooth background set to zero in the resonance region.

The largest contribution to the thermal capture cross section (about 98%) is from the bound level at -5 eV. The thermal capture cross section is higher than the ENDF/B-V value by about a factor of 9; the capture resonance integral is slightly lower.

2200 m/s capture cross section (barns)	
(from resonance parameters)	= 439.9

Computed resonance integral (barns)	
(from resonance parameters)	= 429.5
(above 35 eV)	= 144.0
total	= 573.5

REFERENCES

1. S. F. Mughabghab, M. Divadeenam, and N. E. Holden, **Neutron Cross Sections, Volume I, Neutron Resonance Parameters and Thermal Cross Sections**, Part A (Academic Press, NY, 1981)

ENDF/B-V EVALUATION (R. Schenter, F. Mann, HEDL, January 1980)

SMOOTH CROSS SECTIONS File 3)

Total cross section calculated using Moldauer potential [4] above the resonance region.

Elastic cross section from $\sigma_{tot} - \sigma_{n,\gamma} - \sigma_{inl}$ above the resonance region, from $4\pi\times AP^2$ at lower energies.

Inelastic cross section calculated using COMNUC-3 [5].

Neutron capture evaluated using methods (NCAP code) [1,2] above the resonance region. A 1/v component was added to give the 2200 m/s cross section of Mughabghab. Low energy capture also adjusted to give resonance integral (to within 1 σ) of Ribon and Krebs [6].

ANGULAR DISTRIBUTIONS (File 4)

Angular distribution assumed isotropic.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

Evaporation spectrum (LF=9) parameters obtained using NCAP code [2].

REFERENCES

1. F. Schmittroth and R. E. Schenter, **HEDL TME 73-63** (1973) Hanford Engineering Development Laboratory
2. F. Schmittroth, **HEDL TME 73-79** (1973) Hanford Engineering Development Laboratory
3. E. Clayton, **AAEC/TM619** (1972) Australian Atomic Energy Commission
4. P. A. Moldauer, ***Nucl. Phys.* 47**, 65 (1963)
5. C. L. Dunford, **AI-AEC-12931** (1970) Atomics International, and private communication
6. P. Ribon and J. Krebs, **IAEA-169**, Vol. I, p.235 (1974) International Atomic Energy Agency

Evaluation: **^{147}Pm Incident Neutron Library, Release 1 (MAT 6149)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, August 1991)
Illegal J-values in File 2 were corrected.

ENDF/B-VI MOD 1 NEW EVALUATION (R. Q. Wright, ORNL, April 1989)
See ENDF-201 Summary Documentation, 4th Edition (1991), page 260, for documentation of ENDF/B-VI evaluation.

Evaluation: **^{144}Sm Incident Neutron Library, Release 3 (MAT 6225)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL), F. M. Mann (HEDL)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, October 1994)

RESONANCE PARAMETERS (File 2)

Resonance parameters have been added for the resolved resonance range from 0.4 to 12 keV using the MLBW formalism; the highest resonance included is 39.117 keV. The principal source for the resolved resonance parameters is the data of Macklin, et al. [1]; 18 s-wave and 56 p-wave resonances are included from Table II of this reference. An additional 26 s-wave resonances and 2 p-wave resonances are included from Table III. These additional resonances are above the cutoff and are only used to calculate the cross sections below 12 keV.

Unresolved resonance parameters have been added in the range is 12 to 80 keV. The fit is based on average Γ_γ of 0.074 eV for s-wave, and 0.089 eV for both p-wave and d-wave, scattering radius (R) = 5.617 fm, D_0 = 670 eV, $S_0 = 3.6\times10^{-4}$. $S_1 = 1.0\times10^{-4}$, $S_2 = 2.4\times10^{-4}$.

The revised values represent a change of 134% for the thermal capture and -93.8% for the capture resonance integral. The measured values of Alexander [2] are 1.64±0.10 barns for the thermal capture and 2.38±0.17 barns for the capture resonance integral.

2200 m/sec Cross Sections

Total	= 2.813 barns
Elastic	= 1.173 barns
Capture	= 1.640 barns

Capture Resonance Integral = 1.861 barns

SMOOTH CROSS SECTIONS (File 3)

Cross sections are revised below 400 eV. The low energy elastic cross section is calculated from the resolved resonance parameters. The low energy capture is 1/v up to 400 eV with a thermal value of 1.64 barns [2]. The elastic cross section has been set to zero in the resolved resonance range but for the capture a small 1/v background has been used.

Changes above 80 keV

Total cross section above 1 MeV is based on the ^{148}Sm total of Shamu, et al. [3,4].

The elastic is calculated by subtracting the nonelastic from the total.

The (n,2n) cross section is based on measured data as shown in McLane, et al. [4]. (n,2n) was not included in the previous evaluation but was included in the inelastic.

The inelastic above 11 MeV is revised to remove the (n,2n) contribution. In the continuum, it is also revised to be the same as the total inelastic scattering.

The capture is based on Macklin, et al. [1], Table IV, for the energy range 80-500 keV. The extension to 20 MeV is based on shape of ^{154}Sm capture. The average capture cross sections, calculated with NJOY, flat weighting, for this evaluation are compared with the measured values of Macklin, et al. [1] for the energy range 6 to 500 keV in Table I.

Table I. Sm-144 Average Capture (mb)

Energy (keV)	Measured	Calculated
6 - 8	130	113.7
8 -10	143	134.9
10 -12	176	163.5
12 -15	185	124.2
15 -20	120	108.7
20 -30	84	91.8
30 -40	77	79.8
40 -60	73	70.3
60 -80	65	62.7
80-100	57	56.4
100-150	49.1	49.2
150-200	48.2	48.2
200-300	45.0	45.0
300-400	40.9	41.0
400-500	41.7	41.5

ANGULAR DISTRIBUTIONS (File 4)

The elastic angular distributions used data from ^{152}Sm, MAT 6249.
The (n,2n) was assumed to be isotropic.

SECONDARY ENERGY DISTRIBUTIONS (File 5)

The (n,2n) used data from ^{152}Sm, MAT 6249.

REFERENCES

1. R. L. Macklin, N. W. Hill, J. A. Harvey, and G. L. Tweed, ***Phys. Rev. C* 48**, 1120 (1993)
2. C. W. Alexander, J. Halperin, J. B. Knauer, R. L. Walker, ***Nucl. Sci. Eng.* 95**, 194 (1987)
3. R. E. Shamu et al., ***Phys. Rev. C* 22**, 1857 (1980)
4. V. McLane, C. L. Dunford, and P. F. Rose, **Neutron Cross Sections, Vol. 2, Neutron Cross Sections** (Academic Press, NY, 1988)

ENDF/B-VI MOD 0 (NNDC, February 1990)

ENDF/B-V MAT 9083 converted to ENDF6 format by NNDC.

Evaluation: **^{150}Sm Incident Neutron Sublibrary, Release 2 (MAT 6243)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth (HEDL)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, October 1991)

RESONANCE PARAMETERS (File 2)

The resolved resonance region is revised and extended from 581.7 to 1600 eV using the MLBW formalism; the highest energy resonance included is 1563 eV.

The resolved resonance parameters are taken from Mughabghab, et al. [1]; the bound level at -3.2 eV is not included. Including both the -10.2 and -3.2 eV bound levels gives a value for the thermal capture cross section which is much too high. Including only the -10.2 eV level gives a thermal capture cross section of 103.4 barns and a total cross section of 122.2 barns; this would appear to indicate an error in [1]. For resonances for which a value of Γ_γ is not specified in [1], the value 0.060 eV is used.

The s-wave strength function is 3.79×10^{-4} compared to $(3.6\pm1.1)\times10^{-4}$ in [1]. The thermal capture cross section is only about 1.4% higher than ENDF/B-V. The capture resonance integral is in good agreement with the value given in [1], 358±50 barns, but somewhat higher than the value of 310±15 barns given by Eiland, et al. [2]. The revised capture resonance integral is 5.6% higher than the ENDF/B-V value of about 320 barns. Negative scattering cross sections were encountered in the ENDF/B-V evaluation; since the revised evaluation uses MLBW, rather than SLBW parameters, this problem is eliminated.

Unresolved resonance parameters have been added in the unresolved range of 1.6 to 100 keV. The unresolved resonance parameters are based on (in eV):

$D_0 = 48$, $S_0 = 3.6$, $S_1 = 0.6$, $S_2 = 2.9$

$D_1 = 15$, $S_{\gamma 0} = 12.5$, $S_{\gamma 1} = 40$

2200 m/s cross sections (barns)

From resonance parameters	= 103.42

Computed resonance integral (barns)

0.5 - 1600 eV	= 334.00
Above 1600 eV	= 3.78
Total	= 337.78

SMOOTH CROSS SECTIONS (File 3)

Elastic, and capture are set to zero in the resolved and unresolved resonance range (1.0×10^{-5} eV to 100 keV). Total, elastic, and capture cross sections are revised above 100 keV. The revised total cross section is based on the measurements of Shamu, et al. [3]. ^{150}Sm σ_{tot} = ^{148}Sm $\sigma_{tot}\times$ R, where R is defined as: R = 1.0 + (^{150}Sm σ_{tot} - ^{148}Sm σ_{tot})/^{148}Sm σ_{tot}.

The data for total inelastic scattering and scattering to the 5th excited state are revised. The revised data below 3 MeV is based on the work of Efrosinin, et al. [4]. The inelastic continuum data was revised above 7 MeV.

The (n,2n) cross section was added to the file and is based on the data of Frehaut, et al. [5].

SECONDARY PARTICLE DISTRIBUTIONS (File 4 and File 5)

Angular distributions (File 4) and secondary energy distributions (File 5) were added for the (n,2n) reaction.

REFERENCES

1. S. F. Mughabghab, **Neutron Cross Sections, Vol 1, Neutron Resonance Parameters and Thermal Cross Sections**, Part B (Academic Press, NY, 1984).
2. H. M. Eiland, S. Weinstein, and K. W. Seemann, ***Nucl. Sci. Eng.* 54**, 286 (1979)
3. R. E. Shamu, et al., ***Phys.Rev. C* 22**, 1857 (1980).
4. V. P. Efrosinin, et al., **Nuclear Spectroscopy and Nuclear Structure**, 19th Conference, Riga, 27-30 March, 1979 (Leningrad, 1979) p. 274
5. J. Frehaut, et al., **BNL-NCS-50681**, Vol. I, p. 399 (1980) Brookhaven National Laboratory

ENDF/B-VI MOD 0 (NNDC, February 1990)

ENDF/B-V MAT 9809 converted to ENDF-6 format.

ENDF/B-V EVALUATION (R. E. Schenter and F. Schmittroth, HEDL, April 1974)

SMOOTH CROSS SECTIONS (File 3) (for energy region above resonance region)

Total cross sections calculated using Moldauer potential [3].
Elastic cross sections from $\sigma_{tot} - \sigma_{n,\gamma} - \sigma_{inl}$.
Inelastic cross sections calculated using COMNUC-3 [4].
Neutron capture evaluated using NCAP code of Schmittroth [1,2].

ANGULAR DISTRIBUTIONS (File 4)

Elastic and nonelastic angular distributions assumed isotropic.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

Evaporation spectrum (LF=9) parameters obtained using NCAP code [2].

REFERENCES

1. T. Tamura, **ORNL-4152** (1967) Oak Ridge National Laboratory
2. F. Schmittroth, **HEDL TME 73-79** (1973) Hanford Engineering and Development Laboratory
3. P. A. Moldauer, ***Nucl. Phys.* 47**, 65 (1963)
4. C. L. Dunford, **AI-AEC-12931** (1970) Atomics International, and private communication

Evaluation: **^{151}Sm Incident Neutron Sublibrary, Release 1 (MAT 6246)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, August 1991)
Illegal J-values in File 2 were corrected.

ENDF/B-VI MOD 1 NEW EVALUATION (R. Q. Wright, ORNL, March 1980)
See ENDF-201 Summary Documentation, 4th Edition (1991), page 268, for documentation of ENDF/B-VI evaluation.

Evaluation: **^{152}Sm Incident Neutron Sublibrary, Release 2 (MAT 6249)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, July 1992))

RESONANCE PARAMETERS (File 2)

The resolved resonance region is revised and extended from to 5025 eV using the MLBW formalism; the highest energy resonance included is 5100 eV.

The resolved resonance parameters are taken from Mughabghab, et al. [1]. 92 s-wave resonances are assigned. The bound level at -136 eV has Γ_n^0 of 161.6 meV and Γ_γ of 61 meV, and accounts for only about 1.1% of the thermal capture cross section. For resonances for which the value of Γ_γ is not given in [1], the value 0.061 eV is used.

The capture resonance integral is in good agreement with the value of 2970±100 barns in Mughabghab. The thermal capture cross section is equivalent to the Mughabghab value of 206±6 barns.

Unresolved resonance parameters have been added in the unresolved range of 5.025 to 100 keV and are based on the average capture cross sections of Kononov [2]. These parameters (at 30 keV) result in the following values:

D_0 = 28 eV, $S_0 = 2.5\times10^{-4}$, $S_1 = 0.6\times10^{-4}$, $S_2 = 3.0\times10^{-4}$

D_1 = 9.33 eV, $S_{\gamma 0} = 21.79\times10^{-4}$, $S_{\gamma 1} = 65.36\times10^{-4}$

The scattering radius is = 7.665 fm.

2200 m/s cross sections (barns)

Total	= 209.0
Elastic	= 3.1
Capture	= 205.9

Computed resonance integral (barns) = 2983

SMOOTH CROSS SECTIONS (File 3)

The total cross section is small but non-zero due to small cross sections for MT = 22 and 107. The total cross section is revised above 100 keV, based on the measurements of Shamu, et al., [4]. ^{152}Sm σ_{tot} = ^{148}Sm $\sigma_{tot}\times$ R, where R is defined as: R = 1.0 + (^{152}Sm σ_{tot} - ^{148}Sm σ_{tot})/^{148}Sm σ_{tot}.

Elastic and capture are set to zero in the resonance range (1.0×10^{-5} eV to 100 keV). The elastic cross section is revised above 100 keV; the capture cross section is revised between 100 keV and 3.5 MeV to agree with the experimental values of Kononov, et al [2], and Zhou, et al. [3].

REFERENCES
1. S. F. Mughabghab, **Neutron Cross Sections, Vol 1, Neutron Resonance Parameters and Thermal Cross Sections**, Part B (Academic Press, NY, 1984)
2. V. N. Kononov, et al., ***Soviet J. Nucl. Phys.* 27**, 5 (1978); translated from ***Yad. Fiz.* 27**, 10
3. Zhou Zuying, et al., ***Chinese J. Nucl. Phys.* 6**, 174 (1984)
4. R. E. Shamu, et al., ***Phys.Rev. C* 22**, 1857 (1980)

ENDF/B-VI MOD 0 (NNDC, February 1990)
ENDF/B-V MAT 9811 converted to ENDF-6 format.

ENDF/B-V EVALUATION (R. Schenter, F. Schmittroth, F. Mann, et al., HEDL, RCN, February 1980)

SMOOTH CROSS SECTIONS (File 3) (for energy region above resonance region)

Total cross section calculated using the Moldauer potential [3].

Elastic cross section from $\sigma_{tot} - \sigma_{n,\gamma} - \sigma_{inl}$.

Inelastic cross section calculated using COMNUC-3 [4]. Level scheme data taken from Nuclear Data Tables and Igarasi [5]

(n,2n), (n,3n), (n,nd), (n,np), (n,p), (n,d), (n,t), (n,^{3}He), (n,α) calculated using the THRESH code [6].

Neutron capture was evaluated using COMNUC-3 and (NCAP code) of Schmittroth [1,2], updated by combining available integral and differential data using the generalized least squares adjustment code FERRET [8].

ANGULAR DISTRIBUTIONS (File 4)

Elastic angular distribution calculated from Moldauer potential. Nonelastic angular distribution assumed isotropic.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

Energy distributions of secondary neutrons given as histogram using calculations of nuclear temperature from Gilbert and Cameron [7].

REFERENCES
1. T. Tamura, **ORNL-4152** (1967) Oak Ridge National Laboratory
2. F. Schmittroth, **HEDL TME 73-79** (1973) Hanford Engineering Development Laboratory
3. P. A. Moldauer, ***Nucl. Phys.* 47**, 65 (1963)
4. C. L. Dunford, **AI-AEC-12931** (1970) Atomics International, and private communication
5. S. Igarasi, private communication
6. S. Pearlstein, ***J. Nucl. En.* 27**, 81 (1973)
7. A. Gilbert and A. G. W. Cameron, ***Can. J. Phys.* 43**, 1446 (1965)
8. F. Schmittroth, **HEDL-TME 77-51** (1978) Hanford Engineering Development Laboratory

Evaluation: **^{155}Eu Incident Neutron Sublibrary, Release 1 (MAT 6337)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL), R. Schenter (HEDL), A. Prince (BNL)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, August 1991)
Illegal J-values in File 2 were corrected.

ENDF/B-VI MOD 1 NEW EVALUATION (R. Q. Wright, ORNL, August 1991)
See ENDF-201 Summary Documentation, 4th Edition (1991), page 298, for documentation of ENDF/B-VI evaluation.

Evaluation:	**^{152}Gd Incident Neutron Sublibrary, Release 4 (MAT 6425)**
Energy Range:	10^{-5} eV to 20 MeV
Files:	1, 2, 3, 4, 5
Evaluators:	R. Q. Wright (ORNL), Fission Product Working Group (JNDC)

ENDF/B-VI MOD 1 (R. Q. Wright, ORNL, December 1994)

This evaluation is a revision of the JENDL-3.2 evaluation below 100 keV, and includes the resolved and unresolved resonance data, and (n,α) below 2,660 eV. Small changes in the (n,γ) cross section between 100 and 700 keV were also made.

RESOLVED RESONANCE RANGE

Resonance parameters are given for the resolved resonance range 1.0×10^{-5} to 2,660 eV using the MLBW formalism; the highest resonance included is 2,657.7 eV. The resolved resonance parameters are based on the data of Macklin [2]. Macklin gives values of Γ_n and Γ_γ for 30 resonances and $g\Gamma_\gamma\Gamma_n/\Gamma$ values for a total of 128 resonances. For the 98 resonances which do not have values given for Γ_n and Γ_γ, the strategy used is to assign a value for Γ_γ and then pick Γ_n to match the values of $g\Gamma_\gamma\Gamma_n/\Gamma$ given in Macklin. For many resonances, Macklin's average value for Γ_γ = 58.6 meV is used. All resonances are assumed to be *s*-wave. In the JENDL-3.2 evaluation, which is also based on Macklin, 17 resonances were assigned as *p*-wave. The low energy resonances at 3.31, 8.00, and 9.55 eV given in Mughabghab [3] were not found by Macklin [2] and are not included in this evaluation. The parameters for the bound level at -1.0 eV given in Mughabghab [3] are revised to give the desired value of the thermal capture cross section; Γ_γ is taken as 58.6 meV, Γ_n as 4.516 meV. The scattering radius, R = 8.2 fm.

UNRESOLVED RESONANCE RANGE

For the unresolved resonance range, 2.66 to 50 keV, the average Γ_γ is 58.6 meV. D_0 = 11.25 eV, $S_0 = 3.3\times10^{-4}$, $S_1 = 1.1\times10^{-4}$, and $S_2 = 2.4\times10^{-4}$; scattering radius, R = 5.40 fm. Unresolved parameters are energy independent.

SMOOTH CROSS SECTIONS (File 3)

The total, elastic, and capture cross sections are given as zero for energies up to 50 keV. The capture cross section is revised to 700 keV based on average capture of Beer and Macklin [4]. The elastic cross section was also revised to keep the total unchanged. Above 700 keV, the evaluation is unchanged from the JENDL-3.2.

The (n,α) cross section below 2,660 eV has been changed. The histogram interpolation region was eliminated and (n,α) is given in pointwise form with log-log interpolation. An attempt was made to preserve the infinitely dilute (n,α) resonance integral between 10 eV and 2,660 eV.

2200 m/sec Cross Sections (barns)

Total	= 1,074.0
Elastic	= 23.4
Capture	= 1,050.6

Capture resonance integral (barns) = 474.7

The revised thermal capture cross section is based on the measured total cross section of Vertebniy [5] and on JENDL-3.2 thermal capture of 1056 barns. The revised capture resonance integral is about 19% higher than Holden's [6] recommended value of 400 barns, but is 52% lower than the JENDL-3.2 evaluation, therefore, the resonance integral should be considered uncertain at present.[4] The difference is primarily due to eliminating the three low energy resonances. It should also be noted that 99.3% of the thermal capture cross section is due to the bound level at -1 eV.

The average capture cross sections, flat weighting, calculated with NJOY, using this evaluation are compared with the measured values of Beer and Macklin [4] for the energy range 3 to 700 keV in Table I.

Table I. Gd-152 Average Capture (mb)

Energy (keV)	Measured	Calculated	Energy (keV)	Measured	Calculated
3 - 4	3664	3400	60 -80	658	662
4 - 6	2730	2782	80-100	622	611
6 - 8	2246	2158	100-150	569	570
8 -10	1785	1808	150-200	538	542
10 -15	1426	1480	200-300	531	530
15 -20	1186	1217	300-400	461	452
20 -30	1008	1019	400-500	398	406
30 -40	905	869	500-600	393	393
40 -60	784	763	600-700	390	393

REFERENCES

1. S. F. Mughabghab, D. I. Garber, **BNL-325**, 3rd edition, Vol. 1 (1973) Brookhaven National Laboratory
2. R. L. Macklin, ***Nucl. Sci. Eng.*, 95**, 304 (1987)
3. S. F. Mughabghab, **Neutron Cross Sections, Vol. 1, Neutron Resonance Parameters and Thermal Cross Sections**, Part B (Academic Press, NY, 1984)
4. H. Beer and R. L. Macklin, ***Astrophysical J.* 331**, 1047 (1988)
5. V. P. Vertebnyi, et al., ***Sov. At. En.* 57**, 718 (1984); translated from ***At. En.* 57**, 260 (1984)
6. N. E. Holden, ***Trans. Am. Nucl. Soc.* 53**, 163-164 (1986)

[4] The evaluator (RQW) believes that 475 barns is a much better estimate than 991 barns (JENDL-3.2).

Evaluation: **^{154}Gd Incident Neutron Sublibrary, Release 4 (MAT 6431)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL), JNDC Fission Product Working Group

ENDF/B-VI MOD 1 NEW EVALUATION (R. Q. Wright, ORNL, December 1994)

This evaluation is a revision of the JENDL-3.2 evaluation below 100 keV. Small changes were also made in the (n,γ) cross section between 100 keV and 1.152 MeV.

RESOLVED RESONANCE REGION

Resonance parameters are given for the resolved resonance range 1.0×10^{-5} to 2,680 eV using the MLBW formalism; the highest resonance included is 2751.8 eV. The resolved resonance parameters are based on the data of Mughabghab [2] for energies below 486 eV and of Macklin [3] above 486 eV. Mughabghab has values of Γ_n for 28 resonances below 486 eV; nine of these resonances have values for Γ_γ, the others assume an average value of 0.088 eV. Macklin [3] gives values of Γ_n and Γ_γ for 18 resonances and values of $g^*\Gamma_\gamma\Gamma_n/\Gamma$ are given in for a total of 134 resonances. For the 116 resonances which do not have values given for Γ_n and Γ_γ, the strategy used is to assign a value for Γ_γ and then pick Γ_n to match the values of $g\Gamma_\gamma\Gamma_n/\Gamma$ given in Macklin. For most resonances, an average value of 0.088 eV is used for Γ_γ. All resonances are assumed to be s-wave. The parameters of the bound level at -3.0 eV [2] give the desired value of the thermal capture cross section; Γ_γ = 88 meV, and Γ_n = 3.55 meV. The scattering radius, R = 8.0 fm.

UNRESOLVED RESONANCE REGION

The unresolved resonance range is 2.68 to 50 keV. The average Γ_γ = 0.088 eV. D_0 = 19.2 eV, $S_0 = 2.0\times10^{-4}$, $S_1 = 1.110^{-4}$, and $S_2 = 2.410^{-4}$, $S_{\gamma0} = 45.810^{-4}$; scattering radius = 6.78 fm. The unresolved parameters are energy independent.

SMOOTH CROSS SECTIONS (File 3)

Total, elastic, and capture cross sections are zero for energies up to 50 keV. Capture cross section is revised up to 1.152 MeV based on the average capture of Beer and Macklin [4]. Elastic cross section was also revised to keep total cross section unchanged. The total cross section is unchanged above 100 keV.

2200 m/sec Cross Sections (barns)	
Total	= 92.34
Elastic	= 7.29
Capture	= 85.05

Capture resonance integral (barns) = 215.91

The revised thermal capture cross section is based on the recommended value from Mughabghgab [2]. The capture resonance integral is 6.5% lower than the previous evaluation. About 96% of the thermal capture cross section is from the bound level at -3 eV.

The average capture cross sections, flat weighting, calculated with NJOY, using this evaluation are compared with the measured values from Beer and Macklin for the energy range 3 to 500 keV in Table I.

Table I. Gd-154 Average Capture (mb)

Energy (keV)	Measured	Calculated	Energy (keV)	Measured	Calculated
2 - 4	2818	2931	40 -60	682	680
4 - 6	2196	2258	60 -80	591	594
6 - 8	1692	1781	80-100	560	559
8 -10	1640	1512	100-150	486	490
10 -15	1239	1258	150-200	393	392
15 -20	1044	1055	200-300	337	337
20 -30	914	898	300-400	302	303
30 -40	771	777	400-500	292	293

REFERENCES

1. S. F. Mughabghab, D. I. Garber, Brookhaven National Laboratory report **BNL-325**, 3rd edition, Vol. 1 (1973) Brookhaven National Laboratory
2. S. F. Mughabghab, **Neutron Cross Sections, Vol. 1, Neutron Resonance Parameters and Thermal Cross Sections**, Part B (Academic Press, NY, 1984)
3. R. L. Macklin, ***Nucl. Sci. Eng.*, 95**, 304 (1987)
4. H. Beer and R. L. Macklin, ***Astrophysical J.* 331**, 1047 (1988)

Evaluation: **^{174}Hf Incident Neutron Sublibrary, Release 2 (MAT 7225)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); M. K. Drake, D. A. Sargis, T. Maung (SAI)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, April 1992)

RESONANCE PARAMETERS (File 2)

Resonance parameters are given using a MLBW formalism in the resolved resonance range up to 230 eV. A bound level at -0.99 eV [1] is used in this evaluation. Values of Γ_γ, except for the bound level, are set to 0.060 eV. The value for the scattering radius is 7.7 fm [1].

The unresolved resonance range is 230 eV to 90 keV. The thermal capture cross section is 44% higher than in the previous evaluation, while the capture resonance integral is 26% lower. The unresolved resonance parameters have been revised based on:

D_0 = 21 eV, $S_0 = 2.8\times10^{-4}$, $S_1 = 0.910^{-4}$, and $S_2 = 2.510^{-4}$

D_1 = 6 eV, $S_{\gamma 0} = 28.5710^{-4}$, $S_{\gamma 1} = 10010^{-4}$

2200 m/s cross sections (barns)

Total	= 577.36
Elastic	= 15.51
Capture	= 561.85

Computed resonance integral (barns) = 355.18

SMOOTH CROSS SECTIONS (File 3)

Elastic, and capture are set to zero in the resolved and unresolved resonance range (10^{-5} eV to 90 keV).

REFERENCES

1. S. F. Mughabghab, **Neutron Cross Sections, Vol 1, Neutron Resonance Parameters and Thermal Cross Sections**, Part B (Academic Press, NY, 1984)
2. M. K. Drake, D. A. Sargis, and T. Maung, **SAI-76-677-LJ** (1976)

ENDF/B-VI MOD 0 (R. Q. Wright, ORNL, February 1990)

ENDF/B-V MAT 1374 converted to ENDF-6 format.

ENDF/B-V EVALUATION Hafnium isotopes (M. Drake, D. Sargis, T.Maung, SAI, April 1976)

SMOOTH CROSS SECTIONS (FILE 3)

Total cross section:

- < 1.0 eV: elemental data of Moore [1] and Joki [2], isotopic data of Conrad, et al. [3]
- 100 - 500 keV: data of Sherwood, et al. [4]
- 500 keV - 2.5 MeV: data of Sherwood [4] and Green and Mitchell [5]
- > 2.5 MeV: data of Foster and Glasgow [6]

Elastic scattering cross section:

- < 500 keV and >2.5 MeV: σ_{tot} - σ_{non}
- 500 keV - 2.5 MeV: data of Sherwood, et al. [4] and Walt and Barschall [7]

Inelastic scattering cross section: 12 level excitation cross sections based on data of Sherwood, et al. [4].

Capture cross section: extended from 15 to 20 MeV by S. Pearlstein (BNL), following total cross-section measurements [8] for Ta and W, corrected for Hf size.

ANGULAR DISTRIBUTIONS (File 4)

Elastic scattering taken from ^{182}W, ENDF/B-V MAT 1128.

REFERENCES

1. W. E. Moore, ***Bull. Am. Phys. Soc.* 6**, 70, paper X11 (1961)
2. E. G. Joki, et al., ***Nucl. Sci. Eng.* 11**, 298 (1961)
3. C. A. Conrad, et al, ***Bull. Am. Phys. Soc.* 14**, 496, paper AH16 (1969)
4. G. L. Sherwood, et al, ***Nucl. Sci. Eng.* 39**, 67 (1970)
5. L. Green and J. A. Mitchell, **WAPD-TM-1073** (1973) Bettis Atomic Power Laboratory
6. D. G. Foster and D. W. Glasgow, ***Phys. Rev. C* 3**, 576 (1971)
7. M. Walt and H. H. Barschall, ***Phys. Rev.* 93**, 1062 (1954)
8. Peterson, et al, ***Phys. Rev.* 120**, 521 (1960)

Evaluation: **^{176}Hf Incident Neutron Sublibrary, Release 2 (MAT 7231)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); M. K. Drake, D. A. Sargis, T. Maung (SAI)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, August 1992)

RESONANCE PARAMETERS (File 2)

The resolved resonance region is revised to 1080.0 eV using the MLBW formalism; the highest energy resonance included is 1563 eV.

The resolved resonance parameters are taken from Mughabghab, et al. [1]. Bound levels at -80 and -20 eV are used in this evaluation. Values of Γ_γ, except for the first three levels, are set to 0.051 eV. The value for the scattering radius is 7.6 fm [1].

The parameters of the 7.886 eV resonance are based on the data of Moxon [3]: E_0 = 7.886±0.01 eV; Γ_n = 4.71 (+5.50 -2.57) MeV; Γ_γ = 57±12 MeV. The parameters of the two bound levels are also changed.

The thermal capture cross section is 67% lower than in the previous evaluation and is in good agreement with the data of Pavlenko, et al. [4] which is 11.30±5.0 barns, and with the unpublished M. C. Moxon [3] value of 13.7±3.2 barns. The capture resonance integral is 15% higher than in the previous evaluation.

The unresolved resonance range is 1080 eV to 90 keV. The thermal capture cross section is 44% higher than in the previous evaluation, while the capture resonance integral is 26% lower. The unresolved resonance range fit is based on the average capture cross sections from Beer, et al. [2]; the parameters are based on:

D_0 = 35 eV, $S_0 = 2.5\times10^{-4}$, $S_1 = 0.87\times10^{-4}$, $S_2 = 2.0\times10^{-4}$

D_1 = 10 eV, $S_{\gamma 0} = 15.43\times10^{-4}$, $S_{\gamma 1} = 54\times10^{-4}$

2200 m/s cross sections (barns)

Elastic	= 6.70
Capture	= 13.76
Total	= 20.46

Computed resonance integral (barns)= 401.33

SMOOTH CROSS SECTIONS (File 3)

Elastic, and capture are set to zero in the resolved and unresolved resonance range (10^{-5} eV to 90 keV). Capture cross sections for the energy range 90 to 700 keV are taken from Beer, et al. [2], Table IV.

REFERENCES

1. S. F. Mughabghab, **Neutron Cross Sections, Vol 1, Neutron Resonance Parameters and Thermal Cross Sections**, Part B (Academic Press, NY, 1984)
2. H. Beer, et al., ***Phys. Rev. C* 30**, 464 (1984)
3. M. C. Moxon, private communication to R. Q. Wright, August 1992
4. Pavlenko, et al., **Neutron Physics**, Conference, Kiev 9-13 June, 1975 Vol. 3 (Moscow, 1976) p. 171
5. M. K. Drake, D. A. Sargis and T. Maung, **SAI-76-677-LJ** (1976)

ENDF/B-VI MOD 0 (R. Q. Wright, ORNL, February 1990)

ENDF/B-V MAT 1376 converted to ENDF-6 format. See ^{174}Hf for documentation of the ENDF/B-V evaluation.

Evaluation: **^{177}Hf Incident Neutron Sublibrary, Release 2 (MAT 7234)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); M. K. Drake, D. A. Sargis, T. Maung (SAI)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, September 1991)

RESONANCE PARAMETERS (File 2)

The resolved resonance region is revised and extended from 300 to 700 eV using the MLBW formalism; the highest energy resonance included is 1563 eV. The resolved resonance parameters are taken from Mughabghab, et al. [1]; the bound level is not included. Values of Γ_γ not given explicitly in Mughabghab are set to 0.065 eV.

The value for the scattering radius is 8.0 fm. The thermal capture cross section is about 1% lower than in the previous evaluation and the capture resonance integral is about 1.6% lower. The negative elastic scattering cross section below 0.8 eV in the previous evaluation has been eliminated.

The unresolved resonance range is 700 eV to 90 keV. The resonance parameters are based on the average capture cross sections from Beer, et al. [2]; the parameters are based on:

$D_0 = 2.3625$ eV, $S_0 = 1.7\times10^{-4}$, $S_1 = 1.0\times10^{-4}$, $S_2 = 2.1\times10^{-4}$

$D_1 = 1.4175$ eV, $S_{\gamma 0} = 275\times10^{-4}$, $S_{\gamma 1} = 459\times10^{-4}$

2200 m/s cross sections (barns)

Total	= 373.49
Elastic	= 0.02
Capture	=373.47

Computed resonance integral (barns) = 7175

SMOOTH CROSS SECTIONS (File 3)

Elastic, and capture are set to zero in the resolved and unresolved resonance range (1.0×10^{-5} eV to 90 keV). Capture cross sections for the energy range 90 to 700 keV from Beer, et al. [2].

REFERENCES

1. S. F. Mughabghab, **Neutron Cross Sections, Vol 1, Neutron Resonance Parameters and Thermal Cross Sections**, Part B (Academic Press, 1984)
2. H. Beer, et al., ***Phys. Rev. C* 30**, 464 (1984)
3. M. K. Drake, D. A. Sargis and T. Maung, **SAI-76-677-LJ** (1976)

ENDF/B-VI MOD 0 (R. Q. Wright, ORNL, February 1990)

ENDF/B-V MAT 1377 converted to ENDF-6 format. See ^{174}Hf for documentation of the ENDF/B-V evaluation.

Evaluation: **^{178}Hf Incident Neutron Sublibrary, Release 2 (MAT 7237)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); M. K. Drake, D. A. Sargis, T. Maung (SAI)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, September 1991)

RESONANCE PARAMETERS (File 2)

The resolved resonance region is revised to 2100 eV using the MLBW formalism; the upper limit is unchanged from the previous evaluation. The highest energy resonance included is 1563 eV. The resolved resonance parameters are taken from Mughabghab, et al. [1], except for the value of Γ_γ for the 446.5 eV level; the bound level at -54.5 eV [1] is used in this evaluation.

The value for the scattering radius is 7.77 fm. The thermal capture cross section is 13% higher than in the previous evaluation and the capture resonance integral is 7.6% higher. The negative elastic scattering cross section in the previous evaluation below 4 eV has been eliminated.

The upper limit for the unresolved resonance range is 2100 eV to 90 keV. The unresolved resonance range fit is based on the average capture cross sections from Beer, et al. [2]; the parameters are based on:

$D_0 = 51$ eV, $S_0 = 2.2\times10^{-4}$, $S_1 = 0.51\times10^{-4}$, $S_2 = 1.66\times10^{-4}$
$D_1 = 14.67$ eV, $S_{\gamma0} = 10.59\times10^{-4}$, $S_{\gamma1} = 36.82\times10^{-4}$

2200 m/s cross sections (barns)

Total	= 88.90
Elastic	= 4.87
Capture	= 84.03

Computed resonance integral (barns) = 1905

SMOOTH CROSS SECTIONS (File 3)

Elastic, and capture are set to zero in the resolved and unresolved resonance range (1.0×10^{-5} eV to 90 keV). Capture cross sections for the energy range 90 to 2 MeV are taken from Beer, et al. [2], Table IV.

REFERENCES

1. S. F. Mughabghab, **Neutron Cross Sections, Vol 1, Neutron Resonance Parameters and Thermal Cross Sections**, Part B (Academic Press, 1984)
2. M. K. Drake, D. A. Sargis and T. Maung, **SAI-76-677-LJ** (1976)

ENDF/B-VI MOD 0 (R. Q. Wright, ORNL, February 1990)

ENDF/B-V MAT 1378 converted to ENDF-6 format. See ^{174}Hf for documentation of the ENDF/B-V evaluation.

Evaluation: **^{179}Hf Incident Neutron Sublibrary, Release 2 (MAT 7240)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); M. K. Drake, D. A. Sargis, T. Maung (SAI)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, September 1991)

RESONANCE PARAMETERS (File 2)

The resolved resonance region is revised to 450 eV using the MLBW formalism; the upper limit is unchanged from the previous evaluation. The highest energy resonance included is 1563 eV. The resolved resonance parameters are taken from Mughabghab, et al. [1]; the bound level at -6.1 eV [1] is included. Values of Γ_γ not given explicitly in [1] are set to 0.066 eV.

The thermal capture cross section is 6.5% lower than in the previous evaluation while the capture resonance integral is 2.2% higher.

The upper limit for the unresolved resonance range is 450 eV to 90 keV. The unresolved resonance range fit is based on the average capture cross sections from Beer, et al. [2]; the parameters are based on:

$D_0 = 4.356$ eV, $S_0 = 1.8\times10^{-4}$, $S_1 = 0.83\times10^{-4}$, $S_2 = 2.1\times10^{-4}$

$D_1 = 2.512$ eV, $S_{\gamma 0} = 152\times10^{-4}$, $S_{\gamma 1} = 263\times10^{-4}$

2200 m/s cross sections (barns)

Total	= 49.83
Elastic	= 7.23
Capture	= 42.60
Scattering Radius	= 7.83 fm

Computed resonance integral (barns) = 548

SMOOTH CROSS SECTIONS (File 3)

Total, elastic, and capture are set to zero in the resolved and unresolved resonance range (1.0×10^{-5} eV to 90 keV). Capture cross sections for the energy range 90 to 2 MeV are taken from Beer, et al. [2], Table IV.

REFERENCES

1. S. F. Mughabghab, **Neutron Cross Sections, Vol 1, Neutron Resonance Parameters and Thermal Cross Sections**, Part B (Academic Press, 1984)
2. H. Beer and R. L. Macklin, ***Phys. Rev. C* 26**, 1404 (1982)
3. M. K. Drake, D. A. Sargis, and T. Maung, **SAI-76-677-LJ** (1976)

ENDF/B-VI MOD 0 (R. Q. Wright, ORNL, February 1990)

ENDF/B-V MAT 1383 converted to ENDF-6 format. See ^{174}Hf for documentation of the ENDF/B-V evaluation.

Evaluation: **^{180}Hf Incident Neutron Sublibrary, Release 1, 2 (MAT 7243)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); M. K. Drake, D. A. Sargis, T. Maung (SAI)

ENDF/B-VI MOD 2 REVISION 1 (R. Q. Wright, ORNL, September 1991)

RESONANCE PARAMETERS (File 2)

The resolved resonance region is revised using the MLBW formalism and the upper limit is reduced from 12 to 10 keV; the highest energy resonance included is 1563 eV. The resolved resonance parameters are taken from Mughabghab, et al. [1]; the bound level at -48.7 eV is included. Values of Γ_γ, not explicitly given in [1], are set to 0.051 eV, or in some cases a different value is used in order to preserve the value of $g\Gamma_n\Gamma_\gamma/\Gamma$, given in [2].

The thermal capture cross section is 1.3% lower than in the previous evaluation and the capture resonance integral is 0.3% lower.

The upper limit for the unresolved resonance range is 10 to 90 keV. The resonance parameters are fit to the average capture cross sections from Beer, et al. [2]; the parameters are based on:

D_0 = 100 eV, $S_0 = 1.9\times10^{-4}$, $S_1 = 0.44\times10^{-4}$, $S_2 = 1.08\times10^{-4}$
D_1 = 30 eV, $S_{\gamma0} = 5.10\times10^{-4}$, $S_{\gamma1} = 17.0\times10^{-4}$

2200 m/s cross sections (barns)

Total	= 34.16
Elastic	= 21.15
Capture	= 13.01

Scattering radius = 8.0 fm [1]

Computed resonance integral (barns)= 34.48

SMOOTH CROSS SECTIONS (File 3)

Total, elastic, and capture are set to zero in the resolved and unresolved resonance range (1.0×10^{-5} eV to 90 keV). Capture cross sections for the energy range 90 to 2 MeV are taken from Beer, et al. [2], Table IV.

REFERENCES

1. S. F. Mughabghab, **Neutron Cross Sections, Vol 1, Neutron Resonance Parameters and Thermal Cross Sections**, Part B (Academic Press, 1984)
2. M. K. Drake, D. A. Sargis, and T. Maung, **SAI-76-677-LJ** (1976)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, August 1991)

The second J-value for L=1 in the unresolved resonance region. (Note that the revised evaluation from Release 2 has also been labeled as MOD 2, Revision 1).

ENDF/B-VI MOD 0 (NNDC, February 1990)

ENDF/B-V MAT 1384 converted to ENDF-6 format. See ^{174}Hf for documentation of the ENDF/B-V evaluation.

Evaluation: **^{nat}W Incident Neutron Library, Release 1 (MAT 7400)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: E. D. Arthur, P. G. Young, R. Boicourt (LANL)

ENDF/B-VI MOD 2 REVISION 1 (E. D. Arthur, LANL, July 1991)

File 3: For total, elastic, and capture, unequal energies at several discontinuities marking resonance region boundaries were corrected.

File 14: For inelastic scattering, NK(N1) corrected.

ENDF/B-VI MOD 0 (NNDC, February 1990)

ENDF/B-V MAT 1474 converted to ENDF-6 format.

See ENDF-201 Summary Documentation, 3rd Edition, Suppl. 1 (1985), page 115, for documentation of the ENDF/B-V evaluation.

Evaluation: **^{191,193}Ir Incident Neutron Library, Release 4 (MAT 7725)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 14, 15
Evaluators: R. Q. Wright, R. R. Spencer (ORNL)

ENDF/B-VI MOD 1 NEW EVALUATION (R.Q.Wright, R. R. Spencer, ORNL, March 1995)

This evaluation uses the BROND natural iridium evaluation, and includes resolved and unresolved resonance data. Changes for this evaluation are given following.

RESOLVED RESONANCE RANGE

The MLBW resonance formalism is used in this evaluation. The resonance parameters are taken from Mughabghab [1] and are unchanged from the BROND evaluation with the exception of the bound level in ^{193}Ir.

^{191}Ir Resolved resonance range upper limit is 160 eV; the highest energy resonance included is at 171 eV. 51 s-wave (1 bound level) resonances are given. The last five (highest energy) resonances are fictitious resonances above the upper cutoff of the resolved resonance range. The scattering radius is 9.9 fm which gives a thermal scattering cross section of 13.92 barns.

^{193}Ir Resolved resonance range upper limit is 300 eV; the highest energy resonance included is at 336 eV. 45 s-wave (1 bound level) resonances are included; the last five (highest energy) resonances are fictitious resonances above the upper cutoff of the resolved resonance range. The scattering radius is 11.3 fm which gives a thermal scattering cross section of 19.34 barns.

The parameters for the bound level at -21.7 eV [1] are not the same as those in the BROND evaluation. This change gives a thermal capture cross section of 112 b which is adopted for this evaluation.

UNRESOLVED RESONANCE RANGE

The unresolved resonance range includes parameters for s-wave and p-wave resonances. Unresolved parameters are energy independent but are specified using an energy dependent format (energies given in the file). The SESH program [2] was used to determine the total, elastic, and capture cross sections in the unresolved range in order to compare calculated cross sections with measurements.

^{191}Ir The unresolved resonance range is 160 eV to 10 keV. The average Γ_γ is 0.077 eV. D_0 = 2.15 eV, $S_0 = 2.2\times10^{-4}$, $S_1 = 0.4\times10^{-4}$, $S_{\gamma0}$ = 358.14 and the scattering radius = 8.8 fm.

^{193}Ir The unresolved resonance range is 300 eV to 10 keV. The average Γ_γ is 0.093 eV. D_0 = 5.54 eV, $S_0 = 2.0\times10^{-4}$, $S_1 = 0.4\times10^{-4}$, $S_{\gamma0}$ = 167.87 and the scattering radius = 9.0 fm.

SMOOTH CROSS SECTIONS (File 3)

The total cross section for ^{191}Ir was modified from 10 to 130 keV; it is 19% higher than natural iridium at 10 keV and unchanged above 130 keV. The total cross section for ^{193}Ir was modified from 10 to 150 keV; it is 17% higher than natural iridium at 10 keV and unchanged above 150 keV.

The elastic cross section is taken from total - nonelastic.

The inelastic cross section was obtained from the sum of MT = 51, 52, 53, 54, and 91. The discrete inelastic levels correspond to MT = 53, 54, 56, and 57 for ^{191}Ir, and to MT = 51, 52, 55, and 58, respectively, for ^{193}Ir in the BROND natural iridium evaluation.

The capture cross section is based on Macklin, et al., [3] from 10 keV to 2 MeV. From 2 to 20 MeV, the capture was obtained by renormalizing the natural iridium capture to the Macklin capture value at 2 MeV.

2200 m/s cross sections (barns)	^{191}Ir	^{193}Ir
Total	968.26	131.34
Elastic	13.92	19.34
Capture	954.34	112.00
Resonance integral (barns)	3551.5	1373.0

PHOTON PRODUCTION (File 12)

The separation of the natural element into ^{191}Ir and ^{193}Ir is based on information given in the file 1 comments for MF = 12, MT = 102 in the original BROND evaluation and on Kruger [4].

REFERENCES

1. S. F. Mughabghab, **Neutron Cross Sections, Vol 1, Neutron Resonance Parameters and Thermal Cross Sections**, Part B (Academic Press, 1984)
2. F. H. Fröhner, **GA-8380** (1968) Gulf General Atomic
3. R. L. Macklin (ORNL), D. M. Drake and J. J. Malanify, **LA-7479-MS** (1978) Los Alamos National Laboratory
4. H. Kruger, et al., ***Nucl. Phys.* A169**, 363-384 (1971)

Evaluation: **^{197}Au Incident Neutron Library, Release 1 (MAT 7925)**
Energy Range: 10^{-5} eV to 30 MeV
Files: 1, 2, 3, 4, 5, 8, 10, 12, 13, 14, 15, 33
Evaluators: P. G. Young, E. D. Arthur (LANL)

ENDF/B-VI MOD 2 REVISION 1 (P. G. Young, LANL, July 1991)

File 1: The comments following were added regarding estimated (expanded) covariance for the Standards Cross Sections.

File 3: Q-value corrected for capture cross section.

STANDARDS COVARIANCES

Phase 1 reviewers of the ENDF/B-VI standards cross sections have expressed the concern that the uncertainties resulting from the combination of R-matrix and simultaneous evaluations might have led to uncertainties that are too small. As a result, the Standards Subcommittee produced (at the May, 1990 CSEWG meeting) a set of expanded covariance estimates for the standard cross section reactions. These uncertainties are estimates such that if a modern day experiment were performed on a given standard cross section using the best techniques, approximately 2/3 of the results should fall within these expanded uncertainties. The expanded uncertainties for the ^{197}Au(n,γ) cross section are given in the following table and are compared to values from the combined output of the standards covariance analysis:

Energy Range (keV)	Estimated Uncertainty %	Combined Analysis %
2.53×10^{-5}	0.14	0.14
200 - 500	3.0	1.31
500 - 1000	3.5	2.1
1000 - 2500	4.5	2.0

ENDF/B-VI MOD 1 NEW EVALUATION (P. G. Young, E. D. Arthur, LANL, January 1984)

See ENDF-201 Summary Documentation, 4th Edition (1991), page 325, for documentation of the ENDF/B-VI evaluation.

Evaluation: **^{207}Pb Incident Neutron Library, Release 1 (MAT 8234)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: C. Y. Fu, N. M. Larson, D. C. Larson (ORNL)

ENDF/B-VI MOD 2 REVISION 1 (C. Y. Fu, N. M. Larson, D. C. Larson, ORNL, July 1991)
Resonance parameters have been revised.

ENDF/B-VI MOD 1 NEW EVALUATION (C. Y. Fu, N. M. Larson, D. C. Larson, ORNL, March 1989)
See ENDF-201 Summary Documentation, 4th Edition (1991), page 336, for documentation of the ENDF/B-VI evaluation.

Evaluation: **^{209}Bi Incident Neutron Library, Release 3 (MAT 8325)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 13, 14, 15, 33
Evaluators: A. B. Smith, D. Smith, P. T. Guenther (ANL)

ENDF/B-VI MOD 1 REVISION 1 (V. McLane, NNDC, May 1995)
Minor correction to File 1 comments made in Release 3; MOD not changed.

ENDF/B-VI MOD 1 NEW EVALUATION (A. Smith, D. Smith, P. Guenther, et al., ANL, August 1989)
For complete documentation, see Guenther, et al. [1] and Summary Documentation, 4th Edition (1991), page 351.

REFERENCE

1. P. T. Guenther, R. D. Lawson, J. W. Meadows, A. B. Smith, D. L. Smith, M. Sugimoto, R. J. Howerton, **ANL/NDM-109** (1989) Argonne National Laboratory

Evaluation:	**^{235}U Incident Neutron Library, Release 1, 2, 3, 4 (MAT 9228)**
Energy Range:	10^{-5} eV to 20 MeV
Files:	1, 2, 3, 4, 5, 6, 12, 13, 14, 15, 31
Evaluators:	L. Weston (ORNL), P. G. Young (LANL), W. Poenitz (ANL), C. Lubitz (KAPL)

ENDF/B-VI MOD 5 REVISION 4 (V. McLane, NNDC, November 1996)

The following changes were made in File 1.
MT=455: Obsolete fields on second LIST record set to zero.
MT=456, prompt $\overline{\nu}$ updated.

ENDF/B-VI MOD 4 REVISION 3 (C. R. Lubitz, KAPL, November 1993)

The resonance parameters below 900 eV were adjusted as described in Lubitz [1]. The principal change was to increase the capture areas under the resonance so that the average capture cross section agreed with the data of Perez, et al. [4]. A smaller adjustment has been made to make the fission averages agree with the lower of several measurements, principally the work of Schrack [2], Weston [3], and Todd [5]. The thermal parameter $K_1 = (\nu\text{-}1)*$fission-capture (Maxwellian averages) was increased slightly by making small changes to the resonances below 0.5 eV. $\overline{\nu}$ and the fission widths were increased, and the capture widths were decreased iteratively, until the desired value of K_1 was reached, subject to the constraint that the 2200 m/sec values of $\overline{\nu}$, σ_f, and $\sigma_{n,\gamma}$ all differed from the Standards Committee recommendations (quoted below) by equal fractions of their uncertainties. This fraction ended up being 0.5 of one standard deviation.

The following thermal cross sections (0.0253 eV) and the resonance integrals for a 1/E spectrum (0.5 eV to 20 MeV) were computed using NJOY 91.38, at 293°K, with the following convergence criteria:

```
RECONR* 0.001    0   6    .01  1.E-6 / ERR    TEMPR  NDIGITS ERRMAX ERRINT
BROADR* 0.001 1.E6 .01 1.0E-6         / ERRTHN THNMAX ERRMAX  ERRINT
```

Other choices will give slightly different values.[5]

	Thermal (b)	Resonance Integral (b)	g-factors
$\sigma_{n,\gamma}$	98.59	143.4	0.9897
σ_f	584.81	277.5	0.9786
$\sigma_{n,\gamma}/\sigma_f$	0.517		
$\overline{\nu}$	2.4338		
K_1	723.0		

The uncertainties attached to the above values are the same as given by the Standards Committee and by Mughabghab [6]. For the g-factors, the Committee gives ±.0008 and for $\overline{\nu}$, ±.0036 [7].

[5] Some of these numbers are slightly different from those given in Ref. [1], and supersede them, although the underlying data are the same.

REFERENCES

1. C. R. Lubitz, **Nuclear Data for Science and Technology**, Int. Conference, Gatlinburg, TN, 9-13 May 1994 (American Nuclear Soc. 1994) Vol. 1, p. 646
2. R. C. Schrack, **Nuclear Data for Science and Technology**, Int. Conference, Mito, Japan, 30 May - 3 June 3 (Saikon Publishing 1988) p. 101
3. L. W. Weston and J. H. Todd, ***Nucl. Sci. Eng.* 88**, 567 (1984)
4. R. B. Perez, et al., ***Nucl. Sci. Eng.* 52**, 46 (1973)
5. J. H. Todd and L. W. Weston, private communication (1988)[6]
6. S. F. Mughabghab, **Neutron Cross Sections, Vol 1, Neutron Resonance Parameters and Thermal Cross Sections**, Part B (Academic Press, 1984)
7. A. D. Carlson, et al., **NISTIR 5177 (ENDF-351)** (1993) National Inst. of Standards and Technology

ENDF/B-VI MOD 3 REVISION 2 (L. W. Weston, February 1993)

Missing File 1 section added.

ENDF/B-VI MOD 1 NEW EVALUATION (L. Weston (ORNL), P. Young (LANL), W. Poenitz (ANL), April 1989)

See Summary Documentation, 4th Edition (1991), page 356, for complete summary of evaluation.

GENERAL INFORMATION (File 1)

The uncertainties on the fission cross section recommended by the CSEWG Standards Committee are listed. The updated description of File 2, the resolved resonance parameters, is given.

RESONANCE PARAMETERS (File 2)

The resolved resonance parameters were changed extensively. The neutron energy region below 4 eV was made a separate group. η decreases with decreasing neutron energy below 0.1 eV. At the higher neutron energies, the resonance parameters are more refined.

SMOOTH CROSS SECTIONS (File 3)

Smooth cross sections above 100 keV have minor corrections.

COVARIANCE FILES

File 31: $\bar{\nu}$ covariance files were updated.

File 33: All covariance files were removed as correct new files were not yet available.

The following reference is missing from the file 1 comments.

Ma88 D. G. Madland, **Preequilibrium Nuclear Reactions**, Specialists Meeting, Semmering, Austria, 10-12 February 1988, **NEANDC-245** (1988) p. 103.

---

[6] These measurements done on a flight path of 80 m. have a much better resolution than those of [3] and have been used above 110 eV.

Evaluation: **^{237}U Incident Neutron Sublibrary, Release 2 (MAT 9234)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: R. Benjamin, F. McCrosson (SRL); R. Howerton (LLNL) (Assembled by R. Kinsey NNDC)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, May 1993)

Missing fission neutron angular distribution added; assumed to be isotropic.

ENDF/B-VI MOD 1 EVALUATION (NNDC, February 1990)

ENDF/B-V MAT 8237 converted to ENDF-6 format. The ENDF/B-V evaluation is a combination of the evaluation of Benjamin and McCrosson[7] (SRL) and the ENDL evaluation of Howerton [5]. Important changes or modifications are noted.

GENERAL INFORMATION (File 1)

The thermal $\bar{\nu}$ value is computed from the semi-empirical work of Gordeeva and Smirenkin [1] as revised by Manero and Konshin [2]. The energy dependence is based on Howerton. Renormalization of the Howerton shape was done at BNL.

$\bar{\nu}_d$ taken from Brady and England [6].

RESONANCE PARAMETERS (File 2)

The resolved region is 0 to 102.5 eV. Resolved resonance parameters are determined by the GENPAR code [3] based on the SRL data set and an average level spacing of 3.5 eV [4]. A bound level at -2.109 eV was removed from the SRL parameters and appropriate backgrounds were inserted into the total, fission, and capture cross sections.

The unresolved resonances were evaluated on the same basis as the resolved over the region is 102.5 eV to 10 keV.

2200 m/s cross sections and resonance integrals

	σ (0.0253 eV)	I (0.5 eV - 20 MeV)
Total	487.106	
Elastic	9.131	
Fission	2.000	9.209
Capture	475.975	309.585

SMOOTH CROSS SECTIONS (File 3)

Total cross section The sum of capture and fission bound level backgrounds up to 10 keV are joined at 10 keV to the Howerton evaluation.

Elastic scattering, a zero background file up to 10 keV was joined to the Howerton evaluation.

[7] Unable to locate documentation for this evaluation (VM).

Inelastic scattering, (n,2n), and (n,3n) Taken from Howerton evaluation; threshold points inserted.

Fission and capture cross sections The background from the deleted bound level up to 10 keV was joined to the Howerton evaluation.

ANGULAR DISTRIBUTIONS (File 4)

Elastic taken from Howerton.

For (n,2n), (n,3n), and neutron production, dummy isotropic distributions were inserted.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

Inelastic scattering, (n,2n), and (n,3n) taken from Howerton evaluation.

Fission taken from McCrossen evaluation, simple Maxwellian with energy dependent temperature.

PHOTON PRODUCTION (Files 12, 13, 14, and 15)

The energy ranges of Howerton were extended to agree with File 3 ranges.

REFERENCES

1. L. D. Gordeeva and G. N. Smirenkin, ***Sov. At. En.*** **14**, 562 (1963); translated from ***At. En.*** **14**, 530 (1963)
2. F. Manero and V. A. Konshin, ***At. En. Rev.*** **10**, 637 (1972)
3. F. J. McCrosson, **Neutron Cross Sections for Science and Technology**, Conference, 15-17 March 1971, Knoxville, TN (National Technical Information Service 1971) p.714
4. J. H. McNally, et al., ***Phys. Rev. C*** **9** , 717 (1974)
5. R. Howerton, **UCRL 50400**, Vol. 15, Part D, Rev. 1, p. 323(1978) Lawrence Livermore National Laboratory
6. M. C. Brady and T. R. England, ***Nucl. Sci. Eng.*** **103**, 129 (1989)

Evaluation:	**^{238}U Incident Neutron Sublibrary, Release 1, 2 (MAT 9237)**
Energy Range:	10^{-5} eV to 20 MeV
Files:	1, 2, 3, 4, 5, 6, 12, 13, 14, 15, 31, 33
Evaluators:	L. W. Weston (ORNL), P. G. Young (LANL), W. Poenitz (ANL)

ENDF/B-VI MOD 3 REVISION 2 (L. Weston, ORNL, January 1993)

The preliminary evaluation of Moxon and Sowerby in the resolved resonance region has been replaced with the final version [1][8]. Fröhner's evaluation [2] of the unresolved resonance region up to 149 keV is used in this evaluation.

1. M. C. Moxon and M. G. Sowerby, Reactor Physics Conference, Jackson Hole, WY, 1988, Volume I, p. 281.
2. F. H. Fröhner, Reactor Physics Conference, Jackson Hole, WY, 1988, Volume III, p. 171.

ENDF/B-VI MOD 2 REVISION 1 (NNDC, July 1991)

Covariance files for total, fission, and capture were removed, since the correct files are not yet available.

ENDF/B-VI MOD 1 NEW EVALUATION (L. Weston (ORNL), P. Young (LANL), W. Poenitz (ANL), et al., November 1989)

See Summary Documentation, 4th Edition (1991), page 386, for summary documentation of ENDF/B-VI evaluation.

[8] This evaluation is identical to that in JEF-2.2 up to 149 keV.

Evaluation: **^{237}Np Incident Neutron Sublibrary, Release 1 (MAT 9346)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 6, 8, 9, 12, 13, 14, 15
Evaluators: P. G. Young, E. D. Arthur (LANL); F. M. Mann (HEDL)

ENDF/B-VI MOD 2 REVISION 1 (P. G. Young, E. D. Arthur (LANL), F. M. Mann (HEDL), July 1991)

Angular distribution data (isotropic) for 1st-, 2nd-, 3rd- and 4th-chance fission removed from File 4 because no energy spectra are available.

ENDF/B-VI MOD 1 NEW EVALUATION (P. G. Young, E. D. Arthur (LANL), F. M. Mann (HEDL), April 1990)

See Summary Documentation, 4th Edition (1991), page 397, for summary documentation of ENDF/B-VI evaluation.

Evaluation: **^{238}Np Incident Neutron Sublibrary, Release 2 (MAT 9349)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8
Evaluators: R. W. Benjamin, F. J. McCrosson (SRL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, May 1993)

The missing fission neutron angular distributions are added; assumed to be isotropic.

ENDF/B-VI MOD 0 (NNDC, February 1990)

ENDF/B-V MAT 8338 was converted to ENDF-6 format.

ENDF/B-V EVALUATION (R. W. Benjamin and F. J. McCrosson, SRL, August 1975)

GENERAL INFORMATION (File 1)

$\bar{\nu}$ thermal value computed from semi-empirical work of Gordeeva and Smirenkin [1] as revised by Manero and Konshin [2]. Energy dependence based on Howerton [3].

$\bar{\nu}_d$ taken from M. C. Brady and T. R. England [5].

RESONANCE PARAMETERS (File 2)

Resolved resonance parameters in the region 0 to 100.2 eV are determined by the GENRPAR code [4] based on the SRL data set and an average level spacing of 1.05 eV.

Unresolved resonance parameters in the region 100.2 to 10 keV are determined on the same basis as the resolved with average resonance parameters.

2200 m/s cross sections and resonance integrals

	σ(0.0253 eV)	I (0.5 eV - 20 MeV)
Total	2250.99	
Elastic	21.25	
Fission	2026.90	895.60
Capture	202.83	100.03

SMOOTH CROSS SECTIONS (File 3)

The data in File 3 are given only so that the various processing codes will work. Continuity with the unresolved region is provided, but the cross sections drop immediately to zero. The elastic scattering cross section above 10 keV is the potential scattering cross section calculated with a spherical optical model potential at 10 keV.

ANGULAR DISTRIBUTIONS (File 4)

The elastic distributions are taken from ENDF/B-V ^{238}U.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

A simple fission Maxwellian with energy dependent temperature is used.

REFERENCES

1. L. D. Gordeeva and G. N. Smirenkin, ***Sov. At. En.*** **14**, 562 (1963); translated from ***At. En.*** **14**, 530 (1963)
2. F. Manero and V. A. Konshin, ***At. En. Rev.*** **10**, 637 (1972)
3. R. J. Howerton, ***Nucl. Sci. Eng.*** **46**, 42 (1971)
4. F. J. McCrosson, **Neutron Cross Sections for Science and Technology**, Conference, 15-17 March 1971, Knoxville, TN (National Technical Information Service 1971) p.714
5. M. C. Brady and T. R. England, ***Nucl. Sci. Eng.*** **103**, 129 (1989)

Evaluation: **^{236}Pu Incident Neutron Sublibrary, Release 4 (MAT 9428)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); T. Hojuyama (MAPI); Y. Kikuchi, T. Nakagawa (JAERI)

ENDF/B-VI MOD 1 NEW EVALUATION (R.Q. Wright, ORNL, September 1995)

This evaluation is an update of the JENDL-3.2 Evaluation. The following changes were made.

GENERAL COMMENTS (File 1)

$\bar{\nu}_p$ Tabulated data added.

RESONANCE PARAMETERS (File 2)

Resolved resonance parameters are given in the range 1.0×10^{-5} to 10 eV using a MLBW formalism. Parameters are given for the -1.27, 3.16, 6.30, 12.0 eV resonances.

Average Γ_γ = 0.044 meV, Γ_f = 0.325 meV, $\Gamma_n^0 = 5.71193\times10^{-4}$ meV. D_0 = 4.42333 eV, $S_0 = 1.72176\times10^{-4}$ eV, and the scattering radius = 9.46 fm.

SMOOTH CROSS SECTIONS (File 3)

Total cross section (MT=1) Revised from 10 eV to 20 MeV. The cross section was obtained by addition of all partial cross sections in the revised evaluation. The total cross section was reduced by 0.6 barns for the energy range 7-20 MeV; this change is due to the lower fission cross section (see discussion of the revised fission cross section).

Comparison of revised total with ^{239}Pu total

Energy (MeV)	^{236}Pu/^{239}Pu total
3.0	1.000
5.0	0.966
7.0	0.981
10.0	0.979
12.0	0.986
14.0	1.008
16.0	1.037
20.0	1.050

Elastic cross section (MT=2) Revised from 10 ev to 50 keV, based on the unresolved resonance calculation described above. Above 50 keV, the elastic from the JENDL-3.2 evaluation is revised to get the final elastic cross section.

Inelastic cross section Revised from 5 to 7 MeV.

Fission cross section Revised:

a) from 10 eV to 6 MeV based on measured data Gromova, et al., [1], tables 2 and 3.

b) above 6 MeV, revised based on the measured value at 5.78 MeV of Gromova, et al. [1], table 3.

c) for the energy range 7-20 meV, the fission cross section is reduced by 0.6 barns.

Comparison of evaluated fission with Gromova, et al. [1]

Maximum energy (eV)	Ref. 1 (barns)	Evaluation (barns)
46.5×10^3	4.3 ± 0.2	4.270
21.5×10^3	5.2 ±0.3	5.225
10.0×10^3	6.8 ± 0.3	6.686
4.65×10^3	8.9 ± 0.4	8.913
2.15×10^3	13.5 ± 0.8	13.43
1.000×10^3	20.9 ± 0.8	21.11
465	33.3 ± 1.5	33.12
215	46.0 ± 1.3	42.35
100	47.2 ± 1.5	50.88
46.5	72.0 ± 2.0	72.31
21.5	91.0 ± 2.0	91.09
10.0	50.0 ± 3.0	250.1
4.65	615.0 ± 6.0	614.3
2.15	25.0 ± 2.0	32.05
1.0	33.0 ± 3.0	29.62

In the range 10 eV to 50 keV, the elastic scattering and α were obtained from an unresolved resonance calculation using the following parameters: $S_0 = 9.92\times10^{-5}$, $\langle D_0\rangle = 2.5$ eV, $\langle\Gamma_\gamma\rangle = 0.044$ eV, $\langle\Gamma_f\rangle = 0.400$ eV, scattering radius = 9.33 fm.

First-chance fission cross section (MT=19) Revised to reflect the changes in MT=18.

Capture cross section (MT=102) Revised from 10 eV to 300 keV based on the estimated value of α (capture/fission ratio) obtained from an unresolved resonance calculation for the energy range 10 eV to 50 keV. The value of α obtained from this calculation is almost constant; thus a value of 0.17 is used.

For the range 20-300 keV, the capture cross section is obtained by log-log interpolation using the following values: (20 kev, 799 mb) and (300 kev, 419 mb). The corresponding values of α are 0.170 and 0.166, at 20 and 300 keV, respectively.

Calculated 2200 m/s cross sections and resonance integrals

	σ(0.0253 eV)	I (0.5 eV - 20 MeV)
Total	205.4	
Elastic	9.2	
Fission	165.0	992
Capture	31.2	286
Absorption	196.2	1278.

REFERENCES

1. E. A. Gromova, et al., ***Sov. At. En.*, 68**, 223 (1990); translated from ***At. En.* 68**, 193 (1990)

Evaluation: **^{239}Pu Incident Neutron Sublibrary, Release 2 (MAT 9437)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 6, 12, 13, 14, 15
Evaluators: P. Young (LANL); L. W. Weston, H. Derrien (ORNL); W. Poenitz (ANL); T. Nakagawa (JAERI)

ENDF/B-VI MOD 2 REVISION 1 (L. Weston, H. Derrien (ORNL); T. Nakagawa (JAERI), January 1993)

The resonance region evaluation by H. Derrien and T. Nakagawa has been added, and has extended the resonance region to 2.5 keV. The resonance parameters have been obtained from a SAMMY [1] fit analysis[9] of high resolution experimental data. The file contains three independent sections:

1) Energy range 0 to 1 keV. The set of resonance parameters contains 398 resonances in the energy range 0 to 1 keV, 4 fictitious negative energy resonances and 3 fictitious resonances above 1 keV;
2) Energy range 1 to 2 keV. The set of resonance parameters contains 435 resonances in the energy range 0.980 to 2.02 keV, 3 fictitious resonances below 0.9 keV and 3 fictitious resonances above 2.02 keV;
3) Energy range 2 to 2.5 kev. The set of resonance parameters contains 218 resonances in the energy range 1.98 to 2.53 keV, 3 fictitious resonances below 1.98 keV and 3 fictitious resonances above 2.53 keV.

In all sections, the fictitious resonance parameters take into account the contribution of all the external truncated resonances in such a way that no total, scattering, fission and capture smooth files are needed in the corresponding energy ranges for the reproduction of the cross sections within the experimental errors.

The following experimental data base has been used in the SAMMY fits: absorption and fission from Gwin, et al. [2,4]; fission from Gwin et al. [5,6], Blons [3], Weston, et al. [7,8]; transmission from Spencer, et al. [10], Harvey, et al. [9].

Prior to the fits, the experimental fission and absorption cross sections were normalized, directly or indirectly, to the 0.0253 eV values obtained by the ENDF/B-VI standard evaluation group [11]. The transmission data were considered as accurate absolute measurements (the Spencer total cross section at 0.0253 ev is 1025.0 b, in excellent agreement with the 1027.3 b standard value). Details on the analysis are found in references [8,12,13].

293°K cross sections calculated from resonance parameters

	SAMMY	RESEND	Proposed
Fission	747.64	747.90	747.99±1.87
Capture	271.10	270.73	271.43±2.14
Scattering	7.97	7.99	7.88±0.97
Total	1026.71	1026.62	1027.30±5.00

[9] Performed at ORNL by H. Derrien and G. deSaussure and at JAERI by H. Derrien and T. Nakagawa

REFERENCES

1. a. N. M. Larson, et al., **ORNL/TM-7485** (1980) Oak Ridge National Laboratory
   b. N. M. Larson, **ORNL/TM-9179** (1984) Oak Ridge National Laboratory
   c. N. M. Larson, **ORNL/TM-9719/R1** (1985) Oak Ridge National Laboratory
2. R. Gwin, et al., ***Nucl. Sci. Eng.*** **45**, 25 (1971)
3. J. Blons, ***Nucl. Sci. Eng.*** **51**, 130 (1973)
4. R. Gwin, et al., ***Nucl. Sci. Eng.*** **59**, 79 (1976)
5. R. Gwin, et al., ***Nucl. Sci. Eng.*** **61**, 116 (1976)
6. R. Gwin, et al., ***Nucl. Sci. Eng.*** **88**, 37 (1984)
7. L. W. Weston, et al., ***Nucl. Sci. Eng.*** **88**, 567 (1984)
8. L. W. Weston, et al., to be published (high resolution 1988 data)
9. J. A. Harvey, et al., **Nuclear Data for Science and Technology**, Int. Conference, Mito, Japan, 30 May - 3 June 3 (Saikon Publishing 1988) p. 115
10. R. R. Spencer, et al., ***Nucl. Sci. Eng.*** **96**, 318 (1987)
11. A. Carlson, et al., preliminary results of the ENDF/B-6 Standard Evaluation (Sep. 8, 1987)
12. H. Derrien and G. de Saussure, **ORNL-TM-10986** (1988) Oak Ridge National Laboratory
13. H. Derrien and G. de Saussure, ***Nucl. Sci. Eng.*** **106**, 434 (1990)

ENDF/B-VI MOD 1 NEW EVALUATION (P. Young (LANL), L. Weston (ORNL), W. Poenitz (ANL), April 1989)

See Summary Documentation, 4th Edition (1991), page 415, for summary documentation of ENDF/B-VI evaluation.

Evaluation: **^{240}Pu Incident Neutron Sublibrary, Release 1,2 (MAT 9440)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15, 31, 32, 33
Evaluators: L. W. Weston, E. D. Arthur
Laboratory: ORNL, LANL

ENDF/B-VI MOD 3 REVISION 2 (L. Weston, ORNL, January 1993)

Added missing fission neutron angular distributions in File 4 (MT=19, MT=20 and MT=21); assumed to be isotropic.

Corrected U value for File 5, MT=20.

Fixed incorrect NER value in File 32, MT=151.

ENDF/B-VI MOD 2 REVISION 1 (L. Weston, ORNL, July 1991)

Covariance File 33 for fission (MT=18) deleted.

ENDF/B-VI MOD 1 NEW EVALUATION 1 (L. Weston (ORNL), E. Arthur (LANL), August 1993)

See ENDF-102 Summary Documentation, 4th Edition (1991), page 434, for documentation of ENDF/B-VI evaluation.

Evaluation: **^{241}Pu Incident Neutron Data, Release 1, 3 (MAT 9443)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15, 31
Evaluators: L. W. Weston, R. Q. Wright, H. Derrien, et al. (ORNL)

ENDF/B-VI MOD 3 REVISION 2 (L. Weston, ORNL, August 1994)

Covariances, which are dependent in the ^{235}U covariances which are not completed, were stripped off the file.

ENDF/B-VI MOD 2 REVISION 1 (L. Weston, ORNL, June 1991)

The following changes were made for Revision 2:

1. insertion of revised resonance parameters by Derrien;
2. renormalization of capture above the resolved resonance region to be 4.8% lower than ENDF/B-V and upward from 14% down in original ENDF/B-VI evaluation. Scattering was adjusted to make up difference. The renormalization was the suggestion of Derrien after study of the new measurements by Wagemans, et al. [1].

Revision of the ^{241}Pu (H. Derrien, Japanese Atomic Energy Research Institute)

Resonance parameters of the neutron cross sections of ^{241}Pu were obtained by Derrien and de Saussure [2] in the energy range from thermal to 300 eV by a Bayesian fit of selected experimental effective total, fission, and capture cross sections using the Reich-Moore fitting code SAMMY [3]. The results of this work were used in the ENDF/B-VI MOD1 evaluated data file. Some difficulties were encountered in the normalization of the experimental fission cross sections due to the discrepancies in the shape of the available experimental data both in thermal and high energy ranges. The consistency among the experimental data base could not be obtained without large renormalization and background correction parameters in the SAMMY fits. Particularly, it was shown that the discrepancy between the fission cross sections in the thermal energy range was due to a deviation from the 1/v shape below about 0.05 eV.

New fission cross section measurements were recently performed by Wagemans, et al. [1,4][10] in the energy range from 0.002 eV to 20 eV in order to check the shape of the cross section in the thermal energy range. They showed a shape which was a contradiction to all the previous measurements reported in the literature. Consequently, the normalization of all the previous results using the low energy region could be erroneous. Particularly, the discrepancy observed in the average fission cross section over the 0.26 eV resonance could be due to the errors of normalization in the thermal region. Wagemans, et al., compared the ENDF/B-VI MOD1 data to their 1991 results and concluded that the evaluated data files using the evaluation of Derrien and de Saussure should be revised in the energy range up to 300 eV.

In the energy range from 0.01 eV to 3 eV the 1991 data of Wagemans are on average 2.2% smaller than ENDF/B-VI MOD1. This difference is mainly due a difference of 3% between the 1976 Wagemans, et al. [5] and 1991 Wagemans, et al. [1]. The 1976 Wagemans data were used in the evaluation of Derrien and de Saussure in the low energy region.

---

[10]Hereinafter called Wagemanns 1991.

In the intermediate energy range from 3 eV to 12 eV, the average fission of ENDF/B-VI MOD1 is in excellent agreement with the 1991 Wagemans data. In this energy range, the SAMMY fits of Derrien and de Saussure were performed on the fission cross section of Weston and Todd [6], of Blons [7] and of Migneco, et al. [8], with an adjustment of the normalization factor and of the background correction parameters of all the experimental data; the agreement between the 1991 Wagemans data and ENDF/B-VI MOD1 shows that, at least in this energy range, SAMMY performed on the data of Weston and Todd a renormalization equivalent to that recommended by 1991 Wagemans.

In the higher range up to 300 eV, the SAMMY fits relied mainly on the high resolution measurements of Blons and of Migneco, et al., for the accurate determination of the resonance parameters. Quite large normalization coefficients and background correction parameters were also needed in this energy range to obtain the consistency between the calculated cross sections and the experimental data. However, the result of the fits was in quite good agreement with the data of Weston and Todd normalized to the 1976 Wagemans data in the low energy region, which is also equivalent to the normalization to the 1983 Wagemans, et al. [9] data. Since the 1976 Wagemans data should decrease by 3% to be consistent with the 1991 data, it is likely that the ENDF/B-VI MOD1 fission cross section could be too large by about 3% in the energy range above 12 eV.

REVISION OF THE RESONANCE PARAMETERS

An accurate up-dating of the ^{241}Pu resonance parameters could be obtained by renormalizing the fission experimental data base according to the 1991 Wagemans data, and by redoing the SAMMY fits of the new experimental data base, including the high resolution transmission data of Harvey and Simpson [10]. Due to lack of time a new SAMMY analysis was performed only in the energy range from 0.002 eV to 3 eV. In the energy range above 3 eV, the updating was performed by applying some small corrections to the resonance parameters.

The SAMMY analysis of the 1991 Wagemans data along with the total cross section of Young and Smith [11] was performed in the energy range from 0.002 eV to 3 eV, by starting with the ENDF/B-VI MOD1 resonance parameters. Only the parameters of the 3+ resonances at -0.122 eV and at 0.265 eV were adjusted in this energy range. The values of the cross sections calculated at 0.0253 eV are compared to the standard data [12] in Table 1. The average total, fission and capture cross sections calculated with the new resonance parameters are displayed on Table 2, 3 and 4 with the corresponding experimental data and the values obtained from ENDF/B-VI MOD1. One should point out that an energy shift of dE/E = +0.00384 was applied to the data of Young and Smith in order to achieve a good consistency with the energy scale of the fission 1991 Wagemans data over the resonance at 0.0265 eV.

In the energy range above 3 eV, the small corrections applied to the resonance parameters result in a decrease of the average fission cross section and in an increase of the average capture cross section,with a variation of the average total cross section smaller than the errors of the experimental data of Harvey and Simpson. The average values of the fission and capture cross sections calculated with the new resonance parameters are shown in Table 5 and 6 along with the renormalized fission cross section of Weston and Todd and the values calculated from ENDF/B-VI MOD1.

Table 1
Cross sections at 0.0253 eV

	Present results	ENDF/B-VI Standard [14]
Fission	1012.50(-0.0%)	1012.68±6.58
Capture	361.52(+0.1%)	361.29±4.95
Scattering	11.36(-7.1%)	12.17±2.62
Total	1385.38(-0.1%)	1386.14±8.64

Table 2
The total cross section integral in the energy range from 0.0021 eV to 3 eV.

Energy range (eV)	Present work (b.eV)	ENDF/B-VI (b.eV)	Young and Smith [13] (b.eV)
0.0021-0.020	43.54	43.09(-1.0%)	43.25(-0.7%)
0.0200-0.030	14.03	14.02(-0.1%)	14.01(-0.1%)
0.0300-0.100	65.09	66.17(+1.7%)	64.99(-0.1%)
0.1000-0.500	378.38	385.27(+1.8%)	380.10(+0.4%)
0.5000-1.000	29.74	29.41(-1.1%)	31.19(+4.4%)
1.0000-3.000	83.36	83.92(+0.7%)	82.50(-1.0%)
0.0021-3.000	614.14	621.88(+1.3%)	616.04(+0.3%)

Table 3
The fission cross section integral in the energy range from 0.0021 eV to 3 eV.

Energy range (eV)	This work (b.eV)	ENDF/B-VI (b.eV)	Wagemans, et al. (b.eV) [1]	Weston and Todd (b.eV) [8]
0.0021-0.020	31.06	30.61(-1.5%)	31.09(+0.1%)	
0.0200-0.030	10.24	10.22(-0.2%)	10.24(0.0%)	
0.0300-0.100	49.02	50.02(+2.0%)	48.70(-0.6%)	
0.1000-0.500	262.76	270.84(+3.1%)	264.58(+0.7%)	262.53(-0.1%)
0.5000-1.000	17.93	17.64(-1.6%)	17.60(-1.8%)	17.67(-1.4%)
1.0000-3.000	54.88	55.62(+1.3%)	54.40(-0.9%)	55.06(+0.3%)
0.0021-3.000	425.89	434.95(+2.1%)	426.61(+0.2%)	
0.1000-3.000	335.57	344.10(+2.5%)	336.58(+0.3%)	335.26(-0.1%)

Weston and Todd experimental data were normalized to 1991 Wagemans in the energy range from 0.1 eV to 12 eV.

Table 4
The capture cross section integral in the energy range from 0.0021 eV to3 eV.

Energy range (eV)	Present work (b.eV)	ENDF/B-VI (b.eV)	Weston and Todd [8] (b.eV)
0.0200-0.030	3.67	3.68(+0.3%)	
0.0300-0.100	15.28	15.39(+0.7%)	15.27(-0.1%)
0.1000-0.500	110.58	109.47(-1.0%)	110.49(-0.1%)
0.5000-1.000	5.90	5.87(-0.5%)	6.51
1.0000-3.000	7.30	7.14(-2.2%)	8.96
0.0021-3.000	154.98	153.83(-0.7%)	
0.0300-3.000	139.06	137.87(-0.9%)	141.29(+1.6%)

Weston and Todd experimental data were normalized to the calculated average capture cross section over the resonance at 0.264 eV; in the energy range from 0.5 eV to 3 eV the experimental data are not accurate due to large corrections for the impurities.

Table 5
The fission cross section integral in the energy range from 3 eV to 300 eV.

Energy range (eV)	Present work (b.eV)	ENDF/B-VI (b.eV)	Weston and Todd [8] (b.eV)
3- 20	3038.63	3066.37(+0.9%)	3036.23(-0.1%)
20- 50	1683.69	1739.68(+3.3%)	1705.50(+1.3%)
50-100	1971.15	2030.10(+3.0%)	1931.50(-2.0%)
100-200	2554.85	2628.39(+2.9%)	2531.00(-0.9%)
200-300	2741.23	2820.75(+2.9%)	2747.00(+0.2%)
3-300	11989.55	12285.29(+2.5%)	1951.23(-0.3%)

Weston and Todd experimental data were normalized to 1991 Wagemans in the energy range from 0.1 eV to 12 eV.

Table 6
The capture cross section integral in the energy range from 3 eV to 300 eV.

Energy range (eV)	Present work (b.eV)	ENDF/B-VI (b.eV)	Weston and Todd [8] (b.eV)
3- 20	1213.07	1138.52(-6.5%)	1192.90(-1.7%)
20- 50	330.34	307.48(-7.5%)	338.09(+2.3%)
50-100	605.40	585.88(-3.2%)	594.83(-1.8%)
100-200	609.83	581.77(-4.8%)	652.68(+7.0%)
200-300	684.97	661.12(-3.6%)	700.53(+2.3%)
3-300	3443.36	3274.77(-5.1%)	3479.04(+1.0%)

Weston and Todd experimental data normalized to the calculated average capture cross section over the resonance at 0.265 eV.

CONCLUSION

The results of the 1991 Wagemans fission cross section measurements in the energy range from 0.002 eV to 4 eV were used in a new evaluation of the resonance parameters. The accuracy of the calculated cross sections was greatly improved in the resonance at 0.265 eV. The cross sections averaged over this resonance should have the same accuracy as the standard values at 0.0253 eV. In the high energy region up to 300 eV the SAMMY analysis of the new experimental data base obtained by the renormalization of the experimental data is recommended in order to improve the corrections to the resonance parameters performed in the present work.

REFERENCES

1. C. Wagemans, et al., **Nuclear Data for Science and Technology**, Conference, Jülich, Germany, 13-17 May 1991 (Springer-Verlag, 1992) p. 35
2. H. Derrien and G. de Saussure, ***Nucl. Sci. Eng.* 106**, 415 (1990)
3. N. M. Larson and F. G. Perey, **ORNL/TM-9719/R1** (1985) Oak Ridge National Laboratory
4. C. Wagemans, P. Schillebeeckx, A. Deruytter and R. Barthelemy, PHYSOR 90, Conference, Marseille, France, 23-26 April 1990 (1990), Vol.1, III-9
5. C. Wagemans and A. J. Deruytter, ***Nucl. Sci. Eng.* 60**, 44 (1976)
6. L. W. Weston and J. H. Todd, ***Nucl. Sci. Eng.* 65**, 454 (1978)
7. J. Blons, ***Nucl. Sci. Eng.* 51**, 130 (1973)
8. E. Migneco, J. P. Theobald and J. A. Wartena, **Nuclear Data for Reactors**, Conference, Helsinki, Finland, 15-19 June 1970, Vol.I (I. A. E. A., 1970) p.437
9. C. Wagemans and A. Deruytter, **Nuclear Data for Science and Technology**, Conference, Antwerp, Belgium, 6-10 September 1982 (D. Reidel Publishing, 1983) p. 69
10. J. A. Harvey and O. D. Simpson, Oak-Ridge National Laboratory(1973), unpublished
11. T. B. Young and J. R. Smith, **WASH-1093**, p. 60 (1968) AEC Nuclear Cross Section Advisory Committee
12. A. Carlson, et al., ENDF/B-VI standard evaluation, private communication from R. W. Peele (1987)

ENDF/B-VI MOD 1 NEW EVALUATION (L. Weston, ORNL, October 1988)

See ENDF-201 Summary Documentation, 4th Edition (1991), page 446, for documentation of ENDF/B-VI evaluation.

Evaluation: **^{243}Pu Incident Neutron Sublibrary, Release 2 (MAT 9449)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: R. Benjamin, F. McCrosson (SRL); R. Howerton (LLNL) (assembled by R. Kinsey, BNL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, May 1993)
Added missing fission neutron angular distribution; assumed to be isotropic.

ENDF/B-VI MOD 0 (NNDC, February 1990)
ENDF/B-V MAT 8443 converted to ENDF-6 format.

ENDF/B-V EVALUATION (assembled by R. Kinsey, NNDC, February 1990)
ENDF/B-V MAT 8443 was converted to ENDF-6 format. This evaluation is, in general, a combination of the August 1975 evaluation of Benjamin and McCrosson at SRL and the ENDL evaluation of Howerton at LLNL [5]. Important changes or additions are noted.

GENERAL INFORMATION (File 1)
$\bar{\nu}$ thermal value computed from semi-empirical work of Gordeeva and Smirenkin [1] as revised by Manero and Konshin [2]. Energy dependence based on work of Howerton [3].

RESONANCE PARAMETERS (File 2)
Resolved resonance region (0 to 101.7 eV). Resonance parameters are determined by the GENRPAR code [3] based on the estimated resonance integrals and thermal cross sections from production studies [4].
Unresolved region (101.7 eV to 10 keV). Unresolved resonances are determined with average parameters by GENRPAR.

2200 m/s cross sections and resonance integrals

	σ(0.0253 eV)	I (0.5 eV - 20 MeV)
Total	289.252	
Elastic	19.752	
Fission	181.394	557.436
Capture	88.106	274.163

SMOOTH CROSS SECTIONS (File 3) (1.-5 EV TO 20 MEV)
For total, elastic, fission, and capture, zero background files up to 10 keV are joined to the Howerton evaluation.
(n,2n), (n,3n), and (n,4n), are taken from the Howerton evaluation with threshold calculated from the Q value.

ANGULAR DISTRIBUTIONS (File 4)

Elastic is taken from the Howerton evaluation, culled to 101 points per distribution and renormalized.

(n,2n), (n,3n), (n,4n), and the inelastic scattering to the continuum are dummy distributions.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

(n,2n), (n,3n), (n,4n), and the inelastic scattering to the continuum are taken from the Howerton evaluation.

Fission is a simple fission Maxwellian with energy-dependent temperature taken from the SRL evaluation.

REFERENCES

1. L. D. Gordeeva and G. N. Smirenkin, ***Sov. At. En.*** **14**, 562 (1963); translated from ***At. En.*** **14**, 530 (1963)
2. F. Manero and V. A. Konshin, ***At. En. Rev.*** **10**, 637 (1972)
3. F. J. McCrosson, **Neutron Cross Sections for Science and Technology**, Conference, 15-17 March 1971, Knoxville, TN (National Technical Information Service 1971) p.714
4. R. W. Benjamin, et al., **DP-1394** (1975) Savannah River Laboratory
5. R. J. Howerton, **UCRL 50400**, Vol 15, Part D, Rev. 1, p. 379 (1978) Lawrence Livermore National Laboratory

^{241}Am Incident Neutron Sublibrary, Release 2, 3

Evaluation:	**^{241}Am Incident Neutron Data, Release 2, 3** (MAT 9543)
Energy Range:	10^{-5} eV to 30 MeV
Files:	1, 2, 3, 4, 5, 6, 8, 9, 12, 13, 14, 15, 32, 33
Evaluators:	P. G. Young, D. W. Madland (LANL); Zhou Delin, Yu Baosheng, et al. (CNDC)

ENDF/B-VI MOD 3 REVISION 2 (P. G. Young, D. G. Madland, LANL, August 1994)

The cross section data file for neutron reactions with ^{241}Am has been reevaluated over the incident neutron energy range from 0.01 to 30 MeV. Details of the analysis are given in the sections that follow. Some general features of the work are:

1. The ENDF/B-VI MOD 2, resonance parameters were adopted at neutron energies below 30 keV, suitably joined with the results of the present analysis at 30 keV.
2. A coupled-channel optical model potential was developed from analyses of nearby actinides that is consistent with measurements of the neutron total cross section. This potential was used to calculate the neutron total cross section, elastic and inelastic scattering cross sections and angular distributions, and reaction cross sections and transmission coefficients for a theoretical analysis of the reaction channels. The direct cross sections from the coupled-channel analysis were combined with compound nucleus calculations at lower energies and with preequilibrium theory calculations at higher energies. Angular distributions for the first 40 excited states of ^{241}Am were obtained from the direct, compound-nucleus, and preequilibrium calculations, and energy-angle correlated distributions are provided for all continuum neutrons.
3. The evaluated fission and total cross sections were obtained by adjusting the theoretical cross sections as needed to match the available experimental data.
4. $\bar{\nu}$ and the fission neutron spectra were obtained using Madland-Nix theory.

ENDF/B-VI MOD 2 REVISION 1 (NNDC, June 1992)

Energy release per fission added from ENDF/B-V.

ENDF/B-VI MOD 2 NEW EVALUATION (P. G. Young, D. G. Madland, LANL, February 1988)

THEORETICAL ANALYSIS

The primary goal of the theoretical analysis was to provide a consistent set of data for all reactions over the energy range 30 keV to 30 MeV. In the case of n+^{241}Am, there are reasonable experimental data available for the neutron total and fission cross sections. Therefore, the function of the theoretical analysis was to provide the elastic, inelastic, (n,2n), (n,3n) and (n,4n) cross sections, as well as the angular and energy distributions of secondary neutrons. To accomplish this, a theoretical analysis was performed, adjusting the relevant parameters to match the total, fission, and (n,γ) cross sections. Additionally, a theoretical analysis was performed to obtain the average neutron multiplicity from fission and the energy spectra of fission neutrons as a function of incident energy.

Coupled-channel deformed optical model calculations were performed with the ECIS code [Ra70] over the incident neutron energy range from 0.001 to 30 MeV. Hauser-Feshbach reaction theory calculations were carried out with the LANL version of the COMNUC code [Du70] at lower energies and the GNASH statistical/preequilibrium code [Yo92] at higher energies to obtain all partial reaction cross section data. Both reaction theory codes used neutron transmission coefficients from the optical model analysis.

A. Optical Model

The optical model potential was obtained by considering several coupled-channel parameterizations developed from n+^{235,238}U and ^{239}Pu experimental data [Ma78, Yo88, Yo92a]. Parameters were adjusted until a reasonable fit to experimental data for the neutron total cross section of ^{241}Am was obtained. The lowest five members of the 5/2- ground state rotational band were included in the calculations, that is, the 7/2-, 9/2-, 11/2- and 13/2- excited states at E_x = 41, 94, 159 and 235 keV were coupled with the 5/2- ground state.

B. Reaction Theory Calculations

The Hauser-Feshbach statistical calculations were performed with the COMNUC and GNASH codes. Both codes include a double-humped fission barrier model, using uncoupled oscillators for the barrier representation in GNASH and coupled or uncoupled oscillators in COMNUC, as described by Arthur [Ar82a]. The COMNUC calculations include the possibility of width-fluctuation corrections and corrections for class II fluctuations [Ly74], which are needed at lower energies, whereas GNASH provides the preequilibrium corrections that are required at higher energies. Accordingly, COMNUC was used in the calculations below about 2 MeV, utilizing a non-resonant model and including class II fluctuations, and the GNASH code was employed at higher energies using two uncoupled oscillators in the fission calculations.

Each compound nucleus formed in the calculations is permitted to decay through the fission channel, by neutron emission, and by gamma-ray emission. Neutron transmission coefficients for the Hauser-Feshbach calculations are obtained from the coupled-channel optical model. Gamma-ray transmission coefficients are obtained from gamma-ray strength functions calculated with the generalized Lorentzian model of Kopecky and Uhl [Ko90]. Transmission coefficients for fission are calculated from the fission model summarized here and detailed in [Yo92b]. Gilbert and Cameron [Gi70] phenomenological level density functions were used to represent continuum levels at ground-state deformations, appropriately matched to available experimental structure data at lower excitation energies. Multiplicative factors were applied to the level density functions to account for enhancements in the fission transition state densities at the fission barriers due to increased asymmetry conditions, and the continuum level densities were matched to the discrete fission transition states at each barrier. The discrete fission transition state spectra were calculated from bandhead information taken from calculations and compilations by Britt [Br82] and by Nagel [Na91].

DESCRIPTION OF EVALUATED DATA BASE

A. Total Cross Section

The evaluated total cross section below 30 keV is obtained from the ENDF/B-VI MOD 2 resonance parameter evaluation, suitably matched to the results of the current analysis at 30 keV. From 30 keV to 30 MeV, the coupled-channel deformed optical model calculations described above were modified to agree with the experimental data of Phillips [Ph70].

B. Elastic Cross Section

The elastic cross section at all energies is obtained from the difference of the total and nonelastic cross sections. Below 30 keV it comes from the ENDF/B-VI MOD 2 resonance parameters and at higher energies it is mainly determined by the coupled- channel optical model calculations. Angular distributions for elastic neutrons were obtained at all energies from the coupled-channel calculations and are given as Legendre expansions.

C. Fission Cross Section

The fission cross section was obtained by adjusting the results of the theoretical analysis to optimize agreement with experimental data. At most energies the adjustment was less than a few percent. Above 8 MeV, the theoretical values were used directly. Neutrons from fission are assumed to isotropic in the laboratory system.

D. Radiative Capture Cross Section

The radiative capture cross section is calculated using the generalized Lorentzian model of Kopecky and Uhl [Ko90]. The normalization of the strength function was set by requiring the calculated (n,γ) cross section be consistent with measured values.

E. Inelastic Neutron Cross Sections

Discrete (n,n′) cross sections are included for the lowest 40 excited states. The first, second, third, and fifth excited states are members of the K = 5/2 ground-state rotational band and include coupled-channel as well as compound nucleus contributions. The remaining discrete-state cross sections through the 40th excited state are combinations of compound nucleus and preequilibrium contributions and were calculated with the GNASH code. Angular distributions for all the discrete inelastic neutrons are appropriate combinations of the compound nucleus, direct reaction, and preequilibrium contributions and are represented by Legendre expansions.

The inelastic data corresponding to excitation energies in ^{241}Am above 0.508 MeV are given as energy-angle correlated continuous spectra and were calculated with the GNASH code. The results are given in File 6 and utilize systematics by Kalbach [Ka88] for angular distribution information, parameterized in terms of preequilibrium ratios calculated in GNASH.

F. Cross Sections for ^{241}Am(n,xn) Reactions

The (n,2n), (n,3n), and (n,4n) cross sections result entirely from the theoretical analysis and GNASH calculations. Energy-angle correlated distributions are given for all the (n,xn) reactions, making use of Kalbach's systematics [Ka88] and the ENDF-6 File 6 representation.

G. $\bar{\nu}$

The evaluation of delayed $\bar{\nu}$ was carried over directly from ENDF/B-VI MOD 2. The prompt $\bar{\nu}$ evaluation was obtained using Madland-Nix theory.

H. Fission Neutron Spectra

The fission neutron spectra was determined using Madland-Nix theory and are consistent with $\bar{\nu}$.

REFERENCES

Ar82 E. D. Arthur, **Fast Neutron Scattering on Actinide Nuclei,** OECD/NEA Specialists' Meeting, Paris, France, November, 1981, **NEANDC-158** (1982) p. 145

Ba74 B. B. Back, et al., ***Phys. Rev. C* 9**, 1924 (1974)

Br82 H. C. Britt, personal communication, 1982

Du70 C. L. Dunford, **AI-AEC-12931** (1970) Atomics International

Gi65 A. Gilbert and A. Cameron, ***Can. J. Phys.* 43**, 1446 (1965)

Ka88 C. Kalbach, ***Phys. Rev. C* 37**, 2350 (1988); C. Kalbach and F. M. Mann, ***Phys. Rev. C* 23**, 112 (1981)

Ko90 J. Kopecky and M. Uhl, ***Phys. Rev. C* 41**, 1941 (1990)

Ra70 J. Raynal, **Computing as a Language of Physics**, Conference, Vienna, Austria, 1970, (International Atomic Energy Agency, 1972), p. 281

Yo88 P. G. Young and E. D. Arthur, **Nucl. Data for Science & Technology**, Mito, Japan, 1988 (Saikon Publishing, Japan, 1988) p. 603

Yo92a P. G. Young and E. D. Arthur, **Nuclear Data for Science and Technology**, Conference, Jülich, Germany, 13-17 May 1991 (Springer-Verlag, 1992) p. 894

Yo92b P. G. Young, E. D. Arthur, and M. B. Chadwick, **LA-12343-MS** (1992) Los Alamos National Laboratory

Evaluation: **^{242}Am Incident Neutron Data, Release 1** (MAT 9546)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8
Evaluators: R. W. Benjamin, F. J. McCrosson (SRL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, August 1991)

Delayed fission neutron spectrum which was intended for ^{242m}Am was removed.

ENDF/B-VI MOD 0 (NNDC, February 1990)

ENDF/B-V MAT 8542 converted to ENDF-6 format.

ENDF/B-V EVALUATION (R. W. Benjamin, F. J. McCrosson, SRL, August 1975)

GENERAL INFORMATION (File 1)

$\bar{\nu}$ thermal value computed from the semi-empirical work of Gordeeva and Smirenkin [1] as revised by Manero and Konshin [2]. Energy dependence is taken from Howerton [3].

$\bar{\nu}_d$ is taken from Brady and England [4]

RESONANCE PARAMETERS (File 2)

Resolved resonance region is 0 to 101.2 eV. Resonance parameters are determined using the GENRPAR code [5] based upon the SRL data set and an average level spacing of 1.2 eV.

Unresolved resonances are determined on same basis as the resolved parameters using average resonance parameters.

	σ(0.0253 ev)	I_{res} (0.5 eV - 20 MeV)
total	2549.91	
elastic	28.95	
fission	2268.88	620.15
capture	252.08	71.88

SMOOTH CROSS SECTIONS (File 3)

The data in file 3 are given only so that the various processing codes can work. Continuity with the unresolved region is provided, but the cross sections drop immediately to zero. The elastic scattering cross section above 10 keV is the potential scattering cross section calculated with a Spherical Optical Model potential at 10 keV.

ANGULAR DISTRIBUTIONS (File 4)

Elastic distributions taken from ENDF/B-V ^{242m}Am.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS

Simple fission Maxwellian with energy-dependent temperature used.

REFERENCES

1. L. D. Gordeeva and G. N. Smirenkin, ***Sov. At. En.*** **14**, 562 (1963); translated from ***At. En.*** **14**, 530 (1963)
2. F. Manero and V. A. Konshin, ***At. En. Rev.*** **10**, 637 (1972)
3. R. J. Howerton, ***Nucl. Sci. Eng.*** **46**, 42 (1971)
4. M. C. Brady and T. R. England, ***Nucl. Sci. Eng.*** **103**, 129 (1989)
5. F. J. McCrosson, **Neutron Cross Sections for Science and Technology**, Conference, 15-17 March 1971, Knoxville, TN (National Technical Information Service 1971) p.714

Evaluation: **^{242m}Am Incident Neutron Data, Release 1 (MAT 9547)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 9, 12, 13, 14, 15
Evaluators: F. Mann, R. Schenter (HEDL); R. Benjamin (SRL); R. Howerton (LLNL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, February 1990)
The delayed fission neutron spectrum was added.

ENDF/B-VI MOD 0 (NNDC, February 1990)
ENDF/B-V MAT 1369 converted to ENDF-6 format.

ENDF/B-V (F. Mann, R. Schenter (HEDL), R. Benjamin (SRL), R. Howerton (LLNL), August 1975)
See ENDF-102 Summary Documentation, 3rd Edition(1991), page 95-Am-242m-1, for documentation of the ENDF/B-V evaluation.

Evaluation: **^{245}Cm Incident Neutron Sublibrary, Release 2 (MAT 9640)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: R. W. Benjamin (SRL), R. J. Howerton (LLNL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, May 1993)
Added missing fission neutron angular distribution to file 4; assumed to be isotropic.

ENDF/B-VI MOD 0 (NNDC, February 1990)
ENDF/B-V MAT 1345 was converted to ENDF-6 format.

ENDF/B-V (R.W. Benjamin (SRL), R. J. Howerton (LLNL), January 1979)
See ENDF-102 Summary Documentation, 3rd Edition (1979), page 96-245-1, for documentation of ENDF/B-V evaluation.

Evaluation:	**^{246}Cm Incident Neutron Sublibrary, Release 2 (MAT 9643)**
Energy Range:	10^{-5} eV to 20 MeV
Files:	1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators:	R. W. Benjamin, F. McCrosson (SRL); R. J. Howerton (LLNL) (assembled by R. Kinsey, BNL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, May 1993)

Added missing fission neutron angular distribution to file 4; assumed to be isotropic.

ENDF/B-VI MOD 0 (NNDC, February 1990)

ENDF/B-V MAT 1346 was converted to ENDF-6 format.

ENDF/B-V (R.W. Benjamin (SRL), R. J. Howerton (LLNL), January 1979)

See ENDF-102 Summary Documentation, 3rd Edition (1979), page 96-246-1, for documentation of ENDF/B-V evaluation.

Evaluation: **^{247}Cm Incident Neutron Sublibrary, Release 2 (MAT 9646)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: R. W. Benjamin, F. J. McCrosson (SRL); R. J. Howerton (LLNL) (assembled by R. Kinsey, BNL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, May 1993)

Added missing fission neutron angular distribution to file 4; assumed to be isotropic.

ENDF/B-VI MOD 0 (NNDC, February 1990)

ENDF/B-V MAT 8647 was converted to ENDF-6 format.

ENDF/B-V EVALUATION (R. W. Benjamin, F. McCrosson, SRL, Assembled by R. Kinsey, NNDC, July 1976)

This evaluation is in general a combination of the August 1975 evaluation, documented here, of Benjamin and McCrosson (SRL) and the ENDL evaluation of Howerton (LLNL). Important changes or additions are noted.

GENERAL INFORMATION (File 1)

$\bar{\nu}$ thermal value is computed from the semi-empirical work of Gordeeva and Smirenkin [1] as revised by Manero and Konshin [2]. The energy dependence is based on work of Howerton [3] renormalized to the thermal value.

RESONANCE PARAMETERS (File 2)

The resolved region is 0 to 61.7 eV and includes 34 resolved resonances plus one bound level. The first 5 resolved resonances were determined by the GENRPAR code [4] to fit integral and production results [5,6]. The bound level was added. 29 additional resonances were added from the measurements of Moore and Keyworth [7].

The unresolved region is 61.7 eV to 10 keV. Unresolved resonances are determined on the same basis as the resolved, using average resonance parameters.

2200 m/s cross sections and resonance integrals

	σ(0.0253 eV)	I (0.5 eV - 20 MeV)
Total	150.010	
Elastic	8.404	
Fission	83.435	749.670
Capture	58.171	491.197

SMOOTH CROSS SECTIONS (File 3)

For total, elastic, fission, and capture, zero background files up to 10 keV were joined to the LLNL evaluation.

The inelastic (MT=4,91) are taken from the LLNL evaluation with Q calculated from threshold.

(n,2n), (n,3n), and (n,4n) are taken from the LLNL evaluation with threshold calculated from the Q value.

ANGULAR DISTRIBUTIONS (File 4)

Elastic from the LLNL evaluation culled to 101 points per distribution and renormalized.

(n,2n), (n,3n), (n,4n), and the inelastic continuum are dummy isotropic distributions.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

(n,2n), (n,3n), (n,4n), and the inelastic continuum are taken from the LLNL evaluation.

The fission spectrum is a simple fission Maxwellian with energy dependent temperature taken from the SRL evaluation.

PHOTON PRODUCTION (Files 12,13,14,15)

The data are taken from the LLNL evaluation with ranges extended at BNL to agree with File 3.

REFERENCES

1. L. D. Gordeeva and G. N. Smirenkin, ***Sov. At. En.*** **14**, 562 (1963); translated from ***At. En.*** **14**, 530 (1963)
2. F. Manero and V. A. Konshin, ***At. En. Rev.*** **10**, 637 (1972)
3. R. J. Howerton, **UCRL 50400**, Vol 15, Part D, Rev. 1, p. 432 (1978) Lawrence Livermore National Laboratory
4. F. J. McCrosson, **Neutron Cross Sections for Science and Technology**, Conference, 15-17 March 1971, Knoxville, TN (National Technical Information Service 1971) p.714
5. R. W. Benjamin, K. W. MacMurdo, J. D. Spencer, ***Nucl. Sci. Eng.*** **47**, 203 (1972)
6. R. W. Benjamin, et al., **DP-1394** (1975) Savannah River Laboratory
7. M. S. Moore and G. A. Keyworth, ***Phys. Rev. C*** **3**, 1656 (1971)

^{250}Cf Incident Neutron Sublibrary, Release 2

Evaluation: **^{250}Cf Incident Neutron Sublibrary, Release 2 (MAT 9855)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: R. W. Benjamin, F. McCrosson (SRL); R. J. Howerton (LLNL) (assembled by R. Kinsey, BNL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, May 1993)

Added missing fission neutron angular distribution to file 4; assumed to be isotropic.

ENDF/B-VI MOD 0 (Assembled by R. Kinsey, NNDC, February 1990)

ENDF/B-V MAT 8850 was converted to ENDF-6 format.

ENDF/B-V EVALUATION (R. W. Benjamin, F. McCrosson, SRL, R. J. Howerton, LLNL, Assembled by R. Kinsey, NNDC, July 1976)

This evaluation is in general a combination of the August 1975 evaluation of Benjamin and McCrosson at SRL, documented here, and the ENDL evaluation of Howerton at LLNL [4]. Important changes or additions are noted.

GENERAL INFORMATION (File 1)

$\bar{\nu}$ taken from LLNL evaluation.

RESONANCE PARAMETERS (File 2) (0 TO 10 KEV)

The resolved region is 0 to 286.1 eV. Resonance parameters were determined by the GENRPAR code [1], based upon resonance integrals and cross sections from production measurements of Benjamin, et al. [2] and ORR irradiations of Halperin, et al. [3]. A bound level at -2.115 eV was removed from the SRL evaluation. Appropriate backgrounds were included in the total cross sections in order that the (n,γ) curve would remain the same.

The unresolved region is 286.1 eV to 10 keV. Unresolved resonances are determined on the same basis as the resolved, using average resonance parameters.

2200 m/s cross sections and resonance integrals

	σ(0.0253 eV)	I_{res} (0.5 eV - 20 MeV)
Total	1619.88	
Elastic	8.90	
Fission	0.00	10.79
Capture	1610.98	11200.1

SMOOTH CROSS SECTIONS (File 3)

The total cross section is the sum of the elastic and (n,γ) background files up to 10 keV joined to the LLNL evaluation.

The elastic background is a constant up to the first resonance which then goes rapidly to zero. The constant chosen to give a thermal cross section in combination with the resonance parameters which is equal to 90% of the Spherical Optical Model value. Above the first resonance, this background does not prevent the cross section from going negative for the next dozen or so resonances. Above 10 keV, the cross section is from the LLNL evaluation.

For fission, a zero background file up to 10 keV was joined to the LLNL evaluation.

For capture, the background was calculated to give the same curve after the bound level was deleted as was obtained with the original SRL parameters up to 10 keV; it was then joined to the LLNL evaluation.

The inelastic data are taken from the LLNL evaluation with Q calculated from the threshold.

(n,2n), (n,3n), and (n,4n) are taken from the LLNL evaluation with threshold calculated from the Q value.

ANGULAR DISTRIBUTIONS (File 4)

Elastic from LLNL evaluation are culled to 101 points per distribution and renormalized.

(n,2n), (n,3n), (n,4n), and the inelastic continuum are dummy isotropic distributions.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

(n,2n), (n,3n), (n,4n), and the inelastic continuum are taken from LLNL evaluation.

The fission spectrum is a simple fission Maxwellian distribution with energy dependent temperature from the LLNL evaluation has been converted from a tabular representation and extended down to 10^{-5} eV.

REFERENCES

1. F. J. McCrosson, **Neutron Cross Sections for Science and Technology**, Conference, 15-17 March 1971, Knoxville, TN (National Technical Information Service 1971) p.714
2. R. W. Benjamin, et al., **DP-1394** (1975) Savannah River Laboratory
3. J. Halperin, et al., **ORNL-4706**, p. 47 (1971) Oak Ridge National Laboratory Progress Report
4. R. J. Howerton, **UCRL 50400**, Vol 15, Part D, Rev. 1, p. 456 (1978) Lawrence Livermore National Laboratory

Evaluation: **^{251}Cf Incident Neutron Sublibrary, Release 2 (MAT 9858)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: R. W. Benjamin, F. McCrosson (SRL); R. J. Howerton (LLNL) (assembled by R. Kinsey, BNL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, May 1993)
Added missing fission neutron angular distribution to file 4; assumed to be isotropic.

ENDF/B-VI MOD 0 (NNDC, February 1990)
ENDF/B-V MAT 8851 converted to ENDF-6 format.

ENDF/B-V EVALUATION (R. W. Benjamin, F. McCrosson, SRL, R. J. Howerton, LLNL, assembled by R. Kinsey, NNDC, July 1976)

This evaluation is in general a combination of the August 1975 evaluation of Benjamin and McCrosson at SRL, documented here, and the ENDL evaluation of Howerton at LLNL [3]. Important changes or additions are noted.

GENERAL INFORMATION (File 1)

$\bar{\nu}$ thermal value is computed from the semi-empirical work of Gordeeva and Smirenkin [1] as revised by Manero and Konshin [2]. The energy dependence is based on work of Howerton [3] renormalized to the thermal value at BNL.

$\bar{\nu}_d$ is taken from Brady and England [7].

RESONANCE PARAMETERS (File 2)

The resolved region is 0 to 163.9 eV. Resolved resonance parameters determined by the GENRPAR Code [4] based upon resonance integrals and cross sections from production measurements [5] and ORR irradiations [6]. A bound level at -2.035 eV was removed from the SRL evaluation. Appropriate backgrounds were included in File 3 in order that the capture and fission curves would remain the same.

The unresolved region is 163.9 eV to 10 keV. Unresolved resonances are determined on the same basis as the resolved, using average resonance parameters.

2200 m/s cross sections and resonance integrals

	σ(0.0253 eV)	I_{res} (0.5 eV - 20 MeV)
Total	8191.73	
Elastic	8.84	
Fission	5321.28	4949.63
Capture	2861.61	1629.34

SMOOTH CROSS SECTIONS (File 3)

The total is sum of the elastic, fission and capture background files up to 10 keV, joined to the LLNL evaluation.

Elastic background is a constant up to the first resonance which then goes rapidly to zero. The constant is chosen to give a thermal cross section in combination with the resonance parameters which is equal to 90% of the spherical optical model value. Above 10 keV, the cross section is from the LLNL evaluation.

The fission and capture backgrounds were calculated to give the same curve after the bound level was deleted as was obtained with the original SRL parameters up to 10 keV joined to the LLNL evaluation.

The inelastic data is taken from LLNL evaluation with Q calculated from threshold.

(n,2n), (n,3n), and (n,4n) is from LLNL evaluation with threshold calculated from the Q value.

ANGULAR DISTRIBUTIONS (File 4)

Elastic from LLNL evaluation culled to 101 points per distribution and renormalized.

(n,2n), (n,3n), (n,4n), and inelastic to the continuum are dummy isotropic distributions.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS

(n,2n), (n,3n), (n,4n), and inelastic to the continuum from LLNL evaluation.

Fission is a simple fission Maxwellian distribution with energy dependent temperature taken from the SRL evaluation.

REFERENCES

1. L. D. Gordeeva and G. N. Smirenkin, ***Sov. At. En.*** **14**, 562 (1963); translated from ***At. En.*** **14**, 530 (1963)
2. F. Manero and V. A. Konshin, ***At. En. Rev.*** **10**, 637 (1972)
3. R. J. Howerton, **UCRL 50400**, Vol 15, Part D, Rev. 1, p. 462 (1978) Lawrence Livermore National Laboratory
4. F. J. McCrosson, **Neutron Cross Sections for Science and Technology**, Conference, 15-17 March 1971, Knoxville, TN (National Technical Information Service 1971) p.714
5. R. W. Benjamin, et al., **DP-1394** (1975) Savannah River Laboratory
6. J. Halperin, et al., **ORNL-4706**, p. 47 (1971) Oak Ridge National Laboratory Progress Report
7. M. C. Brady and T. R. England, ***Nucl. Sci. Eng.*** **103**, 129 (1989)

Evaluation: **^{252}Cf Incident Neutron Sublibrary, Release 1, 2 (MAT 9861)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: R. W. Benjamin, F. McCrosson (SRL); R. J. Howerton (LLNL) (assembled by R. Kinsey, BNL)

ENDF/B-VI MOD 3 REVISION 2 (NNDC, May 1993)
Added missing fission neutron angular distribution to file 4; assumed to be isotropic.

ENDF/B-VI MOD 2 REVISION 1 (NNDC, August 1991)
Removed delayed fission neutron spectra which were for spontaneous fission.

ENDF/B-VI MOD 0 (Assembled by R. Kinsey, NNDC, February 1990)
ENDF/B-V MAT 8851 converted to ENDF-6 format.

ENDF/B-V EVALUATION (R. W. Benjamin, F. McCrosson, SRL, R. J. Howerton, LLNL, assembled by R. Kinsey, NNDC, July 1976)

This evaluation is in general a combination of the August 1975 evaluation of Benjamin and McCrosson at SRL, documented here, and the ENDL evaluation of Howerton at LLNL [3]. Important changes or additions are noted.

GENERAL INFORMATION (File 1)

$\bar{\nu}$ thermal value is computed from the semi-empirical work of Gordeeva and Smirenkin [1] as revised by Manero and Konshin [2]. The energy dependence is based on work of Howerton [3] renormalized to the thermal value at BNL.

$\bar{\nu}_d$ is taken from Brady and England [8].

RESONANCE PARAMETERS (File 2)

The resolved region is 0 to 366.5 eV. Resolved resonance parameters determined by the GENRPAR Code [4] based upon resonance integrals and cross sections from production measurements [5] and ORR irradiations [6,7]. A bound level at -2.035 eV was removed from the SRL evaluation. Appropriate backgrounds were included in File 3 in order that the capture and fission curves would remain the same.

The unresolved region is 366.5 eV to 10 keV. Unresolved resonances are determined on the same basis as the resolved, using average resonance parameters.

2200 m/s cross sections and resonance integrals

	σ(0.0253 eV)	I_{res} (0.5 eV - 20 MeV)
Total	63.881	
Elastic	11.213	
Fission	32.174	119.198
Capture	20.493	47.292

SOOTH CROSS SECTIONS (File 3)

The total is sum of the elastic, fission and capture background files up to 10 keV joined to the LLNL evaluation.

The inelastic data is taken from LLNL evaluation with Q calculated from threshold.

(n,2n), (n,3n), and (n,4n) are taken from LLNL evaluation with threshold calculated from the Q value.

ANGULAR DISTRIBUTIONS (File 4)

The elastic is taken from LLNL evaluation, culled to 101 points per distribution, and renormalized.

The (n,2n), (n,3n), (n,4n), and inelastic to the continuum are dummy isotropic distributions.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

The (n,2n), (n,3n), (n,4n), and inelastic to the continuum are taken from LLNL evaluation.

The fission is a simple fission Maxwellian distribution with energy dependent temperature taken from the SRL evaluation.

REFERENCES

1. L. D. Gordeeva and G. N. Smirenkin, ***Sov. At. En.*** **14**, 562 (1963); translated from ***At. En.*** **14**, 530 (1963)
2. F. Manero and V. A. Konshin, ***At. En. Rev.*** **10**, 637 (1972)
3. R. J. Howerton, **UCRL 50400**, Vol 15, Part D, Rev. 1, p. 468 (1978) Lawrence Livermore National Laboratory
4. F. J. McCrosson, **Neutron Cross Sections for Science and Technology**, Conference, 15-17 March 1971, Knoxville, TN (National Technical Information Service 1971) p.714
5. R. W. Benjamin, et al., **DP-1394** (1975) Savannah River Laboratory
6. J. Halperin, et al., **ORNL-4706**, p. 47 (1971) Oak Ridge National Laboratory Progress Report
7. M. C. Brady and T. R. England, ***Nucl. Sci. Eng.*** **103**, 129 (1989)

Evaluation: **^{253}Cf Incident Neutron Sublibrary, Release 2 (MAT 9864)**
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. W. Benjamin, F. McCrosson (SRL); R. J. Howerton (LLNL) (assembled by R. Kinsey, BNL)

ENDF/B-VI MOD 2 REVISION 1 (NNDC, May 1993)
Added missing fission neutron angular distribution; assumed to be isotropic.

ENDF/B-VI MOD 0 (NNDC, February 1990)
ENDF/B-V MAT 8853 converted to ENDF-6 format.

ENDF/B-V EVALUATION (R. W. Benjamin, F. McCrosson, SRL, Assembled by R. Kinsey, NNDC, December 1995)
This evaluation is, in general, the December 1975 evaluation of Benjamin and McCrosson at SRL documented here.

GENERAL INFORMATION (File 1)
$\bar{\nu}$ thermal value is computed from the semi-empirical work of Gordeeva and Smirenkin [1] as revised by Manero and Konshin [2]. The energy dependence is based on work of Howerton [3].

RESONANCE PARAMETERS (File 2)
The resolved region is 0 to 100.4 eV. Resolved resonance parameters determined by the GENRPAR code [4] based upon resonance integrals and thermal cross sections from production [5] and integral [6,7] measurements. The effective ^{253}Cf capture-to-fission ratio, derived from the measurements of Bemis, et al. [9], is well below the range expected from nuclear systematics. In the present evaluation, alpha has been assumed to be 0.3 over the entire energy range, in accordance with the work of Prince [8].
The unresolved region 100.4 eV to 10 keV. Unresolved resonances are determined on the same basis as the resolved, giving average resonance parameters.

2200 m/s cross sections and resonance integrals

	σ(0.0253 eV)	I_{res} (0.5 eV - 20 MeV)
Total	542.22	
Elastic	64.82	
Fission	1136.12	1244.84
Capture	341.28	379.19

SMOOTH CROSS SECTIONS (File 3)

The data in File 3 are given only so that the various processing codes can work. Continuity with the unresolved region is provided, but the cross sections drop immediately to zero. The elastic cross section is the potential scattering cross section calculated with a Spherical Optical Model potential at 10 keV.

ANGULAR DISTRIBUTIONS (File 4)

Elastic distributions are taken from the ENDF/B-V evaluation for ^{251}Cf.

SECONDARY NEUTRON ENERGY DISTRIBUTIONS (File 5)

The fission is a simple fission Maxwellian distribution with energy dependent temperature.

REFERENCES

1. L. D. Gordeeva and G. N. Smirenkin, ***Sov. At. En.*** **14**, 562 (1963); translated from ***At. En.*** **14**, 530 (1963)
2. F. Manero and V. A. Konshin, ***At. En. Rev.*** **10**, 637 (1972)
3. R. J. Howerton, ***Nucl. Sci. Eng.*** **46**, 42 (1971)
4. F. J. McCrosson, **Neutron Cross Sections for Science and Technology**, Conference, 15-17 March 1971, Knoxville, TN (National Technical Information Service 1971) p.714
5. R. W. Benjamin, et al., **DP-1394** (1975) Savannah River Laboratory
6. J. F. Wild, E. K. Hulet, and R. W. Lougheed, ***J. Inorg. Nucl. Chem.*** **35**, 1063(1973)
7. C. E. Bemis, Jr., R. E. Druschel,and J. Halperin, ***Nucl. Sci. Eng.*** **41**, 146 (1970)
8. A. Prince, **Neutron Cross Sections & Technology**, Conference, Washington, DC, 4-7 March 1968, Volume II (National Bureau of Standards, 1968) p. 951

Part II

Photo-Atomic Interaction Data (NSUB=3)

Evaluation: **Photo-Atomic Interaction Sublibrary, Release** 0
Energy: 10 eV to 100GeV
Files: 1, 23, 27
Evaluators: D. R. Cullen, et al. (LLNL)

Photon interaction cross sections and atomic form factors or scattering functions for 100 materials have been converted from the Livermore Evaluated Photon Data Library (EPDL) Library [1].

From 1 eV to 1 MeV, the photon interaction cross section is based on the total photoelectric cross sections of Scofield [2,3]; from 1 MeV to 100 GeV, the cross sections of Hubbell [4,5] are used. The sets were joined at 1 MeV, where the total photoelectric cross sections from both sources are identical.

The coherent and incoherent form factors are taken from the nonrelativistic data of Hubbell [4,5].

REFERENCE

1. D. E. Cullen, et al., **UCRL-50400**, Vol. 6, Rev. 4, Parts A and B (1989) Lawrence Livermore National Laboratory
2. J. H. Scofield, **UCRL-51326** (1973) Lawrence Livermore National Laboratory
3. E. B. Saloman, J. H. Hubbell, and J. H. Scofield, ***At. Data Nucl. Data Tables* 38**, 1 (1988)
4. J. H. Hubbell, H. M. Gerstenberg, and E. B. Saloman, **NBSIR 86-3461** (1986) National Bureau of Standards
5. M. J. Berger and J. H. Hubbell, XCOM: *Photon Cross Sections on a Personal Computer*, **NBSIR 87-3597**[1] (1987) National Bureau of Standards

[1] The XCOM data is available through the NNDC Online Service XRAY database.

Part III

Radioactive Decay Data (NSUB=4)

The Radioactive Decay Data Sublibrary contains evaluations for 799 materials, which were distributed in Release 1. A modification to ^{98}Tc was distributed in Release 2 to correct the MAT number.

Most evaluations were contributed by C. W. Reich (INEL), F. Mann and F. Schmittroth (HEDL), and T. England (LANL, with contributions from B. Magurno (BNL), W. Mannhart (PTB), and R. Schenter (HEDL). See individual evaluations for more detail.

Part IV

Spontaneous Fission Product Yields (NSUB=15)

Evaluation: **Spontaneous Fission-Product Yields, Release 1,2**
Energy: Spontaneous fission
Files: 1, 8
Evaluators: T. R. England and B. F. Rider (LANL)

Independent and cumulative yield data are given for 9 materials in Release 1 and 2. See England and Rider [1] for complete documentation.

Yields are given for: ^{238}U, ^{244,246,248}Cm, ^{250,252}Cf, ^{253}Es, ^{254,256}Fm.

REFERENCE

1. T. R. England and B. F. Rider, **LA-UR-94-3106** (**ENDF-349**) (1994) Los Alamos National Laboratory

Part V

Neutron-Induced Fission Product Yields (NSUB=11)

Evaluation: **Neutron Induced Fission-Product Yields, Release 1,2,3**
Energy: Thermal, Fission Spectrum, 14-MeV
Files: 1, 8
Evaluators: T. R. England and B. F. Rider (LANL)

Independent and cumulative yield data are given for 51 materials at energies in the thermal range, fission spectrum range, and at 14 MeV in Release 1 and 2. See England and Rider [1] for complete documentation.

An update for ^{241}Pu was made in Release 3 to correct for missing yields.

Thermal yields are given for: ^{227,229}Th, ^{232,233,235}U, ^{237}Np, ^{239,240,242}Pu, ^{241,242m}Am, ^{243,245}Cm, ^{249,251}Cf, ^{254}Es, ^{255}Fm.

Fission spectrum yields are given for: ^{232}Th, ^{233,2345,235,236,237,238}U, ^{237,238}Np, ^{238,239,240,241,242}Pu, ^{241,243}Am, ^{242,243,244,246,248}Cm.

Yields at 14 MeV are given for: ^{232}Th, ^{233,234,235,236,238}U, ^{237}Np, ^{239,240,242}Pu, ^{241}Am.

REFERENCE

1. T. R. England and B. F. Rider, **LA-UR-94-3106** (**ENDF-349**) (1994) Los Alamos National Laboratory

Part VI

Thermal Neutron Scattering Sublibrary (NSUB=12)

All materials in the thermal neutron scattering sublibrary are documented here, including those issued in Release 0, since they have not been documented previously.

Evaluation: **H (H_2O) Thermal Neutron Scattering Sublibrary, Release 3 (MAT 1)**
Temperatures: 296 350 400 450 500 600 800 1000 °K
Files: 1, 7
Evaluators: R. E. MacFarlane (LANL)

This evaluation was generated using the LEAPR module of NJOY [4]. The physical model is very similar to the one used at General Atomic to produced the original ENDF/B-III evaluations [1]. The α and β grids were extended, and the constants were changed to match the values in the previous ENDF/B-VI evaluation.

Water is represented by freely recoiling H_2O molecules of mass 18. Each molecule can undergo torsional harmonic oscillations (hindered rotations) with a broad spectrum of distributed modes. Between 0.04 and 0.165 eV, the rotation spectrum is taken from the work of Haywood and Thorson [2] joined to a quadratic law below 0.04 eV. In addition, there are two internal vibrations at frequencies of 0.205 and 0.48 eV taken over from the Nelkin model [3] with slightly readjusted masses of 6 and 3, respectively. The torsional band is normalized to a mass of 18/8. The scattering by the oxygen atoms is not included in the tabulated scattering law data. It should be taken into account by adding the scattering for free oxygen of mass 16.

REFERENCES

1. J. U. Koppel and D. H. Houston, **GA-8774** General Atomic; revised and reissued as **ENDF-269** (1978) National Nuclear Data Center
2. B. C. Haywood and J. M. Thorson, Neutron Thermalization Conference, **BNL-719** (1962) Brookhaven National Laboratory
3. M. Nelkin, ***Phys. Rev.*** **119**, 741 (1960)
4. R. E. MacFarlane, **LA-12639-MS** (**ENDF-356**) (1994) Los Alamos National Laboratory

Evaluation: **Liquid Para Hydrogen Thermal Neutron Scattering Sublibrary, Release 3 (MAT 2)**
Temperatures: 20 °K
Files: 1, 7
Evaluators: R. E. MacFarlane (LANL)

Liquid para hydrogen at 20 °K computed using the LEAPR module of NJOY [1]. The scattering law is based on the model of Keinert and Sax [2], which includes spin correlations from the Young and Koppel model [3], diffusion and local hindered motions from an effective translational scattering law based on a frequency distribution, and intermolecular coherence after Vinyard [4].

REFERENCES

1. R. E. MacFarlane, **LA-12639-MS (ENDF-356)** (1994) Los Alamos National Laboratory
2. J. Keinhert and J. Sax, ***Kerntechnik* 51**, 19 (1987)
3. J. A. Young and J. U. Koppel, ***Phys. Rev.* 135**, A603 (1964)
4. G. H. Vineyard, ***Phys. Rev.* 110**, 999 (1958)

Evaluation: **Liquid Ortho Hydrogen Thermal Neutron Scattering Sublibrary, Release 3 (MAT 3)**
Temperatures: 20 °K
Files: 1, 7
Evaluators: R. E. MacFarlane (LANL)

Liquid ortho hydrogen at 20 °K computed using the LEAPR module of NJOY [1]. The scattering law is based on the model of Keinert and Sax [2], which includes spin correlations from the Young and Koppel model [3], diffusion and local hindered motions from an effective translational scattering law based on a frequency distribution, and intermolecular coherence after Vinyard [4].

REFERENCES

1. R. E. MacFarlane, **LA-12639-MS (ENDF-356)** (1994) Los Alamos National Laboratory
2. J. Keinhert and J. Sax, ***Kerntechnik* 51**, 19 (1987)
3. J. A. Young and J. U. Koppel, ***Phys. Rev.* 135**, A603 (1964)
4. G. H. Vineyard, ***Phys. Rev.* 110**, 999 (1958)

Evaluation: **H (ZrH) Thermal Neutron Scattering Sublibrary, Release 3 (MAT 7)**
Temperatures: 296 400 500 600 700 800 1000 1200 °K
Files: 1, 7
Evaluators: R. E. MacFarlane (LANL)

This evaluation was generated using the LEAPR module of NJOY [3]. The physical model is very similar to the one used at General Atomic to produced the original ENDF/B-III evaluations [1]. The α and β grids were extended lightly, and the constants were changed to match the values in the previous ENDF/B-VI evaluation.

The lattice dynamics of ZrH were computed from a central force model. The slightly tetragonal lattice of ZrH_2 was approximated by a face-centered-cubic lattice. Four force constants (μ, γ, ν, and δ) were introduced describing respectively the interaction of a zirconium atoms with its nearest neighbors (8 H atoms) and its next nearest neighbors (12 Zr atoms), and the interaction of a hydrogen atom with its next nearest neighbors (6 H atoms) and its third nearest atoms (12 H atoms). Eigenvalues and eigenvectors of the dynamical matrix were calculated, and a phonon frequency spectrum was obtained by means of a root sampling technique. Weighted frequency spectra for hydrogen in ZrH were then obtained by appropriate use of the dynamical matrix eigenvectors [2].

The final values of the four force constants were obtained by fitting both specific heat and neutron data. The position of an optical peak observed by neutron scattering techniques to be centered roughly around 0.14 eV determines the constant μ, while the overall width and shape of this peak determine ν and δ respectively. Existing neutron data are not sufficiently precise to confirm the structure predicted in the optical peak by the central force model. Specific heat data were used to determine the force constant γ, which primarily determines the upper limit on the phonon energies associated with acoustic modes.

REFERENCES

1. J. U. Koppel and D. H. Houston, **GA-8774** General Atomic; revised and reissued as **ENDF-269** (1978) National Nuclear Data Center
2. E. L. Slaggie, **GA-8132** (1967) General Atomic
3. R. E. MacFarlane, **LA-12639-MS** (**ENDF-356**) (1994) Los Alamos National Laboratory

Evaluation: **D (D_2O) Thermal Neutron Scattering Sublibrary, Release 0 (MAT 11)**
Temperatures: 296 350 400 450 500 600 800 1000 °K
Files: 1, 7
Evaluators: J. U. Koppel and D. H. Houston (GA)

This evaluation was produced at General Atomic in 1969 using the GA code gasket [1]. It was converted to ENDF-6 format at Los Alamos in 1989. The only changes made to the contents were adjustments of cross sections to match the ENDF/B-VI values.

Whereas hydrogen is nearly a completely incoherent neutron scatterer, the scattering from deuterium is largely coherent. Although it would appear that due to this fact a treatment of D_2O analogous to the one used for H_2O would be inadequate, calculations [2] have shown that because of a great deal of cancellation between inter and intra-molecular interference scattering, integral quantities like the total cross section or thermal neutron spectra can actually be predicted quite accurately with an incoherent model.

Therefore, the scattering law for D_2O is based on a model quite similar to the one used for the General Atomic evaluation of H_2O; namely, freely recoiling D_2O molecules of mass 20. Each molecule can undergo torsional harmonic oscillations (hindered rotations) with a broad spectrum of distributed modes. Between 0.025 and 0.127 eV, the rotation spectrum is taken from the work of Haywood [3] joined to a quadratic law below 0.025 eV. In addition, there are two internal vibrations at frequencies of 0.142 and 0.305 eV (the frequencies are approximately $1/\sqrt{2}$ times the corresponding frequencies for H_2O as expected from the mass ratio) with masses of 6 and 3, respectively. The torsional band is normalized to a mass of 20/9. The scattering by the oxygen atoms is not included in the tabulated scattering law data. It should be taken into account by adding the scattering for free oxygen of mass 16.

REFERENCES

1. J. U. Koppel and D. H. Houston, **GA-8774** General Atomic; revised and reissued as **ENDF-269** (1978) National Nuclear Data Center
2. J. U. Koppel and J. A. Young, ***Nukleonik* 7**, 408 (1965).
3. B. C. Haywood, **Pulsed Neutron Research**, Symposium, Karlsruhe, 10-14 May 1965, Vol. I, p.434 (1965)

Evaluation: **Para Deuterium Thermal Neutron Scattering Sublibrary, Release 3 (MAT 12)**
Temperatures: 19 °K
Files: 1, 7
Evaluators: R. E. MacFarlane (LANL)

Liquid para deuterium at 19 °K was computed using the LEAPR module of NJOY [1]. The scattering law is based on the model of Keinert and Sax [2], which includes spin correlations from the Young and Koppel model [3], diffusion and local hindered motions from an effective translational scattering law based on a frequency distribution, and intermolecular coherence after Vinyard [4].

REFERENCES

1. R. E. MacFarlane, **LA-12639-MS (ENDF-356)** (1994) Los Alamos National Laboratory
2. J. Keinhert and J. Sax, ***Kerntechnik* 51**, 19 (1987)
3. J. A. Young and J. U. Koppel, ***Phys. Rev.* 135**, A603 (1964)
4. G. H. Vineyard, ***Phys. Rev.* 110**, 999 (1958)

Evaluation: **Ortho Deuterium Thermal Neutron Scattering Sublibrary, Release 3 (MAT 13)**
Temperatures: 19 °K
Files: 1, 7
Evaluators: R. E. MacFarlane (LANL)

Liquid ortho deuterium at 19 °K was computed using the LEAPR module of NJOY [1]. The scattering law is based on the model of Keinert and Sax [2], which includes spin correlations from the Young and Koppel model [3], diffusion and local hindered motions from an effective translational scattering law based on a frequency distribution, and intermolecular coherence after Vinyard [4].

REFERENCES

1. R. E. MacFarlane, **LA-12639-MS (ENDF-356)** (1994) Los Alamos National Laboratory
2. J. Keinhert and J. Sax, ***Kerntechnik* 51**, 19 (1987)
3. J. A. Young and J. U. Koppel, ***Phys. Rev.* 135**, A603 (1964)
4. G. H. Vineyard, ***Phys. Rev.* 110**, 999 (1958)

Evaluation: **Be metal Thermal Neutron Scattering Sublibrary, Release 3 (MAT 26)**
Temperatures: 296, 400, 500, 600, 700, 800, 1000, 1200 °K
Files: 1, 7
Evaluators: R. E. MacFarlane (LANL)

This evaluation was generated using the LEAPR module of NJOY [3]. The physical model is very similar to the one used at General Atomic to produced the original ENDF/B-III evaluations [1]. Tighter grids and extended ranges for α and β were used. A slightly more detailed calculation of the coherent inelastic scattering was generated. The various constants were updated to agree with the ENDF/B-VI evaluation of Be.

The phonon dispersion curves were fitted by Schmunk, et al. [2], using a model of central forces that extend to the fifth nearest neighbors. The phonon spectrum corresponding to this model was calculated by the root sampling method, and then used to compute $S(\alpha,\beta)$. The coherent elastic scattering cross section was computed using the known lattice structure (hexagonal close-packed) and the Debye-Waller integrals from the lattice dynamics model.

REFERENCES

1. J. U. Koppel and D. H. Houston, **GA-8774** General Atomic; revised and reissued as **ENDF-269** (1978) National Nuclear Data Center
2. R. E. Schmunk, et al., ***Phys. Rev.* 128**, 562 (1962)
3. R. E. MacFarlane, **LA-12639-MS** (**ENDF-356**) (1994) Los Alamos National Laboratory

Evaluation: **BeO Thermal Neutron Scattering Sublibrary, Release 3 (MAT 27)**
Temperatures: 296 400 500 600 700 800 1000 1200 °K
Files: 1, 7
Evaluators: R. E. MacFarlane (LANL)

This evaluation was generated using the LEAPR module of NJOY [3]. The physical model is very similar to the one used at General Atomic to produced the original ENDF/B-III evaluations [1]. Tighter grids and extended ranges for α and β were used. A slightly more detailed calculation of the coherent inelastic scattering was generated. The various constants were updated to agree with the ENDF/B-VI evaluation of Be and oxygen.

Beryllium oxide consists of two interpenetrating hexagonal close-packed structures with four atoms per unit cell. The lattice dynamics [2] is described using a shell model whose parameters have been adjusted to fit the elastic constants, the measured Raman frequencies, and preliminary dispersion relations measured by neutron scattering [3]. Only the negative ions are assumed to be polarizable, and short-range repulsive forces are used for the first and second neighbors. The frequency spectra weighted by the squares of the amplitude vectors were computed separately for beryllium and oxygen and used to calculate separate scattering laws with GASKET. The scattering laws were then combined and adjusted to be used with the beryllium free-atom cross section. The oxygen free-atom cross section has been provided for use with the short-collision-time approximation (SCT). Thus, the thermal cross section computed from either $S(\alpha,\beta)$ or by the SCT approximation gives an asymptotic limit of approximately 6.15 ± 3.75 barns. The elastic part of the scattering was calculated using the average of the Debye-Waller factors for beryllium and oxygen.

REFERENCES

1. J. U. Koppel and D. H. Houston, **GA-8774** General Atomic; revised and reissued as **ENDF-269** (1978) National Nuclear Data Center
2. G. Borgonovi, **GA-8758** (1968) General Atomic
3. R. M. Brugger, K. A. Strong, and J. M. Carpenter, ***J. Phys. Chem. Solids* 28**, 249 (1967)
4. R. E. MacFarlane, **LA-12639-MS** (**ENDF-356**) (1994) Los Alamos National Laboratory

Evaluation: **Graphite Thermal Neutron Scattering Sublibrary, Release 3 (MAT 31)**
Temperatures: 296, 400, 500, 600, 700, 800, 1000, 1200, 1600, 2000 °K
Files: 1, 7
Evaluators: R. E. MacFarlane (LANL)

This evaluation was generated using the LEAPR module of NJOY [3]. The physical model is very similar to the one used at General Atomic to produced the original ENDF/B-III evaluations [1]. Tighter grids and extended ranges for α and β were used. A slightly more detailed calculation of the coherent inelastic scattering was generated. The various constants were updated to agree with the ENDF/B-VI evaluation of natural carbon.

Graphite has an hexagonal close-packed crystal structure. The lattice dynamics is represented using a model with four force constants [2,3]. One force constant is used to describe a nearest-neighbor central force that binds two hexagonal planes together, another describes a bond-bending force in an hexagonal plane, the third is for bond-stretching between nearest neighbors in a plane, and the fourth corresponds to a restoring force against bending of the hexagonal plane. The force constants were evaluated numerically using a very precise fit to the high and low temperature specific heat and compressibility of reactor grade graphite. The phonon spectrum was computed from this model using the root sampling method, and then used to compute $S(\alpha,\beta)$. The coherent elastic scattering cross section was computed using the known lattice structure and the Debye-Waller integrals from the lattice dynamics model.

REFERENCES

1. J. U. Koppel and D. H. Houston, **GA-8774** General Atomic; revised and reissued as **ENDF-269** (1978) National Nuclear Data Center
2. J. A. Young, N. F. Wilkner, and D. E. Parks, ***Nukleonik*, 7**, 295 (1965)
3. J. A. Young and J. U. Koppel, ***J. Chem. Phys.* 42**, 357(1965).
4. R. E. MacFarlane, **LA-12639-MS (ENDF-356)** (1994) Los Alamos National Laboratory

Evaluation: **Liquid Methane Thermal Neutron Scattering Sublibrary, Release 3 (MAT 33)**
Temperatures: 100 °K
Files: 1, 7
Evaluators: R. E. MacFarlane (LANL)

Liquid methane (CH_4) at 100 °K was generated using the model of Agrawal and Yip [1] as implemented by Picton [2], modified to include a diffusive component. Optical measurements of methane in the gas phase show four fairly well defined vibrational modes at 162, 190, 361, and 374 meV. These have been included in this model as discrete oscillators and were used to calculate $S(\alpha,\beta)$ using the LEAPR module of NJOY [3].

1. A. K. Agrawal and S. Yip, ***Nucl. Sci. Eng.*** **37**, 368 (1969)
2. D. J. Picton, Ph.D. Thesis
3. R. E. MacFarlane, **LA-12639-MS** (**ENDF-356**) (1994) Los Alamos National Laboratory

Evaluation: **Solid Methane Thermal Neutron Scattering Sublibrary, Release 3 (MAT 33)**
Temperatures: 22 °K
Files: 1, 7
Evaluators: R. E. MacFarlane (LANL)

Solid methane (CH_4) at 22 °K was generated using the model of Picton [1] and the spectrum of Harker and Brugger [2]. Optical measurements of methane in the gas phase show four fairly well defined vibrational modes at 162, 190, 361, and 374 meV. These have been included in this model as discrete oscillators and were used to calculate $S(\alpha,\beta)$ using the LEAPR module of NJOY [3].

1. D. J. Picton, Ph.D. Thesis
2. Y. D. Harker and R. M. Brugger, ***J. Chem. Phys.*** **42**, 275 (1965)
3. R. E. MacFarlane, **LA-12639-MS (ENDF-356)** (1994) Los Alamos National Laboratory

Evaluation: **H (Polyethylene) Thermal Neutron Scattering Sublibrary, Release 0 (MAT 37)**
Temperatures: 296 350 °K
Files: 1, 7
Evaluators: J. U. Koppel, D. H. Houston, and D. Sprevak (GA)

This evaluation was produced at General Atomic in 1969 using the code GASKET [1]. It was converted to ENDF-6 format at Los Alamos in 1989. The only changes made to the contents were adjustments of cross sections to match the ENDF/B-VI values.

Polyethylene is represented using a model of non-interacting chains of CH_2 radicals originally developed by Lin and Koenig [2]. The dispersion relation of polyethylene shows nine branches, the frequency in each branch being a function of the phase difference of the vibrations of corresponding atoms in neighboring CH_2 units. For some normal modes, the ratio of the amplitude of the hydrogen atom vibrations to the amplitude of the carbon atom vibrations also depends strongly on the phase difference. Using this model, the frequency spectrum was computed exactly for the hydrogen atoms in histogram form [3]. The low frequency part of the histogram (below 0.02 eV) was then replaced by a Debye spectrum having the same area, and the other elements of the histogram distribution were replaced by Gaussian functions of appropriate area centered at the center of each interval of the histogram. GASKET was then used to obtain $S(\alpha,\beta)$. The elastic part of the scattering law is represented using the incoherent approximation with Debye-Waller integrals from the GASKET calculation [1]. This evaluation only gives the scattering from the hydrogen in polyethylene. The carbon should be treated as a free gas with mass 12.011 amu.

REFERENCES

1. J. U. Koppel and D. H. Houston, **GA-8774** General Atomic
2. T. P. Lin and J. L. Koenig, ***J. Molec. Spectra* 9**, 228 (1962).
3. D. Sprevak and J. U. Koppel, ***Nucleonik* 12**, 87 (1969).

Evaluation: **Benzene Thermal Neutron Scattering Sublibrary, Release 0 (MAT 40)**
Temperatures: 296 350 400 450 500 600 800 1000 °K
Files: 1, 7
Evaluators: J. U. Koppel, D. H. Houston, and G. M. Borgonovi (GA)

This evaluation was produced at General Atomic in 1969 using the code GASKET [1]. It was converted to ENDF-6 format at Los Alamos in 1989. The only changes made to the contents were adjustments of cross sections to match the ENDF/B-VI values.

The benzine molecule has an hexagonal planar structure with symmetry D6H, carbon-carbon bond length of 1.39 Å, and carbon-hydrogen bond length of 1.08 Å. In constructing a model for the atomic vibrations, it was assumed [2] that there is no interaction between vibrational and rotational states of the molecule, and that the hindered rotations that describe the interactions of molecules in the liquid can be represented by translations of the whole molecule with an effective mass. Continuous frequency distributions were then obtained for the hydrogen and carbon atoms using methods described in [3]. The cluster of frequencies closely spaced around 0.38 eV was lumped into a single oscillator. The GASKET code was then used to compute separate $S(\alpha,\beta)$ functions for hydrogen and carbon. The scattering laws were combined and adjusted to be used with the hydrogen free-atom cross section. The carbon free-atom cross section has been provided for use with the short-collision-time approximation (SCT). Thus, the thermal cross section computed from either $S(\alpha,\beta)$ or by the SCT approximation gives an asymptotic limit of approximately 6*20+6*4.7 barns.

REFERENCES

1. J. U. Koppel and D. H. Houston, **GA-8774** General Atomic
2. D. Sprevak and J. U. Koppel, ***Nucleonik* 12**, 87 (1969).
3. D. Sprevak, G. M. Borgonovi, G. W. Carriveau, and J. M. Neill, **GA-8185** (1967) General Atomics

Evaluation: **Zr (ZrH) Thermal Neutron Scattering Sublibrary, Release 3 (MAT 58)**
Temperatures: 296 400 500 600 700 800 1000 1200 °K
Files: 1, 7
Evaluators: R. E. MacFarlane (LANL)

This evaluation was generated using the LEAPR module of NJOY [3]. The physical model is very similar to the one used at General Atomic to produced the original ENDF/B-III evaluations [1]. The α and β grids were extended lightly, and the constants were changed to match the values in the previous ENDF/B-VI evaluation.

The lattice dynamics of ZrH were computed from a central force model. The slightly tetragonal lattice of ZrH_2 was approximated by a face-centered-cubic lattice. Four force constants (μ, γ, ν, and δ) were introduced describing respectively the interaction of a zirconium atoms with its nearest neighbors (8 H atoms) and its next nearest neighbors (12 Zr atoms), and the interaction of a hydrogen atom with its next nearest neighbors (6 H atoms) and its third nearest atoms (12 H atoms). Eigenvalues and eigenvectors of the dynamical matrix were calculated, and a phonon frequency spectrum was obtained by means of a root sampling technique. Weighted frequency spectra for hydrogen in ZrH were then obtained by appropriate use of the dynamical matrix eigenvectors [2].

The final values of the four force constants were obtained by fitting both specific heat and neutron data. The position of an optical peak observed by neutron scattering techniques to be centered roughly around 0.14 eV determines the constant μ, while the overall width and shape of this peak determine ν and δ respectively. Existing neutron data are not sufficiently precise to confirm the structure predicted in the optical peak by the central force model. Specific heat data were used to determine the force constant γ, which primarily determines the upper limit on the phonon energies associated with acoustic modes.

REFERENCES

1. J. U. Koppel and D. H. Houston, **GA-8774** General Atomic
revised and reissued as **ENDF-269** (1978) National Nuclear Data Center
2. E. L. Slaggie, **GA-8132** (1967) General Atomic
3. R. E. MacFarlane, **LA-12639-MS** (**ENDF-356**) (1994) Los Alamos National Laboratory

Part VII

Incident Proton Sublibrary (NSUB=10010)

Evaluation: **^{1}H Incident Proton Sublibrary, Release 1 (MAT 125)**
Energy Range: 0 to 100 MeV
Files: 1, 3, 6
Evaluators: D. Dodder (LANL)

ENDF/B-VI MOD 1 EVALUATION (D. Dodder, LANL, October 1987)

The p-p elastic cross sections were calculated using an R-matrix analysis of the p-p cross section and polarization data over the energy range evaluated. The maximum nuclear partial wave allowed in the fit is L=6, and the resulting chi-squared per degree of freedom is 0.793.

Evaluation: **^{3}He Incident Proton Sublibrary, Release 1 (MAT 225)**
Energy Range: 1 keV to 20 MeV
Files: 1, 3, 6
Evaluators: G. Hale (LANL)

ENDF/B-VI MOD 1 EVALUATION (G. Hale, LANL, October 1983)

The p-^{3}He elastic and ^{3}He(p,2p)D cross sections and scattering distributions were calculated using an R-matrix analysis with code EDA. The energy-angle distributions for MT=111 are assumed to follow a 3-body phase-space law.

Part VIII

Incident Deuteron Sublibrary (NSUB=10020)

Evaluation: **^{2}H Incident Deuteron Sublibrary, Release 1 (MAT 128)**
Energy Range: 332.5 eV to 30 MeV
Files: 1, 3
Evaluators: R. M. White, D. A. Resler (LLNL)

ENDF/B-VI MOD 1 EVALUATION (R. M. White, D. A. Resler, LLNL, May 1991)

The D(d,n)^{3}He and D(d,p)^{3}H cross sections are evaluated based on all known experimental data published between 1946 and 1990. See White and Resler [1] for more information on evaluation.

REFERENCE

1. R. M. White and D. A. Resler, **Nuclear Data Evaluation Methodology**, Symposium, Brookhaven, NY, 12-16 October 1992 (World Scientific, 1993)

Evaluation: **^{3}H Incident Deuteron Sublibrary, Release 1 (MAT 131)**
Energy Range: 285 eV to 30 MeV
Files: 1, 3
Evaluators: R. M. White, D. A. Resler (LLNL)

ENDF/B-VI MOD 1 EVALUATION (R. M. White, D. A. Resler, LLNL, May 1991)

The ^{3}H(d,n)^{4}He cross section is evaluated based on all known experimental data published between 1946 and 1990. See White, et al. [1] for more information on evaluation.

REFERENCE

1. R. M. White, D. A. Resler, and S. I. Warshaw, **Nuclear Data for Science and Technology**, Conference, Jülich, Germany, 13-17 May 1991 (Springer-Verlay, 1992)

Evaluation: **^{3}He Incident Deuteron Sublibrary, Release 1 (MAT 225)**
Energy Range: 118.75 eV to 30 MeV
Files: 1, 3
Evaluators: R. M. White, D. A. Resler (LLNL)

ENDF/B-VI MOD 1 EVALUATION (R. M. White, D. A. Resler, LLNL, May 1991)

The ^{3}He(d,p)^{4}He cross section is evaluated based on all known experimental data published between 1946 and 1990. See White, et al. [1] for more information on evaluation.

REFERENCE

1. R. M. White, D. A. Resler, and S. I. Warshaw, **Nuclear Data for Science and Technology**, Conference, Jülich, Germany, 13-17 May 1991 (Springer-Verlay, 1992)

Part IX

Incident Triton Sublibrary (NSUB=10030)

Evaluation: **^{3}H Incident Triton Sublibrary, Release 1 (MAT 131)**
Energy Range: 475 eV to 30 MeV
Files: 1, 3
Evaluators: R. M. White, D. A. Resler (LLNL)

ENDF/B-VI MOD 1 EVALUATION (R. M. White, D. A. Resler, LLNL, May 1991)

The ^{3}H(t,2n)^{4}He cross section is evaluated based on all known experimental data published between 1946 and 1990. See White, et al. [1] for more information on evaluation.

REFERENCE

1. R. M. White, D. A. Resler, and S. I. Warshaw, **Nuclear Data for Science and Technology**, Conference, Jülich, Germany, 13-17 May 1991 (Springer-Verlay, 1992)

Part X

ENDF/HE-VI

Incident Neutron Sublibrary (NSUB=10)

Evaluation: **^{12}C ENDF/HE-VI Incident Neutron Sublibrary, Release 2 (MAT 625)**
Energy Range: 1.0×10^{-5} eV to 10 GeV
Files: 1, 2, 3, 4, 6
Evaluators: S. Pearlstein (BNL)

In general, the ENDF/B-VI data [1] was used below 32 MeV. The nuclear model codes ALICE-P [2][1], and LAHET [4][2] were extensively used as well as systematics [2,5,6]. Extensive comparisons were made with experimental data for total, elastic scattering, nonelastic cross sections; residual nuclide production yields, elastic scattering angular distributions, and double-differential neutron emission. The evaluation is partially documented in Ref. [7].

RESONANCE PARAMETERS (File 2)

Resonance range to 100 keV; taken from ENDF/B-VI.

SMOOTH CROSS SECTIONS (File 3)

Total (MT=1), elastic (MT=2), nonelastic (MT=3) cross sections are taken from systematics [2].

Product yields (MT=5) below 25 MeV, used ALICE-P, above 25 MeV LAHET; these were normalized to data where available. Consistency with ENDF/B-VI below 32 MeV is not assured.

Neutron production (MT=201) used ENDF/B-VI to 32 MeV, LAHET to 10 GeV.

γ, p, d, t, ^{3}He, α production (MT=202-207) used ALICE-P to 25 MeV, LAHET to 10 GeV.

π^+, π^0, π^- production (MT=208-210) used LAHET to 10 GeV.

ANGULAR DISTRIBUTIONS (File 4)

Elastic (MT=2) taken from systematics [5].

PRODUCT ENERGY-ANGLE DISTRIBUTIONS (File 6)

Product yields (MT=5) below 25 MeV, used ALICE-P [2], above 25 MeV LAHET [4]. Normalized to data where available. Consistency with ENDF/B-VI below 32 MeVis not assured. Data given for ^{5,6}He,m ^{6,7,8}Li, ^{7,8,9,10,11}Be, ^{8,10,11,12}B, and ^{10,11}C.

Neutron production (MT=201) used ENDF/B-VI to 32 MeV, systematics to 10 GeV.

γ, p, d, t, ^{3}He, α production (MT=202-207) used ALICE-P to 25 MeV, LAHET to 10 GeV.

π^+, π^0, π^- production (MT=208-210) used LAHET to 10 GeV.

REFERENCES

1. C. Fu, ***Nucl. Sci. Eng.*** **106**, 494 (1990)
2. S. Pearlstein, ***Astrophys J.*, 346**, 1049 (1989)
3. M. Blann, **UCID 20169** (1984) Lawrence Livermore National Laboratory, and updates
4. R. Prael, et al., **LA-UR-89-3014** (1989) Los Alamos National Laboratory

---

[1] A modification of ALICE89 [3].

[2] The LANL upgrade of HETC.

5. S. Pearlstein, ***Nucl. Sci. Eng.*, 49**, 162 (1972)
6. S. Pearlstein, ***Nucl. Sci. Eng.*, 95**, 116 (1987)
7. S. Pearlstein, **Nuclear Data Evaluation Methodology**, Conference, Brookhaven National Laboratory, 12-16 October 1992 (World Sci. Singapore, 1993) p. 471

Evaluation: **^{56}Fe ENDF/HE-VI Incident Neutron Sublibrary, Release 2 (MAT 2631)**
Energy Range: 1.0×10^{-5} eV to 1 GeV
Files: 1, 2, 3, 4, 6
Evaluators: S. Pearlstein (BNL)

In general, the ENDF/B-VI data was used below 20 MeV. The nuclear model code ALICE-P [2][1] employed extensively, uses parameters in a Woods-Saxon potential to fit neutron total and particle reaction cross sections from data and systematics [1,14].

RESONANCE PARAMETERS (File 2)

Resonance range to 100 keV; taken from ENDF/B-VI.

SMOOTH CROSS SECTIONS (File 3)

Total cross section (MT=1) empirical fits [6] similar to the method for proton nonelastic [1].

Elastic cross section (MT=2) set equal to total - nonelastic; Rutherford-nuclear interference is ignored.

Nonelastic (MT=3) calculated by ALICE-P. Neutron and proton nonelastic cross-section similar at high energies.

ANGULAR DISTRIBUTIONS (File 4)

Elastic scattering based on the diffraction model [3] amended for relativistic effects and empirical fits to high energy data.

PRODUCT ENERGY-ANGLE DISTRIBUTIONS (File 6)

Spallation product yields (MT=5) Calculated using ALICE-P. Data compares fairly well with experimental data [10-13].

Neutron production (MT=201) calculated by ALICE-P. Below 20 MeV, equal to sum of ENDF/B-VI MT's 4, 2*16, 22, and 28; above 250 MeV, based on systematics [4] and is consistent with data [7,8].

Gamma production (MT=202) calculated by ALICE-P and MODS [9].

Particle production cross sections above 20 MeV calculated by ALICE-P. Proton production (MT=203) below 20 MeV, equal to sum of ENDF/B-VI MTs 28 and 103; d, t, ^{3}He production (MT=204,205,206) below 20 MeV, equal to ENDF/B-VI MTs 104, 105, 106, respectively; α production (MT=207) below 20 MeV, equal to ENDF/B-VI MTs 22 and 107.

REFERENCES

1. J.R. Letaw, et al., ***Astrophys. J. Suppl. ser.*** **51**, 271 (1983)
2. I. Angeli, et al., ***Nucl. Phys. A*** **170**, 577 (1971)
3. S. Pearlstein, ***Nucl. Sci. Eng.,*** **49**, 162 (1972)
4. S. Pearlstein, ***Nucl. Sci. Eng.,*** **95**, 116 (1987)
5. M. Blann, et al., ***Phys. Rev.*** **C28** (1983) 1648, and **UCID 20169** (1984) Lawrence Livermore National Laboratory, and updates
6. S. Pearlstein, ***Astrophys J.,*** **346**, 1049 (1989).

7. M. M. Meier, **Nucl. Data for Basic and Applied Sci.**, Conference, Santa Fe, NM, 13-17 May 1995, Volume 2 (Gordon and Breach, 1986) p. 1415
8. D. Filges, et al., **Jül-1960** (1984) Kernforschungsanlage Jülich
9. M. Blann, et al., ***Nucl. Inst. Meth.* A265**, 490 (1988)
10. B. K. Gupta, et al., ***Nucl. Phys. A 170***, 49 (1970)
11. R. Silberberg, et al., **NRL 7593** (1973) Naval Research Laboratory
12. C. J. Orth, et al., ***J. Inorg. Nucl. Chem.* 38**, 13 (1976)
13. R. Michel, et al., ***Nucl. Instr. Meth. B* 16**, 61 (1986)
14. L. Townsend, et al., ***Rad. Res.* 106**, 283 (1986)

Evaluation: **^{208}Pb ENDF/HE-VI Incident Neutron Sublibrary, Release 2 (MAT 8237)**
Energy Range: 1.0×10^{-5} eV to 1 GeV
Files: 1, 2, 3, 4, 6
Evaluators: T. Fukahori, S. Pearlstein (BNL)

Below 20 MeV the ENDF/B-VI data is used [1]. The nuclear model code ALICE-P[1], used extensively, uses parameters in a Woods-Saxon potential to fit neutron total and particle reaction cross-sections from data and systematics [4,5]. Tritium and ^{3}He emission is added.

RESONANCE PARAMETERS (File 2)

Resonance range to 100 keV; taken from ENDF/B-VI.

SMOOTH CROSS SECTIONS (File 3)

Total cross section (MT=1) empirical fits [2] similar to the method for proton nonelastic [4].

Elastic cross section (MT=2) set equal to total - nonelastic; Rutherford-nuclear interference is ignored.

Nonelastic (MT=3) calculated by ALICE-P. Neutron and proton nonelastic cross-section similar at high energies.

Spallation product yields (MT=5) Calculated using ALICE-P. Data compares fairly well with experimental data [7].

Fission (MT=18) based on systematics [8].

Neutron production (MT=201) calculated by ALICE-P. Below 20 MeV, equal to sum of MT's 4, 2*16, 22, and 28 [1].

Gamma production (MT=202) calculated by ALICE-P and MODS [10].

Particle production cross sections above 20 MeV calculated by ALICE-P. Proton production (MT=203) below 20 MeV, equal to sum of ENDF/B-VI MTs 28 and 103; d, t, ^{3}He production (MT=204,205,206) below 20 MeV, equal to ENDF/B-VI MTs 104, 105, 106, respectively; α production (MT=207) below 20 MeV, equal to ENDF/B-VI MTs 22 and 107.

ANGULAR DISTRIBUTIONS (File 4)

Elastic scattering Based on the diffraction model [6] amended for relativistic effects and empirical fits to high energy data.

PRODUCT ENERGY-ANGLE DISTRIBUTIONS (File 6)

Spallation product yields (MT=5) Calculated using ALICE-P. Data compares fairly well with experimental data [7].

Neutron production (MT=201) Calculated by ALICE-P. Double-differential data based on systematics [9]. Below 20 MeV, equal to sum of ENDF/B-VI MTs 4, 2*16, 22, and 28.

Gamma production (MT=202) Calculated by ALICE-P and MODS [10].

Particle production cross sections above 20 MeV calculated by ALICE-P. Proton production (MT=203) below 20 MeV, equal to sum of ENDF/B-VI MTs 28 and 103; d, t, ^{3}He production (MT=204,205,206) below 20 MeV, equal to ENDF/B-VI MTs 104, 105, 106, respectively; α production (MT=207) below 20 MeV, equal to ENDF/B-VI MTs 22 and 107.

REFERENCES

1. C.Y. Fu, et al., ***Atomic Data and Nucl. Data Tables*** **16**, 409 (1975)
2. S. Pearlstein, ***Astrophys J.*****, 346**, 1049 (1989).
3. M. Blann, et al., ***Phys. Rev.*** **C28** (1983) 1648, and **UCID 20169** (1984) Lawrence Livermore National Laboratory, and updates
4. J.R. Letaw, et al., ***Astrophys. J. Suppl. ser.*** **51**, 271 (1983)
5. L. Townsend, et al., ***Rad. Res.*** **106**, 283 (1986)
6. S. Pearlstein, ***Nucl. Sci. Eng.*****, 49**, 162 (1972)
7. P. Welch, et al., ***Bull. Am. Phys. Soc.*** **26**, 708 (1981)
8. T. Fukahori, internal memorandum (unpublished)
9. S. Pearlstein, ***Nucl. Sci. Eng.*****, 95**, 116 (1987)
10. M. Blann, et al., ***Nucl. Inst. Meth.*** **A265**, 490 (1988)

Evaluation: **^{209}Bi ENDF/HE-VI Incident Neutron Sublibrary, Release 2 (MAT 8325)**
Energy Range: 1.0×10^{-5} eV to 1 GeV
Files: 1, 2, 3, 4, 6
Evaluators: T. Fukahori, S. Pearlstein (BNL)

Below 20 MeV the ENDF/B-VI data are used [1]. The nuclear model code ALICE-P[1], employed extensively, uses parameters in a Woods-Saxon potential to fit neutron total and particle reaction cross-sections from data and systematics [4,5]. Tritium and ^{3}He emission is added.

RESONANCE PARAMETERS (File 2)

Resonance range to 100 keV; taken from ENDF/B-VI.

SMOOTH CROSS SECTIONS (File 3)

Total cross section (MT=1) empirical fits are made[2] similar to the method for proton nonelastic [4].

Elastic cross section (MT=2) Rutherford-nuclear interference is ignored; cross section set equal to total - nonelastic.

Nonelastic (MT=3) calculated by ALICE-P. Neutron and proton nonelastic cross-section similar at high energies.

Spallation product yields (MT=5) Calculated using ALICE-P. Data compares fairly well with experimental data [7].

Fission (MT=18) based on systematics [8].

Neutron production (MT=201) calculated by ALICE-P. Below 20 MeV, equal to sum of MT's 4, 2*16, 22, and 28 [1].

Gamma production (MT=202) calculated by ALICE-P and MODS [10].

Particle production cross sections above 20 MeV calculated by ALICE-P. Proton production (MT=203) below 20 MeV, equal to sum of ENDF/B-VI MTs 28 and 103; d, t, ^{3}He production (MT=204,205,206) below 20 MeV, equal to ENDF/B-VI MTs 104, 105, 106, respectively; α production (MT=207) below 20 MeV, equal to ENDF/B-VI MTs 22 and 107.

ANGULAR DISTRIBUTIONS (File 4)

Elastic scattering based on the diffraction model [6] amended for relativistic effects and empirical fits to high energy data.

PRODUCT ENERGY-ANGLE DISTRIBUTIONS (File 6)

Spallation product yields (MT=5) calculated using ALICE-P. Data compares fairly well with experimental data [7].

Neutron production (MT=201) calculated by ALICE-P. Double-differential data based on systematics [9]. Below 20 MeV, equal to sum of ENDF/B-VI MTs 4, 2*16, 22, and 28.

Gamma production (MT=202) calculated by ALICE-P and MODS [10].

Particle production cross sections above 20 MeV calculated by ALICE-P. Proton production (MT=203) below 20 MeV, equal to sum of ENDF/B-VI MTs 28 and 103; d, t, ^{3}He production (MT=204,205,206) below 20 MeV, equal to ENDF/B-VI MTs 104, 105, 106, respectively; α

production (MT=207) below 20 MeV, equal to ENDF/B-VI MTs 22 and 107.

REFERENCES

1. P. T. Guenther, et al., **ANL/NDM-109** (1989) Argonne National Laboratory
2. S. Pearlstein, ***Astrophys J.*, 346**, 1049 (1989)
3. M. Blann, et al., ***Phys. Rev.* C28** (1983) 1648, and **UCID 20169** (1984) Lawrence Livermore National Laboratory, and updates
4. J.R. Letaw, et al., ***Astrophys. J. Suppl. ser.* 51**, 271 (1983)
5. L. Townsend, et al., ***Rad. Res.* 106**, 283 (1986)
6. S. Pearlstein, ***Nucl. Sci. Eng.*, 49**, 162 (1972)
7. L.R. Veeser, et al., ***Phys. Rev. C* 16**, 1792 (1977)
8. G.A. Prokopets, et al., ***Yad. Fis.* 32**, 37 (1980)
9. T. Fukahori, internal memorandum (unpublished)
10. S. Pearlstein, ***Nucl. Sci. Eng.*, 95**, 116 (1987)
11. M. Blann, et al., ***Nucl. Inst. Meth.* A265**, 490 (1988)

Part XI

ENDF/HE-VI

Incident Proton Sublibrary (NSUB=10010)

Evaluation: **^{12}C ENDF/HE-VI Incident Proton Sublibrary, Release 2 (MAT 625)**
Energy Range: 1.0×10^{-5} eV to 10 GeV
Files: 1, 3, 6
Evaluators: S. Pearlstein (BNL)

ENDF/HE-VI MOD 2 REVISION 1 (V. McLane, NNDC, December 1996)
Comments updated.

ENDF/HE-VI MOD 2 EVALUATION (S. Pearlstein, NNDC, September 1992)
The nuclear model codes ALICE-P [1][1], and LAHET [3][2] were used extensively as well as systematics [1,4,5]. Extensive comparisons were made with experimental data for nonelastic cross sections; residual nuclide production yields, and double-differential neutron emission. The evaluation is partially documented in Ref. [6].

SMOOTH CROSS SECTIONS (File 3)
Elastic (MT=2), nonelastic (MT=3) cross sections are taken from systematics [1].
Product yields (MT=5) below 25 MeV, used ALICE-P, above 25 MeV LAHET; these were normalized to data where available.
Neutron production (MT=201) used LAHET to 10 GeV.
γ, p, d, t, ^{3}He, α production (MT=202-207) used ALICE-P to 25 MeV, LAHET to 10 GeV.
π^+, π^0, π^- production (MT=208-210) used LAHET to 10 GeV.

PRODUCT ENERGY-ANGLE DISTRIBUTIONS (File 6)
Product yields (MT=5) below 25 MeV, used ALICE-P, above 25 MeV LAHET. Normalized to data where available. Data given for ^{6}He, ^{6,7,9}Li, ^{7,8,9,10}Be, ^{10,11}B, and ^{10,11}C.
Neutron emission spectra taken from systematics [4].
Same as File 3 for MT = 201-210.

REFERENCES
1. S. Pearlstein, ***Astrophys. J.*, 346**, 1049 (1989)
2. M. Blann, **UCID 20169** (1984) Lawrence Livermore National Laboratory, and updates
3. R. Prael, et al., **LA-UR-89-3014** (1989) Los Alamos National Laboratory
4. S. Pearlstein, ***Nucl. Sci. Eng.*, 49**, 162 (1972)
5. S. Pearlstein, ***Nucl. Sci. Eng.*, 95**, 116 (1987)
6. S. Pearlstein, **Nuclear Data Evaluation Methodology**, Conference, Brookhaven National Laboratory, 12-16 October 1992 (World Sci. Singapore, 1993) p. 471

[1] A modification of ALICE89 [3].

[2] The LANL upgrade of HETC.

Evaluation: **^{56}Fe ENDF/HE-VI Incident Proton Sublibrary, Release 2 (MAT 2631)**
Energy Range: 1.0×10^{-5} eV to 1 GeV
Files: 1, 3, 6
Evaluators: S. Pearlstein (BNL)

ENDF/HE-VI MOD 2 REVISION 1 (V. McLane, NNDC, December 1996)

Comments updated.

ENDF/HE-VI MOD 2 EVALUATION (S. Pearlstein, NNDC, June 1988)

The nuclear model code ALICE-P [2][1] employed extensively, uses parameters in a Woods-Saxon potential to fit neutron total and particle reaction cross sections from data and systematics [1,14].

SMOOTH CROSS SECTIONS (File 3)

Total cross section (MT=1) empirical fits [6] similar to the method for proton nonelastic [1].

Elastic cross section (MT=2) set equal to total - nonelastic; Rutherford-nuclear interference is ignored.

Nonelastic (MT=3) calculated by ALICE-P. Neutron and proton nonelastic cross-section similar at high energies.

Spallation product yields (MT=5) Calculated using ALICE-P. Data compares fairly well with experimental data [10-13].

Neutron production (MT=201) calculated by ALICE-P. Above 250 MeV, based on systematics [4] and is consistent with data [7,8].

Gamma production (MT=202) calculated by ALICE-P and MODS [9].

p, d, t, ^{3}He production cross sections (MT=203-207) calculated by ALICE-P.

PRODUCT ENERGY-ANGLE DISTRIBUTIONS (File 6)

Same as File for for MT = 5, and 201-207.

REFERENCES

1. J.R. Letaw, et al., ***Astrophys. J. Suppl. ser.*** **51**, 271 (1983)
2. I. Angeli, et al., ***Nucl. Phys. A*** **170**, 577 (1971)
3. S. Pearlstein, ***Nucl. Sci. Eng.***, **49**, 162 (1972)
4. S. Pearlstein, ***Nucl. Sci. Eng.***, **95**, 116 (1987)
5. M. Blann, et al., ***Phys. Rev.*** **C28** (1983) 1648, and **UCID 20169** (1984) Lawrence Livermore National Laboratory, and updates
6. S. Pearlstein, ***Astrophys J.***, **346**, 1049 (1989)
7. M. M. Meier, **Nucl. Data for Basic and Applied Sci.**, Conference, Santa Fe, NM, 13-17 May 1995, Volume 2 (Gordon and Breach, 1986) p. 1415
8. D. Filges, et al., **Jül-1960** (1984)
9. M. Blann, et al., ***Nucl. Inst. Meth.*** **A265**, 490 (1988)
10. B. K. Gupta, et al., ***Nucl. Phys. A 170***, 49 (1970)
11. R. Silberberg, et al., **NRL 7593** (1973) Naval Research Laboratory

12. C. J. Orth, et al., ***J. Inorg. Nucl. Chem.*** **38**, 13 (1976)
13. R. Michel, et al., ***Nucl. Instr. Meth. B*** **16**, 61 (1986)
14. L. Townsend, et al., ***Rad. Res.*** **106**, 283 (1986)

Evaluation: **^{208}Pb ENDF/HE-VI Incident Proton Sublibrary, Release 2 (MAT 8237)**
Energy Range: 1.0×10^{-5} eV to 1 GeV
Files: 1, 3, 6
Evaluators: T. Fukahori, S. Pearlstein (BNL)

ENDF/HE-VI MOD 2 REVISION 1 (V. McLane, NNDC, December 1996)
Comments updated.

ENDF/HE-VI MOD 2 EVALUATION (T. Fukahori and S. Pearlstein, NNDC, June 1990)
The nuclear model code ALICE-P [1][1], employed extensively, uses parameters in a Woods-Saxon potential to fit neutron total and particle reaction cross-sections from data and systematics [4,5]. Tritium and ^{3}He emission is added.

SMOOTH CROSS SECTIONS (File 3)
Total cross section (MT=1) Empirical fits are made [1] similar to the method for nonelastic [3].
Elastic cross section (MT=2) Rutherford-nuclear interference is ignored; set equal to total - nonelastic.
Nonelastic (MT=3) Calculated by ALICE-P. Neutron and proton nonelastic cross-section similar at high energies.
Spallation product yields (MT=5) Calculated using ALICE-P. Data compares fairly well with experimental data [6,7].
Fission (MT=18) Based on systematics [8].
Neutron production (MT=201) Calculated by ALICE-P.
Gamma production (MT=202) Calculated by ALICE-P and MODS [10].
p, d, t, ^{3}He, α production (MT=203) Calculated by ALICE-P.

ANGULAR DISTRIBUTIONS (File 4)
Elastic scattering Based on the diffraction model [6] amended for relativistic effects and empirical fits to high energy data.

PRODUCT ENERGY-ANGLE DISTRIBUTIONS (File 6)
Same as File for for MT = 5, and 201-207.

REFERENCES
1. S. Pearlstein, ***Astrophys J.*, 346**, 1049 (1989).
2. M. Blann, et al., ***Phys. Rev.* C28** (1983) 1648, and **UCID 20169** (1984) Lawrence Livermore National Laboratory, and updates
3. J.R. Letaw, et al., ***Astrophys. J. Suppl. ser.* 51**, 271 (1983)
4. L. Townsend, et al., ***Rad. Res.* 106**, 283 (1986)
5. S. Pearlstein, ***Nucl. Sci. Eng.*, 49**, 162 (1972)
6. R. E. Bell, et al., ***Can. J. Phys.* 34**, 745 (1956)
7. R. G. Thomas, Jr., et al., ***Phys. Rev.* 159**, 1022 (1967)

8. T. Fukahori, internal memorandum (unpublished)
9. S. Pearlstein, ***Nucl. Sci. Eng.*, 95**, 116 (1987)
10. N. S. Biryukov, et al., Conference, Yurmal (1987) p. 284
11. K. Harder, et al., ***Phys. Rev. C* 36**, 834 (1987)
12. M. M. Meier, et al., ***Nucl. Sci. Eng.* 102**, 310 (1989), and **LA-11518-MS** (1989) Los Alamos National Laboratory
13. M. M. Meier, et al., **LA-11656-MS** (1989) Los Alamos National Laboratory
14. M. M. Meier, **Nucl. Data for Basic and Applied Sci.**, Conference, Santa Fe, NM, 13-17 May 1995, Volume 2 (Gordon and Breach, 1986) p. 1415
15. D. Filges, et al., **Jül-1960** (1984)
16. M. Blann, et al., ***Nucl. Inst. Meth.* A265**, 490 (1988)

Evaluation: **^{209}Bi ENDF/HE-VI Incident Proton Sublibrary, Release 2 (MAT 8325)**
Energy Range: 1.0×10^{-5} eV to 1 GeV
Files: 1, 3, 6
Evaluators: T. Fukahori, S. Pearlstein (BNL)

ENDF/HE-VI MOD 2 REVISION 1 (V. McLane, NNDC, December 1996)
Comments updated.

ENDF/HE-VI MOD 2 EVALUATION (T. Fukahori and S. Pearlstein, NNDC, June 1990)
The nuclear model code ALICE-P[1], employed extensively, uses parameters in a Woods-Saxon potential to fit neutron total and particle reaction cross-sections from data and systematics [4,5]. Tritium and ^{3}He emission is added.

SMOOTH CROSS SECTIONS (File 3)
Total cross section (MT=1) Empirical fits are made [1] similar to the method for nonelastic [3].
Elastic cross section (MT=2) Rutherford-nuclear interference is ignored; cross section set equal to total - nonelastic.
Nonelastic (MT=3) Calculated by ALICE-P. Neutron and proton nonelastic cross-section similar at high energies.
Spallation product yields (MT=5) Calculated using ALICE-P. Data compares fairly well with experimental data [6-18].
Fission (MT=18) Based on systematics [19].
Neutron production (MT=201) Calculated by ALICE-P.
Gamma production (MT=202) Calculated by ALICE-P and MODS [22].
p, d, t, ^{3}He, α production (MT=203) Calculated by ALICE-P.

PRODUCT ENERGY-ANGLE DISTRIBUTIONS (File 6)
Same as File for for MT = 5, and 201-207.

REFERENCES
1. S. Pearlstein, ***Astrophys J.*, 346**, 1049 (1989).
2. M. Blann, et al., ***Phys. Rev.* C28** (1983) 1648, and **UCID 20169** (1984) Lawrence Livermore National Laboratory, and updates
3. J.R. Letaw, et al., ***Astrophys. J. Suppl. ser.* 51**, 271 (1983)
4. L. Townsend, et al., ***Rad. Res.* 106**, 283 (1986)
5. S. Pearlstein, ***Nucl. Sci. Eng.*, 49**, 162 (1972)
6. J. M. d'Auria, et al., ***Phys. Rev. C* 30**, 236 (1984)
7. K. Mityano, et al., ***J. Phys. Soc. Japan* 45**, 1071 (1978)
8. J. Wing, et al., ***Phys. Rev.* 128**, 280 (1962)
9. T. E. Ward, et al., ***Phys. Rev. C* 24**, 588 (1981)
10. Y. L. Beloc, et al., ***Nucl. Phys. A* 99**, 131 (1967)
11. P. J. Daly, et al., ***Nucl. Phys.* 56**, 322 (1964)

12. K. Miyano, et al., ***Nucl. Phys. A* 230**, 98 (1974)
13. C. Birattari, et al., ***Nucl. Phys. A* 166**, 605 (1971)
14. W. R. Pierson, et al., ***Phys. Rev. B* 133**, 384 (1964)
15. R. E. Bell, et al., ***Can. J. Phys.* 34**, 745 (1956)
16. E. T. Hunter, et al., ***Phys. Rev.* 115**, 1053 (1959)
17. A. Boos, **ANL-7930** (1972) Argonne National Laboratory Progress Report, p. 32
18. M. Adilbish, et al., ***Radiochem. Radioanal. Letters* 45**, 227 (1980)
19. T. Fukahori, internal memorandum (unpublished)
20. S. Pearlstein, ***Nucl. Sci. Eng.*, 95**, 116 (1987)
21. A. M. Kalend, et al., ***Phys. Rev. C* 28**, 105 (1983)
22. M. Blann, et al., ***Nucl. Inst. Meth.* A265**, 490 (1988)

Appendix A

History of Materials Issued in ENDF/B-VI

This section includes all materials issued in all releases of ENDF/B-VI. The materials are ordered by sublibary and material. The information on the latest release is given first, and is followed by the history of that material.

Evaluation: **^{1}H ENDF/B-VI Incident Neutron Sublibrary** (MAT 125)
Energy Range: 10^{-5} eV to 100 MeV
Files (MF): 1, 2, 3, 4, 12, 14
Evaluators: G. M. Hale, D. C. Dodder, E. R. Siciliano, W. B. Wilson (LANL)
HISTORY

1991 Jul	LANL	G. Hale
	ENDF/B-VI	MAT 125 MOD 2, Release 1
1989 Oct	LANL	G. Hale, D. Dodder, E. Siciliano, W. Wilson (Reviewed by Standards Subcommittee)
	ENDF/B-VI	MAT 125 MOD 1, Release 0

Evaluation: **^{2}H ENDF/B-VI Incident Neutron Sublibrary** (MAT 128)
Files (MF): 1, 2, 3, 4, 6, 8, 9, 12, 14
Energy Range: 10^{-5} eV to 100 MeV
Evaluators: P. G. Young, L. Stewart, A. Horsley (LANL)
HISTORY:

1996 Nov	LANL	P.G. Young
	ENDF/B-VI	MAT 128 MOD 3, Release 4
1994 Aug	LANL	P.G. Young (Reviewed by R.Q. Wright)
	ENDF/B-VI	MAT 128 MOD 2, Release 3
1989 Dec	LANL	R. E. MacFarlane
	ENDF/B-VI	MAT 128 MOD 1, Release 0
1967 Nov	LANL, AWRE	B. Leonard, L. Stewart, A. Horsley
	ENDF/B-V	MAT 1302
	ENDF/B-IV	MAT 1102

Evaluation: **^{3}H ENDF/B-VI Incident Neutron Sublibrary** (MAT 131)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: L. Stewart (LANL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1965 Feb	LANL	L. Stewart
	ENDF/B-V	MAT 1169

Evaluation: **^{3}He ENDF/B-VI Incident Neutron Sublibrary** (MAT 225)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4
Evaluators: G. Hale, D. Dodder, P. Young (LANL)
HISTORY

1991 Jul	LANL	G. Hale
	ENDF/B-VI	MAT 225 MOD 2, Release 1
1990 May	LANL	G. Hale, D. Dodder, P. Young
	ENDF/B-VI	MAT 225 MOD 1, Release 0

Evaluation: **^{4}He ENDF/B-VI Incident Neutron Sublibrary** (MAT 228)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4
Evaluators: R. A. Nisley, G. M. Hale, P. G. Young (LANL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1973 Oct	LANL	R. A. Nisley, G. M. Hale, P. G. Young
	ENDF/B-V	MAT 1270

Evaluation: **^{6}Li ENDF/B-VI Incident Neutron Sublibrary** (MAT 325)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 14
Evaluators: G. Hale, P. Young (LANL)
HISTORY

1991 Jul	LANL	G. Hale
	ENDF/B-VI	MAT 325 MOD 2, Release 1
1989 Apr	LANL	G. Hale, P. Young (Reviewed by Standards Committee)
	ENDF/B-VI	MAT 325 MOD 1, Release 0

Evaluation: **^{7}Li ENDF/B-VI Incident Neutron Sublibrary** (MAT 328)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 14, 33
Evaluators: P. Young (LANL)
HISTORY

1988 Aug	LANL	P. G. Young
	ENDF/B-VI	MOD 1, Release 0

Evaluation: **^{9}Be ENDF/B-VI Incident Neutron Sublibrary** (MAT 425)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 6, 12, 14, 15
Evaluators: S. T. Perkins, E. F. Plechaty, R. J. Howerton (LLNL)
HISTORY

1986 Jan	LLNL	S. Perkins, E. Plecharty, R. Howerton
	ENDF/B-VI	MOD 1, Release 0

Evaluation: **^{10}B ENDF/B-VI Incident Neutron Sublibrary** (MAT 525)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 12, 13, 14
Evaluators: G. Hale, P. Young (LANL)
HISTORY

1991 Jul	LANL	G. Hale
	ENDF/B-VI	MAT 525 MOD 2, Release 1
1989 Nov	LANL	G. Hale, P. Young (Reviewer: F. Mann, W. Poenitz)
	ENDF/B-VI	MAT 525 MOD 1, Release 0

Evaluation: **^{11}B ENDF/B-VI Incident Neutron Sublibrary** (MAT 528)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 6, 12, 13, 14
Evaluators: P. Young (LANL)
HISTORY

1989 May	LANL	P. G. Young (Reviewer: L. Stewart)
	ENDF/B-VI	MOD 0, Release 0

Evaluation: **^{nat}C ENDF/B-VI Incident Neutron Sublibrary** (MAT 600)
Energy Range: 10^{-5} eV to 32 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 14, 33
Evaluators: C. Y. Fu, E. J. Axton, F. G. Perey (ORNL)
HISTORY

1991 Jul	ORNL	C. Y. Fu
	ENDF/B-VI	MAT 600 MOD 2, Release 1
1989 Aug	ORNL	C. Fu, E. Axton, F. Perey
	ENDF/B-VI	MAT 600 MOD 1, Release 0

Evaluation: **^{14}N ENDF/B-VI Incident Neutron Sublibrary** (MAT 725)
Energy Range: 10^{-5} eV to 40 MeV
Files: 1, 2, 3, 4, 6, 12, 13, 14, 15
Evaluators: P. G. Young, G. Hale, M. Chadwick (LANL)
HISTORY:

1994 Aug	LANL	P. G. Young (reviewer: M. Chadwick)
	ENDF/B-VI	MAT 725 MOD 3, Release 3
1992 Sep	LANL	P. G. Young (reviewer: D. Ressler)
	ENDF/B-VI	MAT 725 MOD 2, Release 2
1990 May	LANL	P. Young, G. Hale, M. Chadwick (reviewer: D. Larson)
	ENDF/B-VI	MAT 725 MOD 1, Release 0

Evaluation: **^{15}N ENDF/B-VI Incident Neutron Sublibrary** (MAT 728)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 13, 14, 15
Evaluators: E. Arthur, P. Young, G. Hale (LANL)
HISTORY

1983 Sep	LANL	E. Arthur, P. Young, G. Hale
	ENDF/B-VI	MOD 0, Release 0

Evaluation: **^{16}O ENDF/B-VI Incident Neutron Sublibrary** (MAT 825)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 12, 13, 14
Evaluators: G. Hale, Z. Chen, P. Young (LANL)
HISTORY

1990 Jan	LANL	G. Hale, Z. Chen, P. Young
	ENDF/B-VI	MOD 0, Release 0

Evaluation: **^{17}O ENDF/B-VI Incident Neutron Sublibrary** (MAT 828)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: B. A. Magurno (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1978 Jan	BNL	B. A. Magurno
	ENDF/B-V	MAT 1317

Evaluation: **^{19}F ENDF/B-VI Incident Neutron Sublibrary** (MAT 925)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 6, 8, 9, 12, 14, 33
Evaluators: Z. Zhao (CNDC); C. Y. Fu, D. C. Larson (ORNL)
HISTORY

1990 Jun	CNDC, ORNL	Z. Zhao, C. Y. Fu, D. C. Larson
	ENDF/B-VI	MOD 1, Release 0

Evaluation: **^{23}Na ENDF/B-VI Incident Neutron Sublibrary** (MAT 1125)
Energy Range: 10^{-5} eV to 40 MeV
Files: 1, 2, 3, 4, 5, 8, 9, 12, 13, 14, 15, 32, 33
Evaluators: D. C. Larson (ORNL)
HISTORY

1991 Jul	BNL	NNDC
	ENDF/B-VI	MAT 1125 MOD 2, Release 1
1990 Jan	BNL	NNDC (Translated from ENDF/B-V)
	ENDF/B-VI	MAT 1125 MOD 0, Release 0
1977 Dec	ORNL	D. C. Larson
	ENDF/B-V	MAT 1311

Evaluation: **^{nat}Mg ENDF/B-VI Incident Neutron Sublibrary** (MAT 1200)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: D. C. Larson (ORNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1978 Feb	ORNL	D. C. Larson
	ENDF/B-V	MAT 1312

Evaluation: **^{24}Mg ENDF/B-VI Incident Neutron Sublibrary** (MAT 1225)
Energy Range: 10^{-5} to 20 MeV
Files (MF): 1, 2, 3, 8, 9
Evaluators: F. Mann (HEDL), D. C. Larson (ORNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1979 Nov	HEDL, ORNL	F. Mann, D. C. Larson
	ENDF/B-V	MAT 7124

Evaluation: **^{27}Al ENDF/B-VI Incident Neutron Sublibrary** (MAT 1325)
Energy Range: 10^{-5} eV to 40 MeV
Files: 1, 2, 3, 4, 6, 8, 9, 12, 14, 15
Evaluators: P. G. Young (LANL)
HISTORY

1996 Aug	LANL,BNL	P. G. Young, V. McLane
	ENDF/B-VI	MAT 1325 MOD 2, Release 4
1994 Sep	ANL	P. G. Young (reviewer: M. Chadwick)
	ENDF/B-VI	MAT 1325 MOD 1, Release 3
1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 1325 MOD 0, Release 0
1977 Aug	LANL	P. G. Young, D. G. Foster, Jr.
	ENDF/B-V	MAT 1313

Evaluation: **^{nat}Si ENDF/B-VI Incident Neutron Sublibrary** (MAT 1400)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 12, 13, 14, 15, 33
Evaluators: D. C. Larson, F. Perey (ORNL); M. K. Drake (GGA), P. G. Young (LANL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1974 Feb	ORNL,GGA,LANL	D. C. Larson, F. Perey, M. K. Drake, P. G. Young
	ENDF/B-V	MAT 1314
	ENDF/B-IV	MAT 1194

Evaluation: **^{31}P ENDF/B-VI Incident Neutron Sublibrary** (MAT 1525)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8, 9, 12, 13, 14, 15
Evaluators: R. Howerton (LLNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1977 Oct	LLNL	R. Howerton
	ENDF/B-V	MAT 1315

Evaluation: **^{nat}S ENDF/B-VI Incident Neutron Sublibrary** (MAT 1600)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: M. Divideenum (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1979 Apr	BNL	M. Divideenum
	ENDF/B-V	MAT 1347

Evaluation: **^{32}S ENDF/B-VI Incident Neutron Sublibrary** (MAT 1625)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8, 9, 12, 13, 14, 15
Evaluators: R. Howerton (LLNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1977 Oct	LLNL	R. Howerton
	ENDF/B-V	MAT 1316

Evaluation: **^{nat}Cl ENDF/B-VI Incident Neutron Sublibrary** (MAT 1700)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: M. S. Allen, M. K. Drake (GGA)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1967 Feb	GGA	M. S. Allen, M. K. Drake
	ENDF/B-V	MAT 1149 (γ production representation revised)
	ENDF/B-IV	MAT 1149 (energy range extended to 20 MeV)
	ENDF/B-III	MAT 1149 (low-energy capture and (n,p) revised)

Evaluation: **^{40}Ar ENDF/B-VI Incident Neutron Sublibrary** (MAT 1837)
Material: 1837 MOD 0 (January 1990)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 8, 9
Evaluators: F. Mann (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1979 Jan	HEDL	F. Mann
	ENDF/B-V	MAT 7180

Evaluation: **^{nat}K ENDF/B-VI Incident Neutron Sublibrary** (MAT 1900)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 14, 15
Evaluators: M. K. Drake (GGA)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1967 Feb	GGA	M. K. Drake
	ENDF/B-V	MAT 1150
	ENDF/B-IV	MAT 1150 (extended to 20 MeV)
	ENDF/B-III	MAT 1150

Evaluation: **^{41}K ENDF/B-VI Incident Neutron Sublibrary** (MAT 1931)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 8, 9
Evaluators: F. Mann (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1979 Jan	HEDL	F. Mann
	ENDF/B-V	MAT 7191

Evaluation: **^{nat}Ca ENDF/B-VI Incident Neutron Sublibrary** (MAT 2000)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14
Evaluators: C. Y. Fu, D. M. Hetrick (ORNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1980 Oct	ORNL	C. Y. Fu, D. M. Hetrick
	ENDF/B-V	MAT 1320 (energy range 8-20 MeV reevaluated)
1971 Aug	ORNL	F. G. Perey, M. K. Drake
	ENDF/B-IV	MAT 1195
	ENDF/B-III	MAT 1152

Evaluation: **^{45}Sc ENDF/B-VI Incident Neutron Sublibrary** (MAT 2125)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: A. B. Smith (ANL), R. J. Howerton (LLNL)
HISTORY

1992 Jul	ANL,LLNL	A. B. Smith, R. J. Howerton
	ENDF/B-VI	MAT 2145 MOD 1, Release 2
1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1979 Jul	BNL	B. A. Magurno, S. Mughabghab
	ENDF/B-V	MAT 279, 343

Evaluation: **^{nat}Ti ENDF/B-VI Incident Neutron Sublibrary** (MAT 2200)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: C. Philis (BRC), A. Smith(ANL), R. Howerton (LLNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1979 Aug	BRC,ANL,LLNL	C. Philis, R. Howerton, A. B. Smith
	ENDF/B-V	MAT 5322

Evaluation: **^{46}Ti ENDF/B-VI Incident Neutron Sublibrary** (MAT 2225)
Files (MF): 1, 2, 3, 8, 9, 33
Evaluators: C. Philis, O. Bersillon (BRC); D. Smith, et al. (ANL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1977 Jan	BRC,ANL,LLNL	C. Philis, O. Bersillon, D. Smith
	ENDF/B-V	MAT 6227

Evaluation: **^{47}Ti ENDF/B-VI Incident Neutron Sublibrary** (MAT 2228)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 8, 9, 33
Evaluators: C. Philis, O. Bersillon (BRC); D. Smith, et al. (ANL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1977 Jan	BRC,ANL,LLNL	C. Philis, O. Bersillon, D. Smith
	ENDF/B-V	MAT 6228

Evaluation: **^{48}Ti ENDF/B-VI Incident Neutron Sublibrary** (MAT 2231)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 8, 9, 33
Evaluators: C. Philis, O. Bersillon (BRC); D. Smith, et al. (ANL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1977 Jan	BRC,ANL,LLNL	C. Philis, O. Bersillon, D. Smith
	ENDF/B-V	MAT 6229

Evaluation: **^{50}Ti ENDF/B-VI Incident Neutron Sublibrary** (MAT 2237)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 8, 9
Evaluators: E. Arthur (LANL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1979 May	LANL	E. Arthur
	ENDF/B-V	MAT 7220

Evaluation: **^{nat}V ENDF/B-VI Incident Neutron Sublibrary** (MAT 2300)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15, 33
Evaluators: A. Smith, D. Smith, P. Guenther, J. Meadows, R. Lawson (ANL); R. Howerton (LLNL); T. Djemil, B. Micklich (UI)
HISTORY

1988 Jun	ANL,LLNL,UI	A. Smith, D. Smith, J. Meadows, et al.
	ENDF/B-VI	MOD 1, Release 0

Evaluation: **^{50}Cr ENDF/B-VI Incident Neutron Sublibrary** (MAT 2425)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, D. C. Larson, N. M. Larson, C. Y. Fu (ORNL)
HISTORY

1991 Jul	ORNL	D. Hetrick, D. Larson, N. Larson, C. Fu
	ENDF/B-VI	MAT 2425 MOD 2, Release 1
1989 Nov	ORNL	D. Hetrick, D. Larson, N. Larson, C. Fu
	ENDF/B-VI	MAT 2425 MOD 1, Release 0

Evaluation: **^{52}Cr ENDF/B-VI Incident Neutron Sublibrary** (MAT 2431)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, D. C. Larson, N. M. Larson, C. Y. Fu (ORNL)
HISTORY

1991 Jul	ORNL	D. Hetrick, D. Larson, N. Larson, C. Fu
	ENDF/B-VI	MAT 2431 MOD 2, Release 1
1989 Nov	ORNL	D. Hetrick, D. Larson, N. Larson, C. Fu
	ENDF/B-VI	MAT 2431 MOD 1, Release 0

Evaluation: **^{53}Cr ENDF/B-VI Incident Neutron Sublibrary** (MAT 2434)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, D. C. Larson, N. M. Larson, C. Y. Fu (ORNL)
HISTORY

1991 Jul	ORNL	D. Hetrick, D. Larson, N. Larson, C. Fu
	ENDF/B-VI	MAT 2434 MOD 2, Release 1
1989 Nov	ORNL	D. Hetrick, D. Larson, N. Larson, C. Fu
	ENDF/B-VI	MAT 2431 MOD 1, Release 0

Evaluation: **^{54}Cr ENDF/B-VI Incident Neutron Sublibrary** (MAT 2437)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, D. C. Larson, N. M. Larson, C. Y. Fu (ORNL)
HISTORY

1991 Jul	ORNL	D. Hetrick, D. Larson, N. Larson, C. Fu
	ENDF/B-VI	MAT 2437 MOD 2, Release 1
1989 Nov	ORNL	D. Hetrick, D. Larson, N. Larson, C. Fu
	ENDF/B-VI	MAT 2437 MOD 1, Release 0

Evaluation: **^{55}Mn ENDF/B-VI Incident Neutron Sublibrary** (MAT 2525)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: K. Shibata (JAERI, ORNL)
HISTORY

1988 Mar	JAERI,ORNL	K. Shibata (Reviewed by D. Muir)
	ENDF/B-VI	MOD 1, Release 0

Evaluation: **^{54}Fe ENDF/B-VI Incident Neutron Sublibrary** (MAT 2625)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, C. Y. Fu, N. M. Larson (ORNL)
HISTORY

1991 Jul	ORNL	D. Hetrick, C. Fu, N. Larson
	ENDF/B-VI	MAT 2625 MOD 2, Release 1
1989 Nov	ORNL	D. Hetrick, C. Fu, N. Larson
	ENDF/B-VI	MAT 2625 MOD 1, Release 0

Evaluation: **^{56}Fe ENDF/B-VI Incident Neutron Sublibrary** (MAT 2631)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, C. Y. Fu, N. M. Larson (ORNL)
HISTORY

1991 Jul	ORNL	D. Hetrick, C. Fu, N. Larson
	ENDF/B-VI	MAT 2631 MOD 2, Release 1
1989 Mar	ORNL	D. Hetrick, C. Fu, N. Larson
	ENDF/B-VI	MAT 2631 MOD 1, Release 0

Evaluation: **^{57}Fe ENDF/B-VI Incident Neutron Sublibrary** (MAT 2634)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, C. Y. Fu, N. M. Larson (ORNL)
HISTORY

1991 Jul	ORNL	D. Hetrick, C. Fu, N. Larson
	ENDF/B-VI	MAT 2634 MOD 2, Release 1
1989 Nov	ORNL	D. Hetrick, C. Fu, N. Larson
	ENDF/B-VI	MAT 2634 MOD 1, Release 0

Evaluation: **^{58}Fe ENDF/B-VI Incident Neutron Sublibrary** (MAT 2637)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, C. Y. Fu, N. M. Larson (ORNL)
HISTORY

1991 Jul	ORNL	D. Hetrick, C. Fu, N. Larson
	ENDF/B-VI	MAT 2637 MOD 2, Release 1
1989 Nov	ORNL	D. Hetrick, C. Fu, N. Larson
	ENDF/B-VI	MAT 2637 MOD 1, Release 0

Evaluation: **^{59}Co ENDF/B-VI Incident Neutron Sublibrary** (MAT 2725)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 13, 14, 15, 33
Evaluators: G. DeSaussure, N. M. Larson, J. A. Harvey, N. W. Hill (ORNL), A. B. Smith, D.Smith, P. Gunther, et al. (ANL); R. Howerton (LLNL), M. Sugimoto (JAERI)

HISTORY

1992 Jun	ORNL	G. deSaussure, N. M. Larson, J. A. Harvey, N. W. Hill
	ENDF/B-VI	MAT 2725 MOD 2, Release 1
1989 Jul	ANL,LLNL,JAERI	A.Smith, D.Smith, et al. (reviewer: P. Young)
	ENDF/B-VI	MAT 2725 MOD 1, Release 0

Evaluation: **^{58}Ni ENDF/B-VI Incident Neutron Sublibrary** (MAT 2825)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. C. Larson, C. M. Perey, D. M. Hetrick, C. Y. Fu (ORNL)

HISTORY

1991 Jul	ORNL	D. C. Larson, C. M. Perey, D. M. Hetrick, C. Y. Fu
	ENDF/B-VI	MAT 2825 MOD 2, Release 1
1989 Oct	ORNL	D. C. Larson, C. M. Perey, D. M. Hetrick, C. Y. Fu (reviewer: D. L. Smith)
	ENDF/B-VI	MAT 2825 MOD 1, Release 0

Evaluation: **^{59}Ni ENDF/B-VI Incident Neutron Sublibrary** (MAT 2831)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3
Evaluators: F. Mann (HEDL)

HISTORY

1983 Jan	HEDL	F. Mann
	ENDF/B-VI	MAT 2828 MOD 1, Release 0

Evaluation: **^{60}Ni ENDF/B-VI Incident Neutron Sublibrary** (MAT 2831)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. C. Larson, C. M. Perey, D. M. Hetrick, C. Y. Fu (ORNL)

HISTORY

1991 Jul	ORNL	D. Larson, C. Perey, D. Hetrick, C. Fu
	ENDF/B-VI	MAT 2831 MOD 2, Release 1
1989 Oct	ORNL	D. Larson, C. Perey, D. Hetrick, C. Fu (reviewer: D. Smith)
	ENDF/B-VI	MAT 2831 MOD 1, Release 0

Evaluation: **^{61}Ni ENDF/B-VI Incident Neutron Sublibrary** (MAT 2834)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, C. Y. Fu, D. C. Larson (ORNL)
HISTORY

1991 Jul	ORNL	D. Hetrick, C. Fu, D. Larson
	ENDF/B-VI	MAT 2834 MOD 2, Release 1
1989 Oct	ORNL	D. Hetrick, C. Fu, D. Larson (reviewer: D. L. Smith)
	ENDF/B-VI	MAT 2834 MOD 1, Release 0

Evaluation: **^{62}Ni ENDF/B-VI Incident Neutron Sublibrary** (MAT 2837)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, C. Y. Fu, D. C. Larson (ORNL)
HISTORY

1991 Jul	ORNL	D. Hetrick, C. Fu, D. Larson
	ENDF/B-VI	MAT 2837 MOD 2, Release 1
1989 Oct	ORNL	D. Hetrick, C. Fu, D. Larson (reviewer: D. Smith)
	ENDF/B-VI	MAT 2837 MOD 1, Release 0

Evaluation: **^{64}Ni ENDF/B-VI Incident Neutron Sublibrary** (MAT 2843)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, C. Y. Fu, D. C. Larson (ORNL)
HISTORY

1991 Jul	ORNL	D. Hetrick, C. Fu, D. Larson
	ENDF/B-VI	MAT 2843 MOD 2, Release 1
1989 Oct	ORNL	D. Hetrick, C. Fu, D. Larson (reviewer: D. Smith)
	ENDF/B-VI	MAT 2843 MOD 1, Release 0

Evaluation: **^{63}Cu ENDF/B-VI Incident Neutron Sublibrary** (MAT 2925)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, C. Y. Fu, D. C. Larson (ORNL)
HISTORY

1992 Mar	ORNL	D. Hetrick, C. Fu, D. Larson
	ENDF/B-VI	MAT 2925 MOD 3 (No MOD 2), Release 2
1989 Nov	ORNL	D. Hetrick, C. Fu, D. Larson
	ENDF/B-VI	MAT 2925 MOD 1, Release 0

Evaluation: **^{65}Cu ENDF/B-VI Incident Neutron Sublibrary** (MAT 2931)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: D. M. Hetrick, C. Y. Fu, D. C. Larson (ORNL)
HISTORY

1992 Mar	ORNL	D. Hetrick, C. Fu, D. Larson
	ENDF/B-VI	MAT 2931 MOD 3 (No MOD 2), Release 2
1989 Nov	ORNL	D. Hetrick, C. Fu, D. Larson
	ENDF/B-VI	MAT 2931 MOD 1, Release 0

Evaluation: **^{nat}Ga ENDF/B-VI Incident Neutron Sublibrary** (MAT 3231)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: R. Howerton (LLNL), P. G. Young (LANL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3100 MOD 0, Release 0
1980 May	LLNL,LANL	R. Howerton, P. G. Young
	ENDF/B-V	MAT 1459

Evaluation: **^{72}Ge ENDF/B-VI Incident Neutron Sublibrary** (MAT 3231)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3231 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9050
	ENDF/B-IV	MAT 0048

Evaluation: **^{73}Ge ENDF/B-VI Incident Neutron Sublibrary** (MAT 3234)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. E. Schenter and F. Schmittroth (HEDL)
HISTORY

1993 Feb	BNL	NNDC (correction to MF=3, MT=53)
	ENDF/B-VI	MAT 3234 MOD 2, Release 2
1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3234 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter and F. Schmittroth
	ENDF/B-V	MAT 9051
	ENDF/B-IV	MAT 49

Evaluation: **^{74}Ge ENDF/B-VI Incident Neutron Sublibrary** (MAT 3237)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9053 (Translated from ENDF/B-IV)
	ENDF/B-IV	MAT 51

Evaluation: **^{76}Ge ENDF/B-VI Incident Neutron Sublibrary** (MAT 3243)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3243 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9056
	ENDF/B-IV	MAT 0054

Evaluation: **^{75}As ENDF/B-VI Incident Neutron Sublibrary** (MAT 3325)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3325 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9071 (Translated from ENDF/B-IV)
	ENDF/B-IV	MAT 0068

Evaluation: **^{74}Se ENDF/B-VI Incident Neutron Sublibrary** (MAT 3425)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: F. Mann (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3425 MOD 0, Release 0
1980 Apr	HEDL	F. Mann
	ENDF/B-V	MAT 9089

Evaluation: **^{76}Se ENDF/B-VI Incident Neutron Sublibrary** (MAT 3431)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3431 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9056 (Translated from ENDF/B-IV)
	ENDF/B-IV	MAT 0085

Evaluation: **^{77}Se ENDF/B-VI Incident Neutron Sublibrary** (MAT 3434)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3434 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9092
	ENDF/B-IV	MAT 0086

Evaluation: **^{78}Se ENDF/B-VI Incident Neutron Sublibrary** (MAT 3437)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3437 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9094
	ENDF/B-IV	MAT 0088

Evaluation: **^{80}Se ENDF/B-VI Incident Neutron Sublibrary** (MAT 3443)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3443 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9097
	ENDF/B-IV	MAT 0091

Evaluation: **^{82}Se ENDF/B-VI Incident Neutron Sublibrary** (MAT 3449)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3449 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9100 (Translated from ENDF/B-IV)
	ENDF/B-IV	MAT 0094

Evaluation: **^{79}Br ENDF/B-VI Incident Neutron Sublibrary** (MAT 3525)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3525 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9113
	ENDF/B-IV	MAT 0108

Evaluation: **^{81}Br ENDF/B-VI Incident Neutron Sublibrary** (MAT 3531)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3531 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9117
	ENDF/B-IV	MAT 0112

Evaluation: **^{78}Kr ENDF/B-VI Incident Neutron Sublibrary** (MAT 3625)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: A. Prince (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3625 MOD 0, Release 0
1978 Apr	BNL	A. Prince
	ENDF/B-V	MAT 1330

Evaluation: **^{80}Kr ENDF/B-VI Incident Neutron Sublibrary** (MAT 3631)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: A. Prince (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3631 MOD 0, Release 0
1978 Apr	BNL	A. Prince
	ENDF/B-V	MAT 1331

Evaluation: **^{82}Kr ENDF/B-VI Incident Neutron Sublibrary** (MAT 3637)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: A. Prince (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3637 MOD 0, Release 0
1978 Apr	BNL	A. Prince
	ENDF/B-V	MAT 1332

Evaluation: **^{83}Kr ENDF/B-VI Incident Neutron Sublibrary** (MAT 3640)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: A. Prince (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3640 MOD 0, Release 0
1978 Apr	BNL	A. Prince
	ENDF/B-V	MAT 1333

Evaluation: **^{84}Kr ENDF/B-VI Incident Neutron Sublibrary** (MAT 3643)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: A. Prince (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3643 MOD 0, Release 0
1978 Apr	BNL	A. Prince
	ENDF/B-V	MAT 1334

Evaluation: **^{85}Kr ENDF/B-VI Incident Neutron Sublibrary** (MAT 3646)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3646 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9145
	ENDF/B-IV	MAT 0138

Evaluation: **^{86}Kr ENDF/B-VI Incident Neutron Sublibrary** (MAT 3649)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: A. Prince (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3649 MOD 0, Release 0
1978 Apr	BNL	A. Prince
	ENDF/B-V	MAT 1336

Evaluation: **^{85}Rb ENDF/B-VI Incident Neutron Sublibrary** (MAT 3725)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: A. Prince (BNL), BRC
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3725 MOD 0, Release 0
1979 Oct	BNL,BRC	A. Prince
	ENDF/B-V	MAT 1360

Evaluation: **^{86}Rb ENDF/B-VI Incident Neutron Sublibrary** (MAT 3728)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3728 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9161 (Translated from ENDF/B-IV)
	ENDF/B-IV	MAT 0154

Evaluation: **^{87}Rb ENDF/B-VI Incident Neutron Sublibrary** (MAT 3731)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: A. Prince (BNL), BRC
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3731 MOD 0, Release 0
1979 Oct	BNL,BRC	A. Prince
	ENDF/B-V	MAT 1341

Evaluation: **^{84}Sr ENDF/B-VI Incident Neutron Sublibrary** (MAT 3825)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: F. Mann (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3825 MOD 0, Release 0
1980 Feb	HEDL	F. Mann
	ENDF/B-V	MAT 9179

Evaluation: **^{86}Sr ENDF/B-VI Incident Neutron Sublibrary** (MAT 3831)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3831 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9182 (Translated from ENDF/B-IV)
	ENDF/B-IV	MAT 0172

Evaluation: **^{87}Sr ENDF/B-VI Incident Neutron Sublibrary** (MAT 3834)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3834 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9183 (Translated from ENDF/B-IV)
	ENDF/B-IV	MAT 0173

Evaluation: **^{88}Sr ENDF/B-VI Incident Neutron Sublibrary** (MAT 3837)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3837 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9185 (Translated from ENDF/B-IV)
	ENDF/B-IV	MAT 0175

Evaluation: **^{89}Sr ENDF/B-VI Incident Neutron Sublibrary** (MAT 3840)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3840 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9186
	ENDF/B-IV	MAT 0176

Evaluation: **^{90}Sr ENDF/B-VI Incident Neutron Sublibrary** (MAT 3843)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3843 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9187
	ENDF/B-IV	MAT 0177

Evaluation: **^{89}Y ENDF/B-VI Incident Neutron Sublibrary** (MAT 3925)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15, 33
Evaluators: R. Howerton (LLNL); A. B. Smith, D. L. Smith, P. Rousset, R. D. Lawson (ANL)
HISTORY

1996 Oct	BNL, LANL	P. Young, V. McLane
	ENDF/B-VI	MAT 3925 MOD 2, Release 4
1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3925 MOD 0, Release 0
1986 Jan	ANL,LLNL	R. Howerton, A. Smith, D. Smith, P. Rousset, R. Lawson
	ENDF/B-V	MAT 9202 (Reviewers: R. Schenter, P. Young)

Evaluation: **^{90}Y ENDF/B-VI Incident Neutron Sublibrary** (MAT 3928)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3928 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9204
	ENDF/B-IV	MAT 0194

Evaluation: **^{91}Y ENDF/B-VI Incident Neutron Sublibrary** (MAT 3931)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 3931 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9206
	ENDF/B-IV	MAT 0196

Evaluation: **^{nat}Zr ENDF/B-VI Incident Neutron Sublibrary** (MAT 4000)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: M. Drake, D. Sragis, T. Maung (SAI), P. Rose (BNL)
HISTORY

1991 Aug	BNL	NNDC
	ENDF/B-VI	MAT 4000 MOD 2, Release 1
1990 Jan	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 4000 MOD 0, Release 0
1976 Apr	SAI	M. Drake, D. Sargis, T. Maung, P. Rose
	ENDF/B-V	MAT 1340

Evaluation: **^{90}Zr ENDF/B-VI Incident Neutron Sublibrary** (MAT 4025)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8,9
Evaluators: M. Drake, D. Sragis, T. Maung (SAI), P. Rose (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4025 MOD 0, Release 0
1981	SAI	M. Drake, D. Sargis, T. Maung, P. Rose
	ENDF/B-V	MAT 1385 MOD 2
1976 Apr	SAI	M. Drake, D. Sargis, T. Maung
	ENDF/B-V	MAT 1385 MOD 1

Evaluation: **^{91}Zr ENDF/B-VI Incident Neutron Sublibrary** (MAT 4028)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: M. Drake, D. Sragis, T. Maung (SAI), P. Rose (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4028 MOD 0, Release 0
1976 Apr	SAI	M. Drake, D. Sargis, T. Maung, P. Rose
	ENDF/B-V	MAT 1386

Evaluation: **^{92}Zr ENDF/B-VI Incident Neutron Sublibrary** (MAT 4031)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8, 9
Evaluators: M. Drake, D. Sragis, T. Maung (SAI), P. Rose (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4031 MOD 0, Release 0
1976 Apr	SAI	M. Drake, D. Sargis, T. Maung, P. Rose
	ENDF/B-V	MAT 1387

Evaluation: **^{93}Zr ENDF/B-VI Incident Neutron Sublibrary** (MAT 4034)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4031 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9232
	ENDF/B-IV	MAT 0219

Evaluation: **^{94}Zr ENDF/B-VI Incident Neutron Sublibrary** (MAT 4037)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8, 9
Evaluators: M. Drake, D. Sragis, T. Maung (SAI), P. Rose (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4037 MOD 0, Release 0
1976 Apr	SAI	M. Drake, D. Sargis, T. Maung, P. Rose
	ENDF/B-V	MAT 1388

Evaluation: **^{95}Zr ENDF/B-VI Incident Neutron Sublibrary** (MAT 4040)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4040 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9234
	ENDF/B-IV	MAT 0221

Evaluation: **^{96}Zr ENDF/B-VI Incident Neutron Sublibrary** (MAT 4043)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: M. Drake, D. Sragis, T. Maung (SAI), P. Rose (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4043 MOD 0, Release 0
1976 Apr	SAI	M. Drake, D. Sargis, T. Maung, P. Rose
	ENDF/B-V	MAT 1389

Evaluation: **^{93}Nb ENDF/B-VI Incident Neutron Sublibrary** (MAT 4125)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 10, 12, 13, 14, 15, 33, 40
Evaluators: A. B. Smith, D. L. Smith, L. P. Gerardo (ANL); R. J. Howerton (LLNL)
HISTORY

1991 Aug	BNL	NNDC
	ENDF/B-VI	MAT 4125 MOD 2, Release 1
1990 Mar	ANL,LLNL	A. Smith, D. Smith, L. Gerardo, R. Howerton
	ENDF/B-VI	MAT 4125 MOD 1, Release 0

Evaluation: **^{94}Nb ENDF/B-VI Incident Neutron Sublibrary** (MAT 4128)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4128 MOD 0, Release 0
1974 Apr	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9251
	ENDF/B-IV	MAT 238

Evaluation: **^{95}Nb ENDF/B-VI Incident Neutron Sublibrary** (MAT 4131)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4131 MOD 0, Release 0
1974 Apr	HEDL,ANC	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9253
	ENDF/B-IV	MAT 240

Evaluation: **^{nat}Mo ENDF/B-VI Incident Neutron Sublibrary** (MAT 4200)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: R. Howerton (LLNL); R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4200 MOD 0, Release 0
1979 Feb	HEDL,INEL	R. Howerton, R.E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 1321

Evaluation: **^{92}Mo ENDF/B-VI Incident Neutron Sublibrary** (MAT 4225)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 8, 9
Evaluators: R. E. Schenter, D. L. Johnson, F. Mann, F. Schmittroth (HEDL); H. Gruppelaar (RCN)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4225 MOD 0, Release 0
1980 Feb	HEDL,INEL	R. Schenter, D. Johnson, F. Mann, et al.
	ENDF/B-V	MAT 9278

Evaluation: **^{94}Mo ENDF/B-VI Incident Neutron Sublibrary** (MAT 4231)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4231 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9281

Evaluation: **^{95}Mo ENDF/B-VI Incident Neutron Sublibrary** (MAT 4234)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN)

HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4234 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9282

Evaluation: **^{96}Mo ENDF/B-VI Incident Neutron Sublibrary** (MAT 4237)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN)

HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4237 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9283

Evaluation: **^{97}Mo ENDF/B-VI Incident Neutron Sublibrary** (MAT 4240)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN)

HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4240 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9284

Evaluation: **^{98}Mo ENDF/B-VI Incident Neutron Sublibrary** (MAT 4243)
Material: 4243 MOD 0 (January 1990)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, D. Johnson, F. Mann, F. Schmittroth (HEDL); H. Gruppelaar (RCN)

HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4243 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, D. Johnson, F. Mann, et al.
	ENDF/B-V	MAT 9285

Evaluation: **^{99}Mo ENDF/B-VI Incident Neutron Sublibrary** (MAT 4246)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL); C. Reich (INEL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4246 MOD 0, Release 0
1974 Apr	HEDL,INEL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9286

Evaluation: **^{100}Mo ENDF/B-VI Incident Neutron Sublibrary** (MAT 4249)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, D. Johnson, F. Mann, F. Schmittroth (HEDL); H. Gruppelaar (RCN)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4249 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, D. Johnson, F. Mann, et al.
	ENDF/B-V	MAT 9287

Evaluation: **^{99}Tc ENDF/B-VI Incident Neutron Sublibrary** (MAT 4325)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, D. Johnson, F. Mann, F. Schmittroth (HEDL); H. Gruppelaar (RCN); Z. Livolsi (BAW)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4325 MOD 0, Release 0
1978 Nov	HEDL,BAW,RCN	R. Schenter, Z. Livolsi, F. Schmittroth, et al.
	ENDF/B-V	MAT 1308

Evaluation: **^{96}Ru ENDF/B-VI Incident Neutron Sublibrary** (MAT 4425)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: F. Mann (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4425 MOD 0, Release 0
1980 Feb	HEDL	F. Mann
	ENDF/B-V	MAT 9325

Evaluation: **^{98}Ru ENDF/B-VI Incident Neutron Sublibrary** (MAT 4431)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: F. Mann (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4431 MOD 0, Release 0
1980 Feb	HEDL	F. Mann
	ENDF/B-V	MAT 9327

Evaluation: **^{99}Ru ENDF/B-VI Incident Neutron Sublibrary** (MAT 4434)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4434 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9328
	ENDF/B-IV	MAT 308

Evaluation: **^{100}Ru ENDF/B-VI Incident Neutron Sublibrary** (MAT 4437)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Grupelaar (RCN)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4437 MOD 0, Release 0
1980 Feb	HEDL, RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9329

Evaluation: **^{101}Ru ENDF/B-VI Incident Neutron Sublibrary** (MAT 4440)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. L. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN)
HISTORY

1991 Oct	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 4440 MOD 2, Release 2
1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4440 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9330

Evaluation: **^{102}Ru ENDF/B-VI Incident Neutron Sublibrary** (MAT 4443)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. L. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN)

HISTORY

1991 Oct	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 4443 MOD 2, Release 2
1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4443 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9331

Evaluation: **^{103}Ru ENDF/B-VI Incident Neutron Sublibrary** (MAT 4446)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)

HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4446 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9332
	ENDF/B-IV	MAT 312

Evaluation: **^{104}Ru ENDF/B-VI Incident Neutron Sublibrary** (MAT 4449)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Grupelaar (RCN)

HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4449 MOD 0, Release 0
1980 Feb	HEDL, RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9333

Evaluation: **^{105}Ru ENDF/B-VI Incident Neutron Sublibrary** (MAT 4452)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)

HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4452 MOD 0, Release 0
1974 Apr	HEDL,ANC	R. Schenter, F. Schmittroth, C. Reich
	ENDF/B-V	MAT 9334
	ENDF/B-IV	MAT 314

Evaluation: **^{106}Ru ENDF/B-VI Incident Neutron Sublibrary** (MAT 4455)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4455 MOD 0, Release 0
1974 Apr	HEDL,ANC	R. Schenter, F. Schmittroth, C. Reich
	ENDF/B-V	MAT 9335
	ENDF/B-IV	MAT 315

Evaluation: **^{103}Rh ENDF/B-VI Incident Neutron Sublibrary** (MAT 4525)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, D. L. Johnson, F. Mann, F. Schmittroth (HEDL); H. Gruppelaar (RCN); Z. Livolsi (BAW)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4525 MOD 0, Release 0
1978 Nov	HEDL,BAW,RCN	R. Schenter, F. Mann, Z. Livolsi, H. Gruppelaar, et al.
	ENDF/B-V	MAT 1310

Evaluation: **^{105}Rh ENDF/B-VI Incident Neutron Sublibrary** (MAT 4531)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4531 MOD 0, Release 0
1974 Apr	HEDL,ANC	R. Schenter, F. Schmittroth, C. Reich
	ENDF/B-V	MAT 9355
	ENDF/B-V	MAT 334

Evaluation: **^{102}Pd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4625)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: F. Mann (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4625 MOD 0, Release 0
1980 Feb	HEDL	F. Mann
	ENDF/B-V	MAT 9379

Evaluation: **^{104}Pd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4631)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Grupelaar (RCN)

HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4631 MOD 0, Release 0
1980 Feb	HEDL, RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9381

Evaluation: **^{105}Pd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4634)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. Schenter, F. Schmittroth, F. Mann (HEDL); H. Grupelaar, et al. (RCN)

HISTORY

1989 Oct	ORNL,HEDL,RCN	R. Q. Wright, R. Schenter, F. Mann, et al.
	ENDF/B-VI	MAT 4634 MOD 1, Release 0

Evaluation: **^{106}Pd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4637)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. L. Johnson, G. Neely (HEDL); H. Grupelaar (RCN)

HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4637 MOD 0, Release 0
1980 Feb	HEDL, RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9383

Evaluation: **^{107}Pd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4640)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. Schenter, F. Mann, D. Johnson, G. Neely (HEDL); H. Grupelaar (RCN)

HISTORY

1989 Dec	ORNL,HEDL,RCN	R. Q. Wright, R. Schenter, F. Mann, et al.
	ENDF/B-VI	MAT 4640 MOD 1, Release 0

Evaluation: **^{108}Pd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4643)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Grupelaar, et al. (RCN)

HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4643 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9386

Evaluation: **^{110}Pd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4649)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Grupelaar, et al. (RCN)

HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4649 MOD 0, Release 0
1980 Feb	HEDL, RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9389

Evaluation: **^{107}Ag ENDF/B-VI Incident Neutron Sublibrary** (MAT 4725)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: A. Prince (BNL), R. Schenter (HEDL)

HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4725 MOD 0, Release 0
1983 Jun	BNL,HEDL	A. Prince, R. Schenter
	ENDF/B-V	MAT 1407

Evaluation: **^{109}Ag ENDF/B-VI Incident Neutron Sublibrary** (MAT 4731)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8, 9
Evaluators: A. Prince (BNL), R. Schenter (HEDL)

HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4731 MOD 0, Release 0
1983 Jun	BNL,HEDL	A. Prince, R. Schenter
	ENDF/B-V	MAT 1409

Evaluation: **^{111}Ag ENDF/B-VI Incident Neutron Sublibrary** (MAT 4737)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4737 MOD 0, Release 0
1974 Apr	HEDL,ANC	R. Schenter, F. Schmittroth, C. Reich
	ENDF/B-V	MAT 9415
	ENDF/B-IV	MAT 391

Evaluation: **^{nat}Cd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4800)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: S. Pearlstein (BNL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4800 MOD 0, Release 0
1974 May	BNL	S. Pearlstein (transl. from UKNDL DFN-10)
	ENDF/B-V	MOD 1281

Evaluation: **^{106}Cd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4825)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: J. McCabe, A. B. Smith, J. W. Meadows (ANL); R. Q. Wright (ORNL)
HISTORY

1996 Aug	ORNL,NNDC	R.Q. Wright, V. McLane
	ENDF/B-VI	MAT 4825 MOD 4, Release 4
1994 Aug	ANL	J. McCabe, A. Smith, J. Meadows (reviewer: P. Young)
	ENDF/B-VI	MAT 4825 MOD 3, Release 3 (mislabeled MOD 1)
1991 Dec	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 4825 MOD 2, Release 2
1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4825 MOD 0, Release 0
1980 Feb	HEDL	F. Mann
	ENDF/B-V	MAT 9440

Evaluation: **^{108}Cd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4831)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: J. McCabe, A. B. Smith, J. W. Meadows (UAZ,ANL); R. Q. Wright (ORNL)
HISTORY

1996 Aug	ORNL,NNDC	R.Q. Wright, V. McLane
	ENDF/B-VI	MAT 4825 MOD 4, Release 4
1994 Aug	ANL	J. McCabe, A. Smith, J. Meadows (reviewer: P. Young)
	ENDF/B-VI	MAT 4831 MOD 3, Release 3 (mislabeled MOD 1)
1991 Oct	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 4831 MOD 2, Release 2
1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4831 MOD 0, Release 0
1974 Apr	HEDL	R.E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9442

Evaluation: **^{110}Cd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4837)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: J. McCabe, A. B. Smith, J. W. Meadows (UAZ,ANL); R. Q. Wright (ORNL)
HISTORY

1996 Aug	ORNL,NNDC	R.Q. Wright, V. McLane
	ENDF/B-VI	MAT 4825 MOD 4, Release 4
1994 Aug	ANL	J. McCabe, A. Smith, J. Meadows (reviewer: P. Young)
	ENDF/B-VI	MAT 4837 MOD 3, Release 3 (mislabeled MOD 1)
1991 Oct	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 4837 MOD 2, Release 2
1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4837 MOD 0, Release 0
1974 Apr	HEDL	R.E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9444

Evaluation: **^{111}Cd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4840)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: J. McCabe, A. B. Smith, J. W. Meadows (UAZ,ANL); R. Q. Wright (ORNL)
HISTORY

1994 Aug	ANL	J. McCabe, A. Smith, J. Meadows (reviewer: P. Young)
	ENDF/B-VI	MAT 4840 MOD 1, Release 3
1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4840 MOD 0, Release 0
1974 Apr	HEDL	R.E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9445

Evaluation: **^{112}Cd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4843)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: J. McCabe, A. B. Smith, J. W. Meadows (UAZ,ANL); R. Q. Wright (ORNL)
HISTORY

1996 Aug	ORNL,NNDC	R.Q. Wright, V. McLane
	ENDF/B-VI	MAT 4825 MOD 4, Release 4
1994 Aug	ANL	J. McCabe, A. Smith, J. Meadows (reviewer: P. Young)
	ENDF/B-VI	MAT 4843 MOD 3, Release 3 (mislabeled MOD 1)
1991 Oct	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 4843 MOD 2, Release 2
1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4831 MOD 0, Release 0
1974 Apr	HEDL	R.E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9447

Evaluation: **^{113}Cd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4846)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: J. McCabe, A. B. Smith, J. W. Meadows (UAZ,ANL); R. Q. Wright (ORNL)
HSTORY

1994 Aug	ANL	J. McCabe, A. Smith, J. Meadows (reviewer: P. Young)
	ENDF/B-VI	MAT 4846 MOD 1, Release 3
1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4831 MOD 0, Release 0
1978 Nov	BNL,HEDL	S. Pearlstein, F. Mann, R. Schenter
	ENDF/B-V	MAT 1318

Evaluation: **^{114}Cd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4849)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: J. McCabe, A. B. Smith, J. W. Meadows (UAZ,ANL); R. Q. Wright (ORNL)
HISTORY

1996 Aug	ORNL,NNDC	R.Q. Wright, V. McLane
	ENDF/B-VI	MAT 4825 MOD 4, Release 4
1994 Aug	ANL	J. McCabe, A. Smith, J. Meadows (reviewer: P. Young)
	ENDF/B-VI	MAT 4849 MOD 3, Release 3 (mislabeled MOD 1)
1991 Dec	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 4849 MOD 2, Release 2
1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4831 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9450

Evaluation: **^{115m}Cd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4853)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4853 MOD 0, Release 0
1974 Apr	HEDL,ANC	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9452
	ENDF/B-IV	MAT 425

Evaluation: **^{116}Cd ENDF/B-VI Incident Neutron Sublibrary** (MAT 4855)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: J. McCabe, A. B. Smith, J. W. Meadows (UAZ,ANL); R. Q. Wright (ORNL)
HISTORY

1996 Aug	ORNL,NNDC	R.Q. Wright, V. McLane
	ENDF/B-VI	MAT 4825 MOD 4, Release 4
1994 Aug	ANL	J. McCabe, A. Smith, J. Meadows (reviewer: P. Young)
	ENDF/B-VI	MAT 4855 MOD 3, Release 3 (mislabeled MOD 1)
1991 Dec	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 4855 MOD 2, Release 2
1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4855 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9453

Evaluation: **^{nat}In ENDF/B-VI Incident Neutron Sublibrary** (MAT 4900)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15, 33
Evaluators: A. B. Smith, D. L. Smith, P. Guenther (ANL)
HISTORY

1990 Feb	ANL	A. B. Smith, D. L. Smith, P. Guenther
	ENDF/B-VI	MAT 4900 MOD 1, Release 0

Evaluation: **^{113}In ENDF/B-VI Incident Neutron Sublibrary** (MAT 4925)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 4925 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9473
	ENDF/B-IV	MAT 445

Evaluation: **^{115}In ENDF/B-VI Incident Neutron Sublibrary** (MAT 4900)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 8, 9, 10, 33, 40
Evaluators: R. Schenter, F. Schmittroth (HEDL); D. L. Smith, S. Chiba (ANL)
HISTORY

1990 Mar	HEDL,ANL	R. Schenter, F. Schmittroth, D. L. Smith, S. Chiba
	ENDF/B-VI	MAT 4900 MOD 1, Release 0

Evaluation: **^{112}Sn ENDF/B-VI Incident Neutron Sublibrary** (MAT 5025)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: F. M. Mann (HEDL)
HISTORY

1991 Aug	BNL	NNDC
	ENDF/B-VI	MAT 5025 MOD 2, Release 1
1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5025 MOD 0, Release 0
1980 Feb	HEDL	F. Mann
	ENDF/B-V	MAT 9513

Evaluation: **^{114}Sn ENDF/B-VI Incident Neutron Sublibrary** (MAT 5031)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: F. M. Mann (HEDL)
HISTORY

1991 Aug	BNL	NNDC
	ENDF/B-VI	MAT 5031 MOD 2, Release 1
1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5031 MOD 0, Release 0
1980 Feb	HEDL	F. Mann
	ENDF/B-V	MAT 9516

Evaluation: **^{115}Sn ENDF/B-VI Incident Neutron Sublibrary** (MAT 5034)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5034 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9517
	ENDF/B-IV	MAT 482

Evaluation: **^{116}Sn ENDF/B-VI Incident Neutron Sublibrary** (MAT 5037)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5037 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9518
	ENDF/B-IV	MAT 483

Evaluation: **^{117}Sn ENDF/B-VI Incident Neutron Sublibrary** (MAT 5040)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5040 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9519
	ENDF/B-IV	MAT 484

Evaluation: **^{118}Sn ENDF/B-VI Incident Neutron Sublibrary** (MAT 5043)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5043 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9521
	ENDF/B-IV	MAT 486

Evaluation: **^{119}Sn ENDF/B-VI Incident Neutron Sublibrary** (MAT 5046)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5046 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9522
	ENDF/B-IV	MAT 487

Evaluation: **^{120}Sn ENDF/B-VI Incident Neutron Sublibrary** (MAT 5049)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 8, 9
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5049 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9524
	ENDF/B-IV	MAT 489

Evaluation: **^{122}Sn ENDF/B-VI Incident Neutron Sublibrary** (MAT 5055)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 8, 9
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Jan	BNL	NNDC
	ENDF/B-VI	MAT 5055 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9527
	ENDF/B-IV	MAT 492

Evaluation: **^{123}Sn ENDF/B-VI Incident Neutron Sublibrary** (MAT 5058)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5058 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9528
	ENDF/B-IV	MAT 493

Evaluation: **^{124}Sn ENDF/B-VI Incident Neutron Sublibrary** (MAT 5061)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 8, 9
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5061 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9530
	ENDF/B-IV	MAT 495

Evaluation: **^{125}Sn ENDF/B-VI Incident Neutron Sublibrary** (MAT 5064)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5064 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9531
	ENDF/B-IV	MAT 496

Evaluation: **^{126}Sn ENDF/B-VI Incident Neutron Sublibrary** (MAT 5067)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5067 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9533
	ENDF/B-IV	MAT 498

Evaluation: **^{121}Sb ENDF/B-VI Incident Neutron Sublibrary** (MAT 5125)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Grupelaar, et al. (RCN)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5125 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9548

Evaluation: **^{123}Sb ENDF/B-VI Incident Neutron Sublibrary** (MAT 5131)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Grupelaar, et al. (RCN)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5131 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9551

Evaluation: **^{124}Sb ENDF/B-VI Incident Neutron Sublibrary** (MAT 5134)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5134 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9552
	ENDF/B-IV	MAT 515

Evaluation: **^{125}Sb ENDF/B-VI Incident Neutron Sublibrary** (MAT 5137)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5137 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9555 (Translated from ENDF/B-IV)
	ENDF/B-IV	MAT 518

Evaluation: **^{126}Sb ENDF/B-VI Incident Neutron Sublibrary** (MAT 5140)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5140 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9556 (Translated from ENDF/B-IV)
	ENDF/B-IV	MAT 519

Evaluation: **^{120}Te ENDF/B-VI Incident Neutron Sublibrary** (MAT 5225)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: F. Mann (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5225 MOD 0, Release 0
1980 Feb	HEDL	F. Mann
	ENDF/B-V	MAT 9576

Evaluation: **^{122}Te ENDF/B-VI Incident Neutron Sublibrary** (MAT 5231)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5231 MOD 0 (Translated from ENDF/B-V)
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9579
	ENDF/B-IV	MAT 538

Evaluation: **^{123}Te ENDF/B-VI Incident Neutron Sublibrary** (MAT 5224)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5234 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9580
	ENDF/B-IV	MAT 539

Evaluation: **^{124}Te ENDF/B-VI Incident Neutron Sublibrary** (MAT 5237)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5237 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9582
	ENDF/B-IV	MAT 541

Evaluation: **^{125}Te ENDF/B-VI Incident Neutron Sublibrary** (MAT 5240)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5240 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9583
	ENDF/B-IV	MAT 542

Evaluation: **^{126}Te ENDF/B-VI Incident Neutron Sublibrary** (MAT 5243)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5243 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9585
	ENDF/B-IV	MAT 544

Evaluation: **^{127m}Te ENDF/B-VI Incident Neutron Sublibrary** (MAT 5247)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5247 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9587
	ENDF/B-IV	MAT 546

Evaluation: **^{128}Te ENDF/B-VI Incident Neutron Sublibrary** (MAT 5249)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5249 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9588
	ENDF/B-IV	MAT 547

Evaluation: **^{129m}Te ENDF/B-VI Incident Neutron Sublibrary** (MAT 5253)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5253 MOD 0, Release 0
1974 Oct	HEDL,ANC	R. Schenter, F. Schmittroth, C. Reich
	ENDF/B-V	MAT 9590
	ENDF/B-IV	MAT 549

Evaluation: **^{130}Te ENDF/B-VI Incident Neutron Sublibrary** (MAT 5255)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5255 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9591
	ENDF/B-IV	MAT 550

Evaluation: **^{127}I ENDF/B-VI Incident Neutron Sublibrary** (MAT 5325)
Energy Range: 10^{-5} eV to 30 MeV
Files: 1, 2, 3, 4, 6, 8, 9, 12, 14, 15
Evaluators: P. G. Young, R. E. MacFarlane (LANL)
HISTORY

1991 Mar	LANL	P. Young, R. MacFarlane
	ENDF/B-VI	MAT 5325 MOD 1, Release 2

Evaluation: **^{129}I ENDF/B-VI Incident Neutron Sublibrary** (MAT 5331)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Grupelaar, et al. (RCN)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5331 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, F. Schmittroth, F. Mann, et al.
	ENDF/B-V	MAT 9608

Evaluation: **^{130}I ENDF/B-VI Incident Neutron Sublibrary** (MAT 5334)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5334 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9609
	ENDF/B-IV	MAT 568

Evaluation: **^{131}I ENDF/B-VI Incident Neutron Sublibrary** (MAT 5337)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5337 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9611
	ENDF/B-IV	MAT 570

Evaluation: **^{135}I ENDF/B-VI Incident Neutron Sublibrary** (MAT 5349)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5349 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9618
	ENDF/B-IV	MAT 576

Evaluation: **^{124}Xe ENDF/B-VI Incident Neutron Sublibrary** (MAT 5425)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: M. R. Bhat, S. F. Mughabghab (BNL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5425 MOD 0, Release 0
1978 Mar	BNL	M. R. Bhat, S. F. Mughabghab
	ENDF/B-V	MAT 1335

Evaluation: **^{126}Xe ENDF/B-VI Incident Neutron Sublibrary** (MAT 5431)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: M. R. Bhat, S. F. Mughabghab (BNL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5431 MOD 0, Release 0
1978 Mar	BNL	M. R. Bhat, S. F. Mughabghab
	ENDF/B-V	MAT 1339

Evaluation: **^{128}Xe ENDF/B-VI Incident Neutron Sublibrary** (MAT 5437)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: M. R. Bhat, S. F. Mughabghab (BNL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5437 MOD 0, Release 0
1978 Mar	BNL	M. R. Bhat, S. F. Mughabghab
	ENDF/B-V	MAT 1348

Evaluation: **^{129}Xe ENDF/B-VI Incident Neutron Sublibrary** (MAT 5440)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: M. R. Bhat, S. F. Mughabghab (BNL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5440 MOD 0, Release 0
1978 Mar	BNL	M. R. Bhat, S. F. Mughabghab
	ENDF/B-V	MAT 1349

Evaluation: **^{130}Xe ENDF/B-VI Incident Neutron Sublibrary** (MAT 5443)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: M. R. Bhat, S. F. Mughabghab (BNL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5443 MOD 0, Release 0
1978 Mar	BNL	M. R. Bhat, S. F. Mughabghab
	ENDF/B-V	MAT 1350

Evaluation: **^{131}Xe ENDF/B-VI Incident Neutron Sublibrary** (MAT 5446)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: M. R. Bhat, S. F. Mughabghab (BNL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5446 MOD 0, Release 0
1978 Mar	BNL	M. R. Bhat, S. F. Mughabghab
	ENDF/B-V	MAT 1351

Evaluation: **^{132}Xe ENDF/B-VI Incident Neutron Sublibrary** (MAT 5449)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: M. R. Bhat, S. F. Mughabghab (BNL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5449 MOD 0, Release 0
1978 Mar	BNL	M. R. Bhat, S. F. Mughabghab
	ENDF/B-V	MAT 1352

Evaluation: **^{133}Xe ENDF/B-VI Incident Neutron Sublibrary** (MAT 5452)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5452 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9643
	ENDF/B-IV	MAT 595

Evaluation: **^{134}Xe ENDF/B-VI Incident Neutron Sublibrary** (MAT 5455)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: M. R. Bhat, S. F. Mughabghab (BNL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5455 MOD 0, Release 0
1978 Mar	BNL	M. R. Bhat, S. F. Mughabghab
	ENDF/B-V	MAT 1354

Evaluation: **^{135}Xe ENDF/B-VI Incident Neutron Sublibrary** (MAT 5458)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: B. Leonard, K. Stewart (BAW); R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5458 MOD 0, Release 0
1980 Oct	BNW,HEDL	B. Leonard, K. Stewart, R. Schenter, et al.
	ENDF/B-V	MAT 1294 (extended from 1 keV to 20 MeV)

Evaluation: **^{136}Xe ENDF/B-VI Incident Neutron Sublibrary** (MAT 5461)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: M. R. Bhat, S. F. Mughabghab (BNL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5461 MOD 0, Release 0
1978 Mar	BNL	M. R. Bhat, S. F. Mughabghab
	ENDF/B-V	MAT 1356

Evaluation: **^{133}Cs ENDF/B-VI Incident Neutron Sublibrary** (MAT 5525)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, R. Johnson, F. Mann, F. Schmittroth (HEDL); M. R. Bhat, A. Prince (BNL); H. Gruppelaar (RCN)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5525 MOD 0, Release 0
1978 Nov	HEDL,BNL,RCN	R. Schenter, R. Johnson, M. R. Bhat, A. Prince, et al.
	ENDF/B-V	MAT 1355

Evaluation: **^{134}Cs ENDF/B-VI Incident Neutron Sublibrary** (MAT 5528)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. Schenter, F. Schmittroth (HEDL)
HISTORY

1988 Dec	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 5528 MOD 1, Release 0
1974 Aprc	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9663
	ENDF/B-IV	MAT 614

Evaluation: **^{135}Cs ENDF/B-VI Incident Neutron Sublibrary** (MAT 5531)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5531 MOD 0, Release 0
1974 Aprc	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9665
	ENDF/B-IV	MAT 616

Evaluation: **^{136}Cs ENDF/B-VI Incident Neutron Sublibrary** (MAT 5534)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5534 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9667
	ENDF/B-IV	MAT 618

Evaluation: **^{137}Cs ENDF/B-VI Incident Neutron Sublibrary** (MAT 5537)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5537 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9669
	ENDF/B-IV	MAT 619

Evaluation: **^{134}Ba ENDF/B-VI Incident Neutron Sublibrary** (MAT 5637)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. Schenter, F. Schmittroth (HEDL)
HISTORY

1988 Dec	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 5637 MOD 1, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9684
	ENDF/B-IV	MAT 634

Evaluation: **^{135}Ba ENDF/B-VI Incident Neutron Sublibrary** (MAT 5640)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. Schenter, F. Schmittroth (HEDL)
HISTORY

1988 Dec	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 5640 MOD 1, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9685
	ENDF/B-IV	MAT 635

Evaluation: **^{136}Ba ENDF/B-VI Incident Neutron Sublibrary** (MAT 5643)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. Schenter, F. Schmittroth (HEDL)
HISTORY

1988 Dec	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 5643 MOD 1, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9687
	ENDF/B-IV	MAT 637

Evaluation: **^{137}Ba ENDF/B-VI Incident Neutron Sublibrary** (MAT 5646)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. Schenter, F. Schmittroth (HEDL)
HISTORY

1988 Dec	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 5646 MOD 1, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9689
	ENDF/B-IV	MAT 639

Evaluation: **^{138}Ba ENDF/B-VI Incident Neutron Sublibrary** (MAT 5649)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: R. Q. Wright (ORNL); R. Howerton (LLNL)
HISTORY:

1994 Dec	ORNL	R. Q. Wright (reviewed by Evaluation Committee)
	ENDF/B-VI	MAT 5649 MOD 2, Release 3
1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5649 MOD 0, Release 0
1978 Aug	LLNL	R. Howerton
	ENDF/B-V	MAT 1353 (converted from ENDL format)

Evaluation: **^{140}Ba ENDF/B-VI Incident Neutron Sublibrary** (MAT 5655)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY:

1995 May	BNL	NNDC
	ENDF/B-VI	MAT 5655 MOD 0, Release 3
1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5655 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9693
	ENDF/B-IV	MAT 643

Evaluation: **^{139}La ENDF/B-VI Incident Neutron Sublibrary** (MAT 5728)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 9
Evaluators: R. E. Schenter, F. Schmittroth, F. Mann, D. L. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN)
HISTORY:

1991 Jul	BNL	NNDC
	ENDF/B-VI	MAT 5728 MOD 2, Release 1
1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5728 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, F. Schmittroth, F.Mann, et al.
	ENDF/B-V	MAT 9707, 7579

Evaluation: **^{140}La ENDF/B-VI Incident Neutron Sublibrary** (MAT 5731)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5731 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9708
	ENDF/B-IV	MAT 643

Evaluation: **^{140}Ce ENDF/B-VI Incident Neutron Sublibrary** (MAT 5837)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5837 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9724
	ENDF/B-IV	MAT 674

Evaluation: **^{141}Ce ENDF/B-VI Incident Neutron Sublibrary** (MAT 5840)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5840 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9725
	ENDF/B-IV	MAT 675

Evaluation: **^{142}Ce ENDF/B-VI Incident Neutron Sublibrary** (MAT 5843)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5843 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9726
	ENDF/B-IV	MAT 676

Evaluation: **^{143}Ce ENDF/B-VI Incident Neutron Sublibrary** (MAT 5846)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5846 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9727
	ENDF/B-IV	MAT 677

Evaluation: **^{144}Ce ENDF/B-VI Incident Neutron Sublibrary** (MAT 5849)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5849 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9728
	ENDF/B-IV	MAT 678

Evaluation: **^{141}Pr ENDF/B-VI Incident Neutron Sublibrary** (MAT 5925)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth, F. Mann, D. L. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5925 MOD 0, Release 0
1980 Feb	HEDL,RCN,BNL	R. Schenter, H. Gruppelaar, A. Prince, et al.
	ENDF/B-V	MAT 9742
	ENDF/B-IV	MAT 692

Evaluation: **^{142}Pr ENDF/B-VI Incident Neutron Sublibrary** (MAT 5928)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5928 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9743
	ENDF/B-IV	MAT 693

Evaluation: **^{143}Pr ENDF/B-VI Incident Neutron Sublibrary** (MAT 5931)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 5931 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9745
	ENDF/B-IV	MAT 695

Evaluation: **^{142}Nd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6025)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 6025 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9763
	ENDF/B-IV	MAT 713

Evaluation: **^{143}Nd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6028)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. L. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)
HISTORY

1992 Jan	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6028 MOD 2, Release 2
1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 6028 MOD 0, Release 0
1980 Feb	HEDL,RCN	R. Schenter, H. Gruppelaar, A. Prince, et al.
	ENDF/B-V	MAT 9764
	ENDF/B-IV	MAT 714

Evaluation: **^{144}Nd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6031)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 6031 MOD 0, Release 0
1980 Feb	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9765

Evaluation: **^{145}Nd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6034)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)

HISTORY

1992 Jan	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6034 MOD 2, Release 2
1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 6034 MOD 0, Release 0
1980 Feb	HEDL,RCN,BNL	R. Schenter, H. Gruppelaar, A. Prince, et al.
	ENDF/B-V	MAT 9766
	ENDF/B-IV	MAT 716

Evaluation: **^{146}Nd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6037)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)

HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 6037 MOD 0, Release 0
1980 Feb	HEDL,RCN,BNL	R. Schenter, H. Gruppelaar, A. Prince, et al.
	ENDF/B-V	MAT 9767
	ENDF/B-IV	MAT 717

Evaluation: **^{147}Nd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6040)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. Schenter, F. Schmittroth (HEDL)

HISTORY

1991 Aug	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6040 MOD 2, Release 1
1988 Dec	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6040 MOD 1, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9768
	ENDF/B-IV	MAT 718

Evaluation: **^{148}Nd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6043)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)

HISTORY

1990 Fen	BNL	NNDC
	ENDF/B-VI	MAT 6043 MOD 0, Release 0
1980 Feb	HEDL,RCN,BNL	R. Schenter, H. Gruppelaar, A. Prince, et al.
	ENDF/B-V	MAT 9769
	ENDF/B-IV	MAT 719

Evaluation: **^{150}Nd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6049)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)

HISTORY

1990 Feb	BNL	NNDC
	ENDF/B-VI	MAT 6049 MOD 0, Release 0
1980 Feb	HEDL,RCN,BNL	R. Schenter, H. Gruppelaar, A. Prince, et al.
	ENDF/B-V	MAT 9771
	ENDF/B-IV	MAT 721

Evaluation: **^{147}Pm ENDF/B-VI Incident Neutron Sublibrary** (MAT 6149)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)

HISTORY

1991 Aug	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6149 MOD 2, Release 1
1989 Apr	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6149 MOD 1, Release 0
1980 Feb	HEDL	R. Schenter, H. Gruppelaar, A. Prince, et al.
	ENDF/B-V	MAT 9783
	ENDF/B-IV	MAT 733

Evaluation: **^{148}Pm ENDF/B-VI Incident Neutron Sublibrary** (MAT 6152)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6152 MOD 0, Release 0
1974 Feb	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9784
	ENDF/B-IV	MAT 734

Evaluation: **^{148m}Pm ENDF/B-VI Incident Neutron Sublibrary** (MAT 6153)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6153 MOD 0, Release 0
1974 Feb	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9785
	ENDF/B-IV	MAT 735

Evaluation: **^{149}Pm ENDF/B-VI Incident Neutron Sublibrary** (MAT 6155)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6155 MOD 0, Release 0
1974 Feb	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9786
	ENDF/B-IV	MAT 736

Evaluation: **^{151}Pm ENDF/B-VI Incident Neutron Sublibrary** (MAT 6161)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6161 MOD 0, Release 0
1974 Feb	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9788
	ENDF/B-IV	MAT 738

Evaluation: **^{144}Sm Incident Neutron Library, Release 3** (MAT 6225)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); F. M. Mann (HEDL)
HISTORY

1994 Oct	ORNL	R. Q. Wright (reviewed by the Evaluation Committee)
	ENDF/B-VI	MAT 6225 MOD 2, Release 3
1990 Feb	BNL	NNDC (converted from ENDF/B-V format)
	ENDF/B-VI	MAT 6225 MOD 0, Release 0
1980 Feb	HEDL	F. M. Mann
	ENDF/B-V	MAT 9083

Evaluation: **^{147}Sm ENDF/B-VI Incident Neutron Sublibrary** (MAT 6234)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)
HISTORY

1989 Apr	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6234 MOD 1, Release 0
1980 Feb	HEDL,RCN,BNL	R. Schenter, F. Mann, A. Prince, et al.
	ENDF/B-V	MAT 9806
	ENDF/B-IV	MAT 753

Evaluation: **^{148}Sm ENDF/B-VI Incident Neutron Sublibrary** (MAT 6237)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6237 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9807
	ENDF/B-IV	MAT 754

Evaluation: **^{149}Sm ENDF/B-VI Incident Neutron Sublibrary** (MAT 6240)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, D. Johnson, F. Mann, F. Schmittroth (HEDL); H. Gruppelaar (RCN); B. Leonard, K. Stewart (BNW)

HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6240 MOD 0, Release 0
1978 Nov	HEDL,RCN,BNW	R. Schenter, H. Gruppelaar, B. Leonard, et al.
	ENDF/B-V	MAT 1319
	ENDF/B-IV	MAT 1027

Evaluation: **^{150}Sm ENDF/B-VI Incident Neutron Sublibrary** (MAT 6243)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth (HEDL)

HISTORY

1992 Jul	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6243 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6243 MOD 0
1974 Apr	HEDL	R. E. Schenter and F. Schmittroth
	ENDF/B-V	MAT 9809
	ENDF/B-IV	MAT 756

Evaluation: **^{151}Sm ENDF/B-VI Incident Neutron Sublibrary** (MAT 6246)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)

HISTORY

1991 Aug	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6246 MOD 2, Release 1
1989 Mar	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6246 MOD 1, Release 0
1980 Feb	HEDL,RCN,BNL	R. Schenter, H. Gruppelaar, A. Prince, et al.
	ENDF/B-V	MAT 9810
	ENDF/B-IV	MAT 757

Evaluation: **^{152}Sm ENDF/B-VI Incident Neutron Sublibrary** (MAT 6249)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth, F. Mann, D. Johnson, G. Neely (HEDL); H. Gruppelaar (RCN); A. Prince (BNL)

HISTORY

1992 Oct	ORNL	R. Q. Wright (reviewed by F. Mann, P. Young)
	ENDF/B-VI	MAT 6249 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6249 MOD 0, Release 0
1980 Feb	HEDL,RCN,BNL	R. Schenter, H. Gruppelaar, A. Prince, et al.
	ENDF/B-V	MAT 9811
	ENDF/B-IV	MAT 758

Evaluation: **^{153}Sm ENDF/B-VI Incident Neutron Sublibrary** (MAT 6252)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)

HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6252 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9812
	ENDF/B-IV	MAT 759

Evaluation: **^{154}Sm ENDF/B-VI Incident Neutron Sublibrary** (MAT 6255)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Schenter, F. Schmittroth (HEDL)

HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6255 MOD 0, Release 0
1974 Apr	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9813
	ENDF/B-IV	MAT 760

Evaluation: **^{151}Eu ENDF/B-VI Incident Neutron Sublibrary** (MAT 6325)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: P. G. Young, E. D. Arthur (LANL)

HISTORY

1986 Apr	LANL	P. G. Young, E. D. Arthur
	ENDF/B-VI	MAT 6325 MOD 1, Release 0

Evaluation: **^{152}Eu ENDF/B-VI Incident Neutron Sublibrary** (MAT 6328)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL), H. Takahashi (BNL)
HISTORY

1988 Dec	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6328 MOD 1, Release 0
1973 Dec	BNL	H. Takahashi
	ENDF/B-V	MAT 1292

Evaluation: **^{153}Eu ENDF/B-VI Incident Neutron Sublibrary** (MAT 6331)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: P. G. Young, E. D. Arthur (LANL)
HISTORY

1986 Apr	LANL	P. G. Young, E. D. Arthur (Reviewer: R. Schenter)
	ENDF/B-VI	MAT 6331 MOD 1, Release 0

Evaluation: **^{154}Eu ENDF/B-VI Incident Neutron Sublibrary** (MAT 6334)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL), H. Takahashi (BNL)
HISTORY

1989 May	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6334 MOD 1, Release 0
1973 Dec	BNL	H. Takahashi
	ENDF/B-V	MAT 1293

Evaluation: **^{155}Eu ENDF/B-VI Incident Neutron Sublibrary** (MAT 6337)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. Schenter (HEDL); A. Prince (BNL)
HISTORY

1991 Aug	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6337 MOD 2, Release 1
1988 Dec	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6337 MOD 1, Release 0
1979 Dec	HEDL,BNL	R. Schenter, A. Prince
	ENDF/B-V	MAT 9832
	ENDF/B-IV	MAT 774

Evaluation: **^{156}Eu ENDF/B-VI Incident Neutron Sublibrary** (MAT 6340)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6340 MOD 0, Release 0
1974 Feb	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9833
	ENDF/B-IV	MAT 779

Evaluation: **^{157}Eu ENDF/B-VI Incident Neutron Sublibrary** (MAT 6343)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6343 MOD 0, Release 0
1974 Oct	HEDL	R. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9834
	ENDF/B-IV	MAT 780

Evaluation: **^{152}Gd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6425)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL), Fission Product Nuclear Data Group (JNDC)
HISTORY

1994 Dec	ORNL,JNDC	R. Q. Wright, JNDC FP Nuclear Data Group (Reviewer: P. Young)
	ENDF/B-VI	MAT 6425 MOD 1, Release 4
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6425 MOD 0, Release 0
1977 Jan	BNL	B. A. Magurno
	ENDF/B-V	MAT 1362

Evaluation: **^{154}Gd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6431)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL), Fission Product Nuclear Data Group (JNDC)
HISTORY

1994 Dec	ORNL,JNDC	R. Q. Wright, JNDC FP Nuclear Data Group (Reviewer: P. Young)
	ENDF/B-VI	MAT 6425 MOD 1, Release 4
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6431 MOD 0, Release 0
1977 Jan	BNL	B. A. Magurno
	ENDF/B-V	MAT 1364

Evaluation: **^{155}Gd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6434)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: B. A. Magurno (BNL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6434 MOD 0, Release 0
1977 Jan	BNL	B. A. Magurno
	ENDF/B-V	MAT 1365

Evaluation: **^{156}Gd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6437)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: B. A. Magurno (BNL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6437 MOD 0, Release 0
1977 Jan	BNL	B. A. Magurno
	ENDF/B-V	MAT 1366

Evaluation: **^{157}Gd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6440)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: B. A. Magurno (BNL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6440 MOD 0, Release 0
1977 Jan	BNL	B. A. Magurno
	ENDF/B-V	MAT 1367

Evaluation: **^{158}Gd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6443)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: B. A. Magurno (BNL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6443 MOD 0, Release 0
1977 Jan	BNL	B. A. Magurno
	ENDF/B-V	MAT 1368

Evaluation: **^{160}Gd ENDF/B-VI Incident Neutron Sublibrary** (MAT 6449)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: B. A. Magurno (BNL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6449 MOD 0, Release 0
1977 Jan	BNL	B. A. Magurno
	ENDF/B-V	MAT 1370

Evaluation: **^{159}Tb ENDF/B-VI Incident Neutron Sublibrary** (MAT 6525)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6525 MOD 0, Release 0
1980 Feb	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9857

Evaluation: **^{160}Tb ENDF/B-VI Incident Neutron Sublibrary** (MAT 6528)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6528 MOD 0, Release 0
1974 Oct	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9858
	ENDF/B-IV	MAT 804

Evaluation: **^{160}Dy ENDF/B-VI Incident Neutron Sublibrary** (MAT 6637)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6637 MOD 0, Release 0
1974 Oct	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9864
	ENDF/B-IV	MAT 811

Evaluation: **^{161}Dy ENDF/B-VI Incident Neutron Sublibrary** (MAT 6640)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6640 MOD 0, Release 0
1974 Oct	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9865
	ENDF/B-IV	MAT 812

Evaluation: **^{162}Dy ENDF/B-VI Incident Neutron Sublibrary** (MAT 6643)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6643 MOD 0, Release 0
1974 Oct	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9866
	ENDF/B-IV	MAT 813

Evaluation: **^{163}Dy ENDF/B-VI Incident Neutron Sublibrary** (MAT 6646)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6646 MOD 0, Release 0
1974 Oct	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9867
	ENDF/B-IV	MAT 814

Evaluation: **^{164}Dy ENDF/B-VI Incident Neutron Sublibrary** (MAT 6649)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: B. R. Leonard, Jr., K. B. Stewart (BNW)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 6649 MOD 0, Release 0
1967 Jun	BNW	B. R. Leonard, K. Stewart
	ENDF/B-V	MAT 1031
	ENDF/B-IV	MAT 1031

Evaluation: **^{165}Ho ENDF/B-VI Incident Neutron Sublibrary** (MAT 6725)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: P. G. Young, E. D. Arthur (LANL)
HISTORY

1988 Apr	LANL	P. G. Young, E. D. Arthur
	ENDF/B-VI	MAT 6725 MOD 1, Release 0

Evaluation: **^{166}Er ENDF/B-VI Incident Neutron Sublibrary** (MAT 6837)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1988 Dec	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6837 MOD 1, Release 0
1974 Oct	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9875
	ENDF/B-IV	MAT 823

Evaluation: **^{167}Er ENDF/B-VI Incident Neutron Sublibrary** (MAT 6840)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); R. E. Schenter, F. Schmittroth (HEDL)
HISTORY

1989 Mar	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 6840 MOD 1, Release 0
1974 Oct	HEDL	R. E. Schenter, F. Schmittroth
	ENDF/B-V	MAT 9876
	ENDF/B-IV	MAT 824

Evaluation: **^{175}Lu ENDF/B-VI Incident Neutron Sublibrary** (MAT 7125)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: B. R. Leonard, Jr., K. B. Stewart (BNW)
HISTORY

1990 Feb	NNDC	BNL (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7125 MOD 0, Release 0
1967 Jun	BNW	B. R. Leonard, Jr., K. B. Stewart
	ENDF/B-V	MAT 1032
	ENDF/B-IV	MAT 1032

Evaluation: **^{176}Lu ENDF/B-VI Incident Neutron Sublibrary** (MAT 7128)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: B. R. Leonard, Jr., K. B. Stewart (BNW)
HISTORY

1990 Feb	NNDC	BNL (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7128 MOD 0, Release 0
1967 Jun	BNW	B. Leonard, K. Stewart
	ENDF/B-V	MAT 1033
	ENDF/B-IV	MAT 1033

Evaluation: **^{174}Hf ENDF/B-VI Incident Neutron Sublibrary** (MAT 7225)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); M. K. Drake, D. A. Sargis, T. Maung (SAI)
HISTORY

1992 Apr	ORNL	R.Q.Wright
	ENDF/B-VI	MAT 7225 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7225 MOD 0, Release 0
1976 Apr	SAI	M. Drake, D. Sargis, T. Maung
	ENDF/B-V	MAT 1374

Evaluation: **^{nat}Hf ENDF/B-VI Incident Neutron Sublibrary** (MAT 7200)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: M. K. Drake, D. A. Sargis, T. Maung (SAI)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7200 MOD 0, Release 0
1976 Apr	SAI	M. Drake, D. Sargis, T. Maung
	ENDF/B-V	MAT 1372

Evaluation: **^{176}Hf ENDF/B-VI Incident Neutron Sublibrary** (MAT 7231)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); M. K. Drake, D. A. Sargis, T. Maung (SAI)
HISTORY

1992 Aug	ORNL	R.Q. Wright
	ENDF/B-VI	MAT 7231 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7231 MOD 0, Release 0
1976 Apr	SAI	M. Drake, D. Sargis, T. Maung
	ENDF/B-V	MAT 1376

Evaluation: **^{177}Hf ENDF/B-VI Incident Neutron Sublibrary** (MAT 7234)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); M. K. Drake, D. A. Sargis, T. Maung (SAI)
HISTORY

1991 Sep	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 7234 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7234 MOD 0, Release 0
1976 Apr	SAI	M. Drake, D. Sargis, T. Maung
	ENDF/B-V	MAT 1377

Evaluation: **^{178}Hf ENDF/B-VI Incident Neutron Sublibrary** (MAT 7237)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); M. K. Drake, D. A. Sargis, T. Maung (SAI)
HISTORY

1991 Sep	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 7237 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7237 MOD 0 , Release 0
1976 Apr	SAI	M. Drake, D. Sargis, T. Maung
	ENDF/B-V	MAT 1378

Evaluation: **^{179}Hf ENDF/B-VI Incident Neutron Sublibrary** (MAT 7240)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); M. K. Drake, D. A. Sargis, T. Maung (SAI)
HISTORY

1992 Jul	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 7240 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7240 MOD 0, Release 0
1976 Apr	SAI	M. Drake, D. Sargis, T. Maung
	ENDF/B-V	MAT 1383

Evaluation: **^{180}Hf ENDF/B-VI Incident Neutron Sublibrary** (MAT 7243)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); M. K. Drake, D. A. Sargis, T. Maung (SAI)
HISTORY

1991 Sep	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 7243 MOD 2, Release 2
1991 Aug	BNL	NNDC
	ENDF/B-VI	MAT 7243 MOD 2 Revision 1
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7243 MOD 0, Release 0
1976 Apr	SAI	M. Drake, D. Sargis, T. Maung
	ENDF/B-V	MAT 1384

Evaluation: **^{181}Ta ENDF/B-VI Incident Neutron Sublibrary** (MAT 7328)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8, 9, 12, 13, 14, 15
Evaluators: R. J. Howerton, S. T. Perkins, R. C. Haight, M. H. MacGregor (LLNL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7328 MOD 0, Release 0
1972 Jan	LLNL	R. Howerton, S. Perkins, R. Haight, M. MacGregor
	ENDF/B-V	MAT 1285
	ENDF/B-IV	MAT 1285

Evaluation: **^{182}Ta ENDF/B-VI Incident Neutron Sublibrary** (MAT 7331)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8, 9, 12, 13, 14, 15
Evaluators: J. Otter, C. Dunford, E. Ottewitte (AI)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7331 MOD 0, Release 0
1971 Apr	AI	J. Otter, C. Dunford, E. Ottewitte
	ENDF/B-V	MAT 1127
	ENDF/B-IV	MAT 1127

Evaluation: **^{nat}W ENDF/B-VI Incident Neutron Sublibrary** (MAT 7400)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: E. D. Arthur, P. G. Young, R. Boicourt (LANL)
HISTORY

1991 Jul	LANL	E. D. Arthur
	ENDF/B-VI	MAT 7400 MOD 2, Release 1
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7400 MOD 0, Release 0
1982 Mar	LANL	E. D. Arthur, P. G. Young, R. Boicourt
	ENDF/B-VI	MAT 1474

Evaluation: **^{182}W ENDF/B-VI Incident Neutron Sublibrary** (MAT 7431)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: E. Arthur, P. Young (LANL); A. Smith (ANL); C. Philis (BRC)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7431 MOD 0, Release 0
1980 Dec	LANL,ANL,BRC	E. Arthur, P. Young, A. Smith, C. Philis
	ENDF/B-V	MAT 1475

Evaluation: **^{183}W ENDF/B-VI Incident Neutron Sublibrary** (MAT 7434)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: E. Arthur, P. Young (LANL); A. Smith (ANL); C. Philis (BRC)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7434 MOD 0, Release 0
1980 Dec	LANL,ANL,BRC	E. Arthur, P. Young, A. Smith, C. Philis
	ENDF/B-V	MAT 1476

Evaluation: **^{184}W ENDF/B-VI Incident Neutron Sublibrary** (MAT 7437)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: E. Arthur, P. Young (LANL); A. Smith (ANL); C. Philis (BRC)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7437 MOD 0, Release 0
1980 Dec	LANL,ANL,BRC	E. Arthur, P. Young, A. Smith, C. Philis
	ENDF/B-V	MAT 1477

Evaluation: **^{186}W ENDF/B-VI Incident Neutron Sublibrary** (MAT 7443)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 13, 14, 15
Evaluators: E. Arthur, P. Young (LANL); A. Smith (ANL); C. Philis (BRC)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 7443 MOD 0, Release 0
1980 Dec	LANL,ANL,BRC	E. Arthur, P. Young, A. Smith, C. Philis
	ENDF/B-V	MAT 1478

Evaluation: **^{185}Re ENDF/B-VI Incident Neutron Sublibrary** (MAT 7525)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 33
Evaluators: L. W. Weston (ORNL); P. G. Young (LANL)
HISTORY

1990 Mar	ORNL, LANL	L. W. Weston, P. G. Young
	ENDF/B-VI	MAT 7525 MOD 1, Release 0

Evaluation: **^{185}Re ENDF/B-VI Incident Neutron Sublibrary** (MAT 7531)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 33
Evaluators: L. W. Weston (ORNL); P. G. Young (LANL)
HISTORY

1990 Mar	ORNL, LANL	L. W. Weston, P. G. Young
	ENDF/B-VI	MAT 7531 MOD 1, Release 0

Evaluation: **^{191}Ir ENDF/B-VI Incident Neutron Sublibrary** (MAT 7725)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 14, 15
Evaluators: R. Q. Wright, R. R. Spencer (ORNL)
HISTORY

1995 Mar	ORNL	R. Q. Wright, R. R. Spencer (Reviewer: C. Lubitz)
	ENDF/B-VI	MAT 7725 MOD 1, Release 4

Evaluation: **^{193}Ir ENDF/B-VI Incident Neutron Sublibrary** (MAT 7731)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 12, 14, 15
Evaluators: R. Q. Wright, R. R. Spencer (ORNL)
HISTORY

1995 Mar	ORNL	R. Q. Wright, R. R. Spencer (Reviewer: C. Lubitz)
	ENDF/B-VI	MAT 7731 MOD 1, Release 4

Evaluation: **^{197}Au ENDF/B-VI Incident Neutron Sublibrary** (MAT 7925)
Energy Range: 10^{-5} eV to 30 MeV
Files: 1, 2, 3, 4, 5, 8, 10, 12, 13, 14, 15, 33
Evaluators: P. G. Young, E. D. Arthur (LANL)
HISTORY

1991 Jul	LANL	P. G. Young
	ENDF/B-VI	MAT 7925 MOD 2, Release 1
1984 Jan	LANL	P. G. Young, E. D. Arthur (Reviewer: W. Poenitz)
	ENDF/B-VI	MAT 7925 MOD 1, Release 0

Evaluation: **^{206}Pb ENDF/B-VI Incident Neutron Sublibrary** (MAT 8231)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: C. Y. Fu, N. M. Larson, D. C. Larson (ORNL)
HISTORY

1989 Mar	ORNL	C. Y. Fu, N. M. Larson, D. C. Larson
	ENDF/B-VI	MAT 8231 MOD 1, Release 0

Evaluation: **^{207}Pb ENDF/B-VI Incident Neutron Sublibrary** (MAT 8234)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: C. Y. Fu, N. M. Larson, D. C. Larson (ORNL)
HISTORY

1991 Jul	ORNL	C. Y. Fu, N. M. Larson, D. C. Larson
	ENDF/B-VI	MAT 8234 MOD 2, Release 1
1989 Mar	ORNL	C. Y. Fu, N. M. Larson, D. C. Larson
	ENDF/B-VI	MAT 8234 MOD 1, Release 0

Evaluation: **^{208}Pb ENDF/B-VI Incident Neutron Sublibrary** (MAT 8237)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 6, 12, 14, 15, 33
Evaluators: C. Y. Fu, D. C. Larson (ORNL)
HISTORY

1989 Mar	ORNL	C. Y. Fu, D. C. Larson
	ENDF/B-VI	MAT 8237 MOD 1, Release 0

Evaluation: **^{209}Bi ENDF/B-VI Incident Neutron Sublibrary** (MAT 8325)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 13, 14, 15, 33
Evaluators: A. B. Smith, D. Smith, P. T. Gunther (ANL); R. Howerton (LLNL); M. Sugimoto (JAERI)

HISTORY

1995 May	NNDC	V. McLane (minor comment correction)
	ENDF/B-VI	MAT 8325 MOD 1, Release 3
1989 Aug	ANL,LLNL	A. Smith, R. Howerton, M. Suigmoto, et al.
	ENDF/B-VI	MAT 8325 MOD 1, Release 0

Evaluation: **^{230}Th ENDF/B-VI Incident Neutron Sublibrary** (MAT 9034)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: F. Mann (HEDL)

HISTORY

1990 Feb	NNDC	BNL (converted to ENDF/B-VI)
	ENDF/B-VI	MAT 9034 MOD 0, Release 0
1977 Nov	HEDL	F. Mann
	ENDF/B-V	MAT 8030

Evaluation: **^{232}Th ENDF/B-VI Incident Neutron Sublibrary** (MAT 9040)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 14, 15, 31, 33
Evaluators: M. R. Bhat (BNL); J. W. P. Poenitz, A. B. Smith, et al. (ANL); R. Howerton (LLNL); B. R. Leonard, et al. (BNW); G. deSaussure, et al. (ORNL)

HISTORY

1990 Feb	NNDC	BNL (converted to ENDF/B-VI)
	ENDF/B-VI	MAT 9040 MOD 1, Release 0
1977 Dec	BNL,ANL,ORNL+	M. Bhat, J.W. Meadows, R. Howerton, et al.
	ENDF/B-V	MAT 1390

Evaluation: **^{231}Pa ENDF/B-VI Incident Neutron Sublibrary** (MAT 9131)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: F. Mann (HEDL)

HISTORY

1990 Feb	NNDC	BNL (converted to ENDF/B-VI)
	ENDF/B-VI	MAT 9131 MOD 1, Release 0
1977 Nov	HEDL	F. Mann
	ENDF/B-V	MAT 7911

Evaluation: **^{233}Pa ENDF/B-VI Incident Neutron Sublibrary** (MAT 9137)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: D. Mathews (GGA), R. Kinsey (BNL), P. C. Young (BAPL)[1]
HISTORY

1990 Feb	NNDC	BNL (converted to ENDF/B-VI)
	ENDF/B-VI	MAT 9137 MOD 0, Release 0
1978 May	GGA,BNL,BAPL	D. Mathews, R. Kinsey, P. C. Young
	ENDF/B-V	MAT 1391

Evaluation: **^{232}U ENDF/B-VI Incident Neutron Sublibrary** (MAT 9219)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: F. Mann (HEDL)
HISTORY

1990 Feb	NNDC	BNL (converted to ENDF/B-VI)
	ENDF/B-VI	MAT 9219 MOD 0, Release 0
1977 Nov	HEDL	F. Mann
	ENDF/B-V	MAT 8232

Evaluation: **^{234}U ENDF/B-VI Incident Neutron Sublibrary** (MAT 9225)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8
Evaluators: M. Divadeenam (BNL); M. K. Drake, P. F. Nichols (GGA); F. Mann, R. E. Schenter (HEDL)
HISTORY

1990 Feb	NNDC	BNL (converted to ENDF/B-VI)
	ENDF/B-VI	MAT 9225 MOD 0, Release 0
1978 Jul	BNL,GGA,HEDL	M. Divadeenam, M. Drake, F. Mann, et al.
	ENDF/B-V	MAT 1394

Evaluation: **^{233}U ENDF/B-VI Incident Neutron Sublibrary** (MAT 9222)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 12, 14, 15
Evaluators: L. Stewart, et al. (LANL); L. Weston, et al. (ORNL); F. Mann (HEDL); N. Steen (BAPL); B. Leonard (BNW); R. Kinsey (BNL)
HISTORY

1990 Feb	NNDC	BNL (converted to ENDF/B-VI)
	ENDF/B-VI	MAT 9222 MOD 0, Release 0
1978 Dec	LANL,ORNL,HEDL	L. Stewart, L. Weston, F. Mann, et al.
	ENDF/B-V	MAT 1397

[1] Mistakingly coded as LANL in ENDF/B-VI file.

Evaluation: **^{235}U ENDF/B-VI Incident Neutron Sublibrary** (MAT 9228)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 6, 12, 13, 14, 15, 31
Evaluators: L. Weston (ORNL), P. G. Young (LANL), W. Poenitz (ANL), C. Lubitz (KAPL)

HISTORY

1996 Nov	BNL	NNDC
	ENDF/B-VI	MAT 9228 MOD 5, Release 4
1993 Nov	KAPL	C. R. Lubitz (Reviewers: A.Carlson,C.Duston,M. Moore)
	ENDF/B-VI	MAT 9228 MOD 4, Release 3
1993 Feb	ORNL	L. Weston
	ENDF/B-VI	MAT 9228 MOD 3, Release 2
1991 Jun	ORNL,LANL,ANL+	L. Weston, P. Young, W. Poenitz
	ENDF/B-VI	MAT 9228 MOD 2, Release 1
1989 Apr	ORNL,LANL,ANL+	L. Weston, P. Young, W. Poenitz
	ENDF/B-VI	MAT 9228 MOD 1, Release 0

Evaluation: **^{236}U ENDF/B-VI Incident Neutron Sublibrary** (MAT 9231)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8
Evaluators: F. Mann, R. Schenter (HEDL); M. Divadeenum (BNL)

HISTORY

1989 Oct	HEDL	F. Mann, R. Schenter
	ENDF/B-VI	MAT 9231 MOD 1, Release 0
1980 Oct	HEDL,BNL+	F. Mann, R. Schenter, M. Divadeenum, et al.
	ENDF/B-V	MAT 1396

Evaluation: **^{237}U ENDF/B-VI Incident Neutron Sublibrary** (MAT 9234)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: R. Benjamin, F. McCrosson (SRL); R. Howerton (LLNL) (Assembled by R. Kinsey, BNL)

HISTORY

1993 May	BNL	NNDC
	ENDF/B-VI	MAT 9434 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9234 MOD 1, Release 0
1976 Jul	SRL,LLNL,BNL	R.Benjamin, F.McCrosson, R.Howerton, R.Kinsey
	ENDF/B-V	MAT 8237

Evaluation: **^{238}U ENDF/B-VI Incident Neutron Sublibrary** (MAT 9237)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 6, 12, 13, 14, 15, 31, 33
Evaluators: L. W. Weston (ORNL); P. G. Young (LANL); W. Poenitz (ANL)
HISTORY

1993 Jan	ORNL	L. Weston (Reviewer: R. McKnight)
	ENDF/B-VI	MAT 9237 MOD 3, Release 2
1991 Jul	BNL	NNDC
	ENDF/B-VI	MAT 9237 MOD 2, Release 1
1989 Nov	ORNL,LANL,ANL	L. Weston, P. Young, W. Poenitz, et al.
	ENDF/B-VI	MAT 9237 MOD 0, Release 0

Evaluation: **^{237}Np ENDF/B-VI Incident Neutron Sublibrary** (MAT 9346)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 6, 8, 9, 12, 13, 14, 15
Evaluators: P. G. Young, E. D. Arthur (LANL); F. M. Mann (HEDL)
HISTORY

1991 Jul	LANL	P. G. Young, E. D. Arthur, F. M. Mann
	ENDF/B-VI	MAT 9346 MOD 2, Release 1
1990 Apr	LANL,HEDL	P.G. Young, E. D. Arthur, F. M. Mann
	ENDF/B-VI	MAT 9346 MOD 0, Release 0

Evaluation: **^{238}Np ENDF/B-VI Incident Neutron Sublibrary** (MAT 9349)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8
Evaluators: R. W. Benjamin, F. J. McCrosson (SRL)
HISTORY

1993 May	BNL	NNDC
	ENDF/B-VI	MAT 9349 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9349 MOD 0, Release 0
1975 Aug	SRL	R. W. Benjamin and F. J. McCrossen
	ENDF/B-V	MAT 8338

Evaluation: **^{239}Np ENDF/B-VI Incident Neutron Sublibrary** (MAT 9352)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL); Y. Kanda (Kyushu U.)
HISTORY

1988 Dec	ORNL	R. Q. Wright
	ENDF/B-VI	MAT 9352 MOD 1, Release 0

Evaluation: **^{236}Pu ENDF/B-VI Incident Neutron Sublibrary** (MAT 9428)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: R. Q. Wright (ORNL)
HISTORY

1995 Sep	ORNL	R. Q. Wright (Reviewer: C. Lubitz)
	ENDF/B-VI	MAT 9428 MOD 1, Release 4
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9428 MOD 0, Release 0
1978 Apr	HEDL,SRL	F. Mann, R. Schenter, R. Benjamin, F. McCrosson
	ENDF/B-V	MAT 8436

Evaluation: **^{237}Pu ENDF/B-VI Incident Neutron Sublibrary** (MAT 9431)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8
Evaluators: F. Mann, R. Schenter (HEDL)
Documentation:
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9431 MOD 0, Release 0
1978 Apr	HEDL	F. Mann, R. Schenter
	ENDF/B-V	MAT 8437

Evaluation: **^{238}Pu IENDF/B-VI Incident Neutron Sublibrary** (MAT 9434)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8
Evaluators: F. Mann, R. Schenter (HEDL); H. Alter, C. Dunford (AI)
Documentation:
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9434 MOD 1, Release 0
1978 Apr	HEDL,AI	F. Mann, R. Schenter, H. Alter, C. Dunford
	ENDF/B-V	MAT 1338

Evaluation: **^{239}Pu ENDF/B-VI Incident Neutron Sublibrary** (MAT 9437)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 6, 12, 13, 14, 15
Evaluators: P. Young (LANL); L. W. Weston, H. Derrien (ORNL); W. Poenitz (ANL); T. Nakagawa
HISTORY

1993 Jan	ORNL	L. Weston, H. Derrien (reviewer: P. Young)
	ENDF/B-VI	MAT 9437 MOD 3, Release 2
1989 Apr	LANL,ORNL	P. Young, L. Weston, W. Poenitz
	ENDF/B-VI	MAT 9437 MOD 1, Release 0

Evaluation: **^{240}Pu ENDF/B-VI Incident Neutron Sublibrary** (MAT 9440)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15, 31, 32, 33
Evaluators: L. W. Weston (ORNL); E. D. Arthur (LANL)
HISTORY

1993 Jun	ORNL	L. Weston
	ENDF/B-VI	MAT 9440 MOD 3, Release 2
1991 Jul	ORNL	L. Weston
	ENDF/B-VI	MAT 9440 MOD 2, Release 1
1986 Aug	ORNL, LANL	L. Weston, E. Arthur
	ENDF/B-VI	MAT 9440 MOD 1, Release 0

Evaluation: **^{241}Pu ENDF/B-VI Incident Neutron Sublibrary** (MAT 9443)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15, 31
Evaluators: L. W. Weston, R. Q. Wright, H. Derrien, et al. (ORNL)
HISTORY

1994 Aug	ORNL	L. Weston (Reviewer: P. Young)
	ENDF/B-VI	MAT 9443 MOD 3, Release 3
1991 Jun	ORNL	L. Weston
	ENDF/B-VI	MAT 9443 MOD 2, Release 1
1988 Oct	ORNL	L. Weston
	ENDF/B-VI	MAT 9443 MOD 1, Release 0

Evaluation: **^{242}Pu ENDF/B-VI Incident Neutron Sublibrary** (MAT 9446)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8, 12, 13, 14, 15, 32, 33
Evaluators: F. Mann, R. Schenter (HEDL); D. Madland, P. Young (LANL); R. Benjamin (SRL); R. Howerton (LLNL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9446 MOD 1, Release 0
1978 Oct	HEDL,SRL+	F. Mann, R. Benjamin, D. Madland, R. Howerton, et al.
	ENDF/B-V	MAT 1342

Evaluation: **^{243}Pu ENDF/B-VI Incident Neutron Sublibrary** (MAT 9449)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: R. Benjamin, F. McCrosson (SRL); R. Howerton (LLNL) (assembled by R. Kinsey, BNL)

HISTORY

1993 May	BNL	NNDC
	ENDF/B-VI	MAT 9449 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9449 MOD 0, Release 0
1976 Jul	SRL,LLNL,BNL	R. Benjamin, F. McCrosson, R. Howerton, R. Kinsey
	ENDF/B-V	MAT 8443

Evaluation: **^{244}Pu ENDF/B-VI Incident Neutron Sublibrary** (MAT 9452)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8
Evaluators: F. Mann, R. Schenter (HEDL); R. Benjamin, F. McCrosson (SRL)
Documentation:

HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9452 MOD 0, Release 0
1978 Apr	HEDL,SRL	F. Mann, R. Schenter, R. Benjamin, F. McCrosson
	ENDF/B-V	MAT 8444

Evaluation: **^{241}Am ENDF/B-VI Incident Neutron Sublibrary** (MAT 9543)
Energy Range: 10^{-5} eV to 30 MeV
Files: 1, 2, 3, 4, 5, 6, 8, 9, 12, 13, 14, 15, 32, 33
Evaluators: P. G. Young, D. W. Madland (LANL); Zhou Delin, Yu Baosheng, et al. (CNDC)

HISTORY

1994 Aug	LANL	P. Young, D. Madland (reviewer: F. Mann)
	ENDF/B-VI	MAT 9543 MOD 3, Release 3
1992 Jun	CNDC	Zhou Delin, Gu Fuhua, et al.
	ENDF/B-VI	MAT 9543 MOD 2, Release 2
1988 Feb	CNDC	Zhou Delin, Gu Fuhua, et al.
	ENDF/B-VI	MAT 9543 MOD 1, Release 0

Evaluation: **^{242}Am ENDF/B-VI Incident Neutron Sublibrary** (MAT 9546)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8
Evaluators: R. W. Benjamin, F. J. McCrossen (SRL)
HISTORY

1991 Aug	BNL	NNDC
	ENDF/B-VI	MAT 9546 MOD 2, Release 1
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9546 MOD 1, Release 0
	ENDF/B-V	MAT 8542

Evaluation: **^{242m}Am ENDF/B-VI Incident Neutron Sublibrary** (MAT 9547)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 9, 12, 13, 14, 15
Evaluators: F. Mann, R. Schenter (HEDL); R. Benjamin (SRL); R. Howerton (LLNL)
HISTORY

1991 Aug	BNL	NNDC
	ENDF/B-VI	MAT 9547 MOD 2, Release 1
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9547 MOD 0, Release 0
1978 Apr	HEDL,SRL+	F. Mann, R. Schenter, R. Benjamin, et al.
	ENDF/B-V	MAT 1369

Evaluation: **^{243}Am ENDF/B-VI Incident Neutron Sublibrary** (MAT 9549)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8
Evaluators: L. W. Weston (ORNL); F. Mann, R. Schenter (HEDL); R. Howerton (LLNL)
HISTORY

1988 Oct	ORNL	L. Weston, F. Mann, R. Schenter, R. Howerton
	ENDF/B-VI	MAT 9549 MOD 1, Release 0

Evaluation: **^{241}Cm ENDF/B-VI Incident Neutron Sublibrary** (MAT 9628)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8
Evaluators: F. Mann, R. Schenter (HEDL)
HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9628 MOD 0, Release 0
1978 Apr	HEDL	F. Mann, R. Schenter
	ENDF/B-V	MAT 8641

Evaluation: **^{242}Cm ENDF/B-VI Incident Neutron Sublibrary** (MAT 9631)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: F. Mann, R. Schenter (HEDL); R. Benjamin, F. McCrosson (SRL); R. Howerton (LLNL)

HISTORY

1990 Feb	NNDC	BNL (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9631 MOD 1, Release 0
1978 Apr	HEDL,SRL,LLNL	F. Mann, R. Benjamin, R. Howerton, et al.
	ENDF/B-V	MAT 8642

Evaluation: **^{243}Cm ENDF/B-VI Incident Neutron Sublibrary** (MAT 9634)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: F. Mann, R. Schenter (HEDL); R. Benjamin (SRL); R. Howerton (LLNL)

HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9634 MOD 0, Release 0
1978 Apr	HEDL,SRL,LLNL	F. Mann, R. Benjamin, R. Howerton, et al.
	ENDF/B-V	MAT 1343

Evaluation: **^{244}Cm ENDF/B-VI Incident Neutron Sublibrary** (MAT 9637)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: F. Mann, R. Schenter (HEDL); R. Benjamin, F. McCrosson (SRL); R. Howerton (LLNL); C. Dunford, H. Alter (AI)

HISTORY

1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9637 MOD 0, Release 0
1978 Apr	HEDL,SRL,LLNL+	F. Mann, R. Benjamin, R. Howerton, et al.
	ENDF/B-V	MAT 1344

Evaluation: **^{245}Cm ENDF/B-VI Incident Neutron Sublibrary** (MAT 9640)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: R. W. Benjamin (SRL); R. J. Howerton (LLNL)

HISTORY

1993 May	BNL	NNDC
	ENDF/B-VI	MAT 9640 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9640 MOD 1, Release 0
1979 Jan	SRL,LLNL	R. Benjamin, R. Howerton
	ENDF/B-V	MAT 1345

Evaluation: **^{246}Cm ENDF/B-VI Incident Neutron Sublibrary** (MAT 9643)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: R. W. Benjamin, F. McCrosson (SRL); R. J. Howerton (LLNL) (assembled by R. Kinsey, BNL)

HISTORY

1993 May	BNL	NNDC
	ENDF/B-VI	MAT 9643 MOD 2, Release 2
1990 Feb	BNL	NNDC (Translated from ENDF/B-V)
	ENDF/B-VI	MAT 9643 MOD 0, Release 0
1976 Jul	SRL,LLNL,BNL	R. Benjamin, F. McCrosson, R. Howerton, R. Kinsey
	ENDF/B-V	MAT 1346

Evaluation: **^{247}Cm ENDF/B-VI Incident Neutron Sublibrary** (MAT 9646)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: R. W. Benjamin, F. McCrosson (SRL); R. J. Howerton (LLNL) (assembled by R. Kinsey, BNL)

HISTORY

1993 May	NNDC	BNL
	ENDF/B-VI	MAT 9646 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9646 MOD 0, Release 0
1976 Jul	SRL,LLNL,BNL	R. Benjamin, F. McCrosson, R. Howerton, R. Kinsey
	ENDF/B-V	MAT 8647

Evaluation: **^{248}Cm ENDF/B-VI Incident Neutron Sublibrary** (MAT 9649)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: F. Mann, R. Schenter (HEDL); R. Benjamin (SRL); R. Howerton (LLNL)

HISTORY

1990 Feb	NNDC	BNL (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9649 MOD 0, Release 0
1978 Apr	HEDL,SRL,LLNL	F. Mann, R. Schenter, R. Benjamin, R. Howerton
	ENDF/B-V	MAT 8648

Evaluation: **^{249}Bk ENDF/B-VI Incident Neutron Sublibrary** (MAT 9752)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: Zhou Delin, et al. (CNDC)

HISTORY

1986 Jun	CNDC	Zhou Delin, et al.
	ENDF/B-VI	MAT 9752 MOD 1, Release 0

Evaluation: **^{249}Cf ENDF/B-VI Incident Neutron Sublibrary** (MAT 9852)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4, 5
Evaluators: Zhou Delin, Liu Tong, Su Zhongdi, et al. (CNDC)

1989 Apr	CNDC	Zhou Delin, Liu Tong, Su Zhongdi, et al.
	ENDF/B-VI	MAT 9852 MOD 1, Release 0

Evaluation: **^{250}Cf ENDF/B-VI Incident Neutron Sublibrary** (MAT 9855)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: F. Mann, R. Schenter (HEDL); R. Benjamin (SRL); R. Howerton (LLNL)
HISTORY

1993 May	BNL	NNDC
	ENDF/B-VI	MAT 9855 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9855 MOD 0, Release 0
1976 Jul	BNL,SRL,LLNL	R. Benjamin, F. McCrosson, R. Howerton, R. Kinsey
	ENDF/B-V	MAT 8850

'Evaluation: **^{251}Cf ENDF/B-VI Incident Neutron Sublibrary** (MAT 9858)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: F. Mann, R. Schenter (HEDL); R. Benjamin (SRL); R. Howerton (LLNL) (assembled by R. Kinsey, BNL)
HISTORY

1993 May	BNL	NNDC
	ENDF/B-VI	MAT 9858 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9858 MOD 1, Release 0
1976 Jul	BNL,SRL,LLNL	R. Benjamin, F. McCrosson, R. Howerton, R. Kinsey
	ENDF/B-V	MAT 8851

Evaluation: **^{252}Cf ENDF/B-VI Incident Neutron Sublibrary** (MAT 9861)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5, 8, 12, 13, 14, 15
Evaluators: F. Mann, R. Schenter (HEDL); R. Benjamin (SRL); R. Howerton (LLNL) (assembled by R. Kinsey, BNL)

HISTORY

1993 May	BNL	NNDC
	ENDF/B-VI	MAT 9861 MOD 3, Release 2
1991 Aug	BNL	NNDC
	ENDF/B-VI	MAT 9861 MOD 2, Release 1
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9861 MOD 0, Release 0
1976 Jul	BNL,SRL,LLNL	R. Benjamin, F. McCrosson, R. Howerton, R. Kinsey
	ENDF/B-V	MAT 8852

Evaluation: **^{253}Cf ENDF/B-VI Incident Neutron Sublibrary** (MAT 9864)
Energy Range: 10^{-5} eV to 20 MeV
Files: 1, 2, 3, 4, 5
Evaluators: F. Mann, R. Schenter (HEDL); R. Benjamin (SRL) (assembled by R. Kinsey, BNL)

HISTORY

1993 May	BNL	NNDC
	ENDF/B-VI	MAT 9864 MOD 2, Release 2
1990 Feb	BNL	NNDC (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9864 MOD 0, Release 0
1975 Dec	SRL,BNL	R. Benjamin, F. McCrosson (assembled by R. Kinsey)
	ENDF/B-V	MAT 8853

Evaluation: **^{253}Es ENDF/B-VI Incident Neutron Sublibrary** (MAT 9913)
Energy Range: 10^{-5} eV to 20 MeV
Files (MF): 1, 2, 3, 4
Evaluators: R. Kinsey (BNL); R. Benjamin, F. McCrosson (SRL)

HISTORY

1990 Feb	NNDC	BNL (converted from ENDF/B-V)
	ENDF/B-VI	MAT 9913 MOD 0, Release 0
1976 Jul	BNL,SRL	R. Kinsey, R. Benjamin, F. McCrosson
	ENDF/B-V	MAT 8953

Evaluation: **H (H_2O) ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 1)
Energy Range: 296, 350, 400, 450, 500, 600, 800, 1000 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 1 MOD 1, Release 3
1990 May	LANL	R. MacFarlane
	ENDF/B-VI	MAT 1 MOD 0
1969 DEC	GA	J. U. Koppel, D. H. Houston
	ENDF/B-III	MAT 1002

Evaluation: **Liquid Para Hydrogen ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 2)
Energy Range: 20 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 2 MOD 1, Release 3

Evaluation: **Liquid Ortho Hydrogen ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 3)
Energy Range: 20 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 3 MOD 1, Release 3

Evaluation: **H (ZrH) ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 7)
Energy Range: 296, 400, 500, 600, 700, 800, 1000, 1200 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 7 MOD 1, Release 3
1990 May	LANL	R. MacFarlane
	ENDF/B-VI	MAT 7 MOD 0
1969 DEC	GA	J. U. Koppel, D. H. Houston, E. L. Slaggie
	ENDF/B-III	MAT 1097

Evaluation: **D (D_2O) ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 11)
Temperatures: 296, 350, 400, 450, 500, 600, 800, 1000 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1990 May	LANL	R. MacFarlane
	ENDF/B-VI	MAT 11 MOD 0
1969 DEC	GA	J. U. Koppel, D. H. Houston
	ENDF/B-III	MAT 1004

Evaluation: **Liquid Para Deuterium ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 12)
Temperatures: 19 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 12 MOD 1, Release 3

Evaluation: **Liquid Ortho Deuterium ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 13)
Temperatures: 19 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 2 MOD 13, Release 3

Evaluation: **Be Metal ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 26)
Temperatures: 296, 400, 500, 600, 700, 800, 1000, 1200 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 26 MOD 1, Release 3
1990 May	LANL	R. MacFarlane
	ENDF/B-VI	MAT 26 MOD 0
1969 DEC	GA	J. U. Koppel, D. H. Houston
	ENDF/B-III	MAT 1064

Evaluation: **BeO ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 27)
Temperatures: 296, 400, 500, 600, 700, 800, 1000, 1200 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 27 MOD 1, Release 3
1990 May	LANL	R. MacFarlane
	ENDF/B-VI	MAT 27 MOD 0
1969 DEC	GA	J. U. Koppel, D. H. Houston, G. Borgonovi
	ENDF/B-III	MAT 1099

Evaluation: **Graphite ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 31)
Temperatures: 296, 400, 500, 600, 700, 800, 1000, 1200, 1600, 2000 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 31 MOD 1, Release 3
1990 May	LANL	R. MacFarlane
	ENDF/B-VI	MAT 31 MOD 0
1969 DEC	GA	J. U. Koppel, D. H. Houston
	ENDF/B-III	MAT 1065

Evaluation: **Liquid Methane ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 33)
Temperatures: 100 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 33 MOD 1, Release 3

Evaluation: **Solid Methane ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 34)
Temperatures: 22 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 34 MOD 1, Release 3

Evaluation: **H (Polyethylene) ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 37)
Temperatures: 296, 350 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 37 MOD 1, Release 3
1990 May	LANL	R. MacFarlane
	ENDF/B-VI	MAT 37 MOD 0
1969 DEC	GA	J. U. Koppel, D. H. Houston
	ENDF/B-III	MAT 1114

Evaluation: **Benzene ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 40)
Temperatures: 296, 350, 400, 450, 500, 600, 800, 1000 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 40 MOD 1, Release 3
1990 May	LANL	R. MacFarlane
	ENDF/B-VI	MAT 40 MOD 0
1969 DEC	GA	J. U. Koppel, D. H. Houston, G. M. Borgonovi
	ENDF/B-III	MAT 1095

Evaluation: **Zr (ZrH) ENDF/B-VI Thermal Neutron Scattering Sublibrary** (MAT 58)
Temperatures: 296, 400, 500, 600, 700, 800, 1000, 1200 °K
Files (MF): 1, 7
Evaluators: R. E. MacFarlane (LANL)
HISTORY

1993 Apr	LANL	R. E. MacFarlane (Reviewer: M. Lazo)
	ENDF/B-VI	MAT 58 MOD 1, Release 3
1990 May	LANL	R. MacFarlane
	ENDF/B-VI	MAT 58 MOD 0
1969 DEC	GA	J. U. Koppel, D. H. Houston, E. L. Slaggie
	ENDF/B-III	MAT 1096

Evaluation: **UO_2 ENDF/B-III Thermal Neutron Scattering Sublibrary** (MAT 1167)
Temperatures: 296, 400, 500, 600, 700, 800, 1000, 1200 °K
Files (MF): 1, 7
Evaluators: J. U. Koppel, D. H. Houston (GA)
HISTORY

1969 DEC	GA	J. U. Koppel, D. H. Houston
	ENDF/B-III	MAT 1167

Evaluation: **^{1}H Incident Proton Sublibrary** (MAT 125)
Energy Range: 0 to 100 MeV
Files (MF): 1, 3, 6
Evaluators: D. Dodder (LANL)
HISTORY

1987 Oct	LANL	D. Dodder
	ENDF/B-VI	MAT 125 MOD 1, Release 1

Evaluation: **^{3}He Incident Proton Sublibrary** (MAT 225)
Energy Range: 1 keV to 20 MeV
Files (MF): 1, 3, 6
Evaluators: G. Hale (LANL)
HISTORY

1987 Oct	LANL	G. Hale
	ENDF/B-VI	MAT 225 MOD 1, Release 1

Evaluation: **^{2}H Incident Deuteron Sublibrary** (MAT 128)
Energy Range: 332.5 eV to 30 MeV
Files (MF): 1, 3
Evaluators: R, M. White and D. A. Resler (LLNL)
HISTORY

1991 May	LLNL	R, M. White and D. A. Resler
	ENDF/B-VI	MAT 128 MOD 1, Release 1

Evaluation: **^{3}H Incident Deuteron Sublibrary** (MAT 131)
Energy Range: 285 eV to 30 MeV
Files (MF): 1, 3
Evaluators: R, M. White and D. A. Resler (LLNL)
HISTORY

1991 May	LLNL	R, M. White and D. A. Resler
	ENDF/B-VI	MAT 131 MOD 1, Release 1

Evaluation: **^{3}He Incident Deuteron Sublibrary** (MAT 225)
Energy Range: 118.75 eV to 30 MeV
Files (MF): 1, 3
Evaluators: R, M. White and D. A. Resler (LLNL)
HISTORY

1991 May	LLNL	R, M. White and D. A. Resler
	ENDF/B-VI	MAT 225 MOD 1, Release 1

Evaluation: **^{3}H Incident Deuteron Sublibrary** (MAT 131)
Energy Range: 475 eV to 30 MeV
Files (MF): 1, 3
Evaluators: R, M. White and D. A. Resler (LLNL)
HISTORY

1991 May	LLNL	R, M. White and D. A. Resler
	ENDF/B-VI	MAT 131 MOD 1, Release 1

Appendix B

History of Materials Issued in ENDF/HE-VI

This section includes all materials issued in all releases of ENDF/HE-VI. The materials are ordered by sublibrary and material. Information on the latest release is given first, and is followed by the history of that material.

Evaluation: **^{12}C ENDF/HE-VI Incident Neutron Sublibrary (MAT 625)**
Energy Range: 10^{-5} eV to 10 GeV
Files (MF): 1, 2, 3, 4, 6
Evaluators: S. Pearlstein (BNL)
HISTORY

1992 Sep	BNL	S. Pearlstein (reviewed by T. Fukahori)
	ENDF/HE-VI	MAT 625 MOD 1, Release 2

Evaluation: **^{56}Fe ENDF/HE-VI Incident Neutron Sublibrary (MAT 2631)**
Energy Range: 10^{-5} eV to 1 GeV
Files (MF): 1, 2, 3, 4, 6
Evaluators: S. Pearlstein (BNL)
HISTORY

1990 Jun	BNL	S. Pearlstein
	ENDF/HE-VI	MAT 2631 MOD 1, Release 0

Evaluation: **^{208}Pb ENDF/HE-VI Incident Neutron Sublibrary (MAT 8237)**
Energy Range: 10^{-5} eV to 1 GeV
Files (MF): 1, 2, 3, 4, 6
Evaluators: T. Fukahori, S. Pearlstein (BNL)
HISTORY

1990 Jun	BNL	T. Fukahori, S. Pearlstein
	ENDF/HE-VI	MAT 8237 MOD 1, Release 2

Evaluation: **^{209}Bi ENDF/HE-VI Incident Neutron Sublibrary (MAT 8325)**
Energy Range: 10^{-5} eV to 1 GeV
Files (MF): 1, 2, 3, 4, 6
Evaluators: T. Fukahori, S. Pearlstein (BNL)
HISTORY

1990 Jun	BNL	T. Fukahori, S. Pearlstein
	ENDF/HE-VI	MAT 8325 MOD 1, Release 2

Evaluation: **^{12}C ENDF/HE-VI Incident Proton Sublibrary (MAT 625)**
Energy Range: 10^{-5} eV to 10 GeV
Files (MF): 1, 2, 3, 4, 6
Evaluators: S. Pearlstein (BNL)
HISTORY

1996 Dec	BNL	V. McLane
	ENDF/HE-VI	MAT 625 MOD 2, Release 4
1992 Sep	BNL	S. Pearlstein (reviewed by T. Fukahori)
	ENDF/B-HE	MAT 625 MOD 1, Release 2

Evaluation: **^{56}Fe ENDF/HE-VI Incident Proton Sublibrary (MAT 2631)**
Energy Range: 10^{-5} eV to 1 GeV
Files (MF): 1, 3, 6
Evaluators: S. Pearlstein (BNL)
HISTORY

1996 Dec	BNL	V. McLane
	ENDF/HE-VI	MAT 625 MOD 2, Release 4
1990 Jun	BNL	S. Pearlstein (Reviewed by Y. Nakahara)
	ENDF/HE-VI	MAT 2631 MOD 1, Release 0

Evaluation: **^{208}Pb ENDF/HE-VI Incident Proton Sublibrary (MAT 8237)**
Energy Range: 10^{-5} eV to 1 GeV
Files (MF): 1, 2, 3, 4, 6
Evaluators: T. Fukahori, S. Pearlstein (BNL)
HISTORY

1996 Dec	BNL	V. McLane
	ENDF/HE-VI	MAT 625 MOD 2, Release 4
1990 Jun	BNL	T. Fukahori, S. Pearlstein
	ENDF/HE-VI	MAT 8237 MOD 1, Release 2

Evaluation: **^{209}Bi ENDF/HE-VI Incident Proton Sublibrary (MAT 8325)**
Energy Range: 10^{-5} eV to 1 GeV
Files (MF): 1, 2, 3, 4, 6
Evaluators: T. Fukahori, S. Pearlstein (BNL)
HISTORY

1996 Dec	BNL	V. McLane
	ENDF/HE-VI	MAT 625 MOD 2, Release 4
1990 Jun	BNL	T. Fukahori, S. Pearlstein
	ENDF/HE-VI	MAT 8325 MOD 1, Release 2