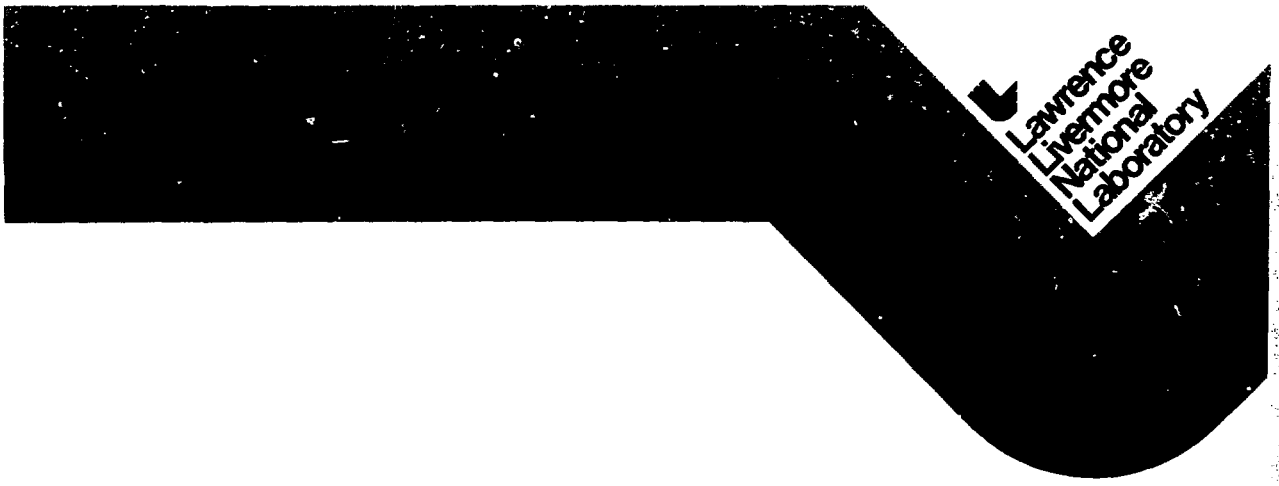
UCRL-50400 Vol. 4 Rev. 1 Appendix C

The Neutron Library (ENDL82) in the Transmittal Format

R. J. Howerton, R. E. Dye, and S. T. Perkins

June 26, 1982



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Foreword

The UCRL-50400 series, *An Integrated System for Production of Neutronics and Photonics Calculational Constants*, describes an integrated, computer-oriented system for the production and application of neutronics and photonics calculational constants.

The system supplies reliable, up-to-date data, selects specific types of data on request, provides output in a variety of forms (ultimately in the form of input to other computer codes), and functions rapidly and efficiently.

The UCRL-50400 series comprises the following volumes:

- **Vol. 1, Part A, Rev. 3, *ECSIL: A System for Storage, Retrieval, and Display of Experimental Neutron Data*, September 1976.**
- **Vol. 1, Part B, *Program ECSX4 (Version 78-1): Conversion of Experimentally Measured Cross-Section Data from the Four-Center-Exchange (X-4) Format to the Livermore ESCIL Format*, December 1978.**
- **Vol. 2, Rev. 2, *A Bibliography of the Experimental Data of Neutron-Induced Interactions*, July 1976.**
- **Vol. 3, Rev. 2, *An Index of the Experimental Data of Neutron-Induced Interactions*, July 1976.**
- **Vol. 4, Rev. 1, *Evaluated Nuclear Data Library*, September 1981.**
- **Vol. 4, Rev. 1, Appendix C, *The Neutron Library (ENDL82) in the Transmittal Format*, June 1982.**
- **Vol. 5, Part A, Rev. 1, *CLYDE: A Code for the Production of Calculational Constants from Nuclear Data*, September 1975.**
- Vol. 5, Part B, Rev. 1, *Relativistic Transformations between Center-of-Mass and Laboratory Systems for Two-Body Nuclear Reactions*, April 1978.
- Vol. 6, Rev. 2, *Tables and Graphs of Photon-Interaction Cross Sections from 1 keV to 100 MeV*, December 1978.
- Vol. 7, Part A, Rev. 1, *Major Neutron-Induced Interactions* ($Z \leq 55$): *Graphical, Experimental Data*, July 1976.
- Vol. 7, Part B, Rev. 1, *Major Neutron-Induced Interactions* ($Z > 55$): *Graphical, Experimental Data*, July 1976.
- Vol. 8, Part A, Rev. 1, *Supplemental Neutron-Induced Interactions* ($Z \leq 35$): *Graphical, Experimental Data*, July 1976.
- Vol. 8, Part B, Rev. 1, *Supplemental Neutron-Induced Interactions* ($Z > 35$): *Graphical, Experimental Data*, July 1976.
- Vol. 9, *Thresholds of Nuclear Reactions Induced by Neutrons, Photons, Deuterons, Tritons, and Alpha Particles*, September 1970.
- Vol. 10, Rev. 1, *Tabulated Experimental Data for Neutron-Induced Interactions*, July 1976.
- Vol. 11, *Experimental Data, Indexes, and Techniques of Obtaining a Selected Set of Neutron Resonance Parameters*, May 1972.
- Vol. 12, *An Atlas of Resolved Neutron Resonance Parameters*, July 1972.
- Vol. 13, *An Atlas of Unresolved Neutron Resonance Parameters*, September 1972.
- Vol. 14, *TARTNP: A Coupled Neutron-Photon Monte Carlotransport Code*, February 1976.
- Vol. 15, Part A, *The LLL Evaluated-Nuclear-Data Library (ENDL): Evaluation Techniques, Reaction Index, and Descriptions of Individual Evaluations*, September 1975.
- Vol. 15, Part B, Rev. 1, *The LLL Evaluated-Nuclear-Data Library (ENDL): Graphs of Cross Sections from the Library*, October 1978.
- Vol. 15, Part C, *The LLL Evaluated-Nuclear-Data Library (ENDL): Translation of ENDL Neutron-Induced Interaction Data into the ENDF/B Format*, April 1976.
- Vol. 15, Part D, Rev. 1, *The LLL Evaluated-Nuclear-Data Library (ENDL): Descriptions of Individual Evaluations for* $Z = 0$–98, May 1978.
- Vol. 15, Part E, *Data Testing Results for the LLL Nuclear Data Library (ENDL-78)*, August 1979.
- Vol. 15, Part F, *Experimental and Evaluated Elastic Nuclear Plus Interference Cross Sections for Light Charged Particles*, July 1980.
- Vol. 16, Rev. 2, *Tabular and Graphical Presentation of 175 Neutron-Group Constants Derived from the LLL Evaluated Nuclear-Data Library (ENDL)*, October 1978.
- Vol. 17, Part A, Rev. 2, *Program LINEAR (Version 79-1): Linearize Data in the Evaluated-Nuclear-Data File/Version B (ENDF/B) Format*, October 1979.

- **Vol. 17, Part B, Rev. 2, *Program SIGMA1 (Version 79-1): Doppler Broaden Evaluated Cross Sections in the Evaluated-Nuclear-Data File/Version B (ENDF/B) Format*, October 1979.**
- **Vol. 17, Part C, *Program RECENT: Reconstruction of Energy-Dependent Cross Sections from Resonance Parameters in the ENDF/B Format*, October 1979.**
- **Vol. 17, Part D, *Program GROUPIE: Calculation of Self-Shielded Cross Sections and Multiband Parameters from Evaluated Data in the ENDF/B Format*, 1980.**
- **Vol. 17, Part E, *Program EVALPLOT: Plot Data in the Evaluated-Nuclear-Data File/Version B (ENDF/B) Format*, February 1979.**
- **Vol. 17, Part F, *DOWNER (Version 79-1): Group Collapse Cross Section and Transfer Matrices*, January 1979.**
- **Vol. 18, *ACTL: Evaluated Neutron Activation Cross-Section Library*, October 1978.**
- **Vol. 19, *Neutron-Induced Angular and Energy Distributions: Graphical Experimental Data*, April 1977.**
- **Vol. 20, *Bonderenko Self-Shielded Cross Sections and Multiband Parameters Derived from the LLL Evaluated-Nuclear-Data Library (ENDL)*, July 1978.**
- **Vol. 21, Part A, *Maxwell-Averaged Reactions Rates (σv) for Selected Reactions between Ions with Atomic Mass $\leq$ 11*, February 1979.**
- Vol. 21, Part C, *Program SIGMAL (Version 79-1): Doppler Broaden Evaluated Cross Sections in the Livermore-Evaluated Nuclear Data Library (ENDL) Format*, March 1979.
- Vol. 22, Rev. 1, *GAMIDEN: A Program to Aid in the Identification of Unknown Materials by Gamma-Ray Spectroscopy*, June 1982.
- Vol. 23, *ENSL and CDRL: Evaluated Nuclear Structure Libraries*, February 1981.
- Vol. 24, *Thresholds and Q Values of Nuclear Reactions Induced by Neutrons, Protons, Deuterons, Tritons, ^{3}He Ions, Alpha Particles, and Photons*, March 1981.

The Neutron Library (ENDL82) in the Transmittal Format

There are four main libraries of data included within the system described in this report. They are ENDL (Evaluated Neutron Data Library), ECPL (Evaluated Charged-Particle Data Library), ACTL (Evaluated Neutron-Induced Activation Cross-Section Library), and EGDL (Evaluated Photon Interaction Data Library). The first three deal with nuclear processes induced by neutrons or light charged particles ($Z \leq 2$, $A \leq 4$). The fourth (EGDL) contains the data appropriate to photons with energies between 100 eV and 100 MeV that interact with atoms of the elements in their ground state, i.e., "cold targets." EGDL does not contain data for photonuclear reactions.

From time to time versions of ENDL have been made available (e.g., see Vol. 15C of the UCRL-50400 Series) in one or more of several formats. During the past few years several features included in the encoding system described in this report have become more important and are not dealt with in other encoding systems and formats. For this reason, the ENDL82 data file is being made available in the transmission format described in Appendix A.

ENDL82 contains complete evaluations for the 94 isotopes or elements listed in Table C-1. It is available on magnetic tape in blocked form (100 logical records in one physical record). The tape may be 7-track, 800-bpi, 6-bit ASCII, or 9-track, 1600-bpi, EBCDIC. There are four files, each dealing with a range of 1000Z + A (ZA) values:

File	ZA range	Number of logical records	Number of physical records
1	$\leq$ 20000	37901	380
2	22000 $\leq$ 50000	37901	380
3	56138 $\leq$ 91233	44411	445
4	92233 $\leq$ 99120*	81745	818

*99120 is the designation of an average fission fragment.

Since the latest issuance of a version of ENDL in 1978, there have been many changes in the data for previously existing evaluations, and several new evaluations have been added. In addition, there have been extensions and a redefinition of some of the quantities represented in the files. The most important of these are:

1. Explicit representations are given for energy and/or angular distributions for all secondary particles from neutron-induced reactions.

2. Average energies of secondary particles are given.

3. With the above features added, it has been possible to ensure energy conservation (to within 10% or 100 keV) among secondary neutrons, secondary charged particles, secondary photons, and residual nuclei.

4. All partial evaluations have been removed.

ENDL82 has been tested against experimental critical assemblies and 14-MeV pulsed spheres by calculating k-effective values for the critical assemblies and time spectra of neutrons for the pulsed spheres. In all cases agreement with experiment ranged from satisfactory to excellent. The calculations were done with the TART Monte Carlo neutronics code.

Table C-1. Nuclides in ENDL82.

Z	A	Z	A
0	1	64	Nat
1	1	67	165
1	2	73	181
1	3	74	Nat
2	3	75	185
2	4	75	187
3	6	78	Nat
3	7	79	197
4	7	82	Nat
4	9	83	209
5	10	90	231
5	11	90	232
6	12	90	233
7	14	91	233
8	16	92	233
9	19	92	234
11	23	92	235
12	Nat	92	236
13	27	92	237
14	Nat	92	238
15	31	92	239
16	32	92	240
17	Nat	93	237
18	Nat	94	238
19	Nat	94	239
20	Nat	94	240
22	Nat	94	241
23	51	94	242
24	Nat	94	243
25	55	95	241
26	Nat	95	242 .0482-MeV level
27	59	95	243
28	Nat	96	242
28	58	96	243
29	Nat	96	244
31	Nat	96	245
33	74	96	246
33	75	96	247
39	88	96	248
39	89	97	249
40	Nat	98	249
41	93	98	250
42	Nat	98	251
47	107	98	252
47	109	99	120 fission product
48	Nat		
50	Nat		
56	138		
63	Nat		

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