RSIC Newsletter

RADIATION SHIELDING INFORMATION CENTER

OAK RIDGE NATIONAL LABORATORY

OPERATED BY UNION CARBIDE CORPORATION • FOR THE U.S. ATOMIC ENERGY COMMISSION

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THE MIND

Companion none is like unto the mind alone;
For many have been harmed by speech,
Through thinking, few or none.

...Thomas Vaux (1557)

NEW NUCLEAR STANDARDS AVAILABLE

The American Nuclear Society (ANS) announces the publication of two new nuclear standards. N18.7-1972, Administrative Controls for Nuclear Power Plants, and N101.6-1972, Concrete Radiation Shields, have been approved as American National Standards. Both are $10.00 per copy and are available from ANS, 244 East Ogden Avenue, Hinsdale, Illinois 60521.

Administrative Controls for Nuclear Power Plants, N18.7-1972, provides criteria necessary for administrative controls necessary for the safe and efficient operation of nuclear power reactors. Test, mobile, and experimental reactors, as well as reactors not subject to U.S. Atomic Energy Commission (USAEC) licensing, are excluded because of difference in operational practices and contractual requirements. N18.7-1972 was referenced in draft form (ANS-3.2) by the USAEC in Safety Guide 33, Quality Assurance Program Requirements (Operation).

Concrete Radiation Shields, N101.6-1972, covers requirements and recommended practices for the construction of concrete radiation shielding structures and for certain elements of design that relate to problems unique to this type of structure. It includes discussions of aggregates, design of concrete mixtures and forms, placement of concrete, design and installation of penetrations, embedments, metal liners and penetration plugs, and an outline of testing and quality assurance provisions needed to verify that the desired quality of design and construction has been met.

N18.7-1972 was prepared by Subcommittee ANS-3, "Reactor Operations," of the ANS Standards Committee. N101.6-1972 was prepared by working group ANS-11.13 of Subcommittee ANS-11, "Radioactive Materials Handling Facilities and Specialized Equipment," composed of H. G. Duggan, Chairman, ORNL, C. A. Burchsted, Secretary, ORNL, A. F. Campagnone, USAEC, F. D. Carpenter, Gulf General Atomic, H. S. Davis, Douglas United Nuclear; R. F. Denkins, Portland Cement Assoc.; B. A. Lamberton, Instrusion-Prepakt; F. J. Patti, Burns & Roe; and A. P. Rosa, Catalytic, Inc.

ENGINEERING COMPENDIUM STATUS REPORT

H. E. (Gene) Hungerford, now on sabbatical leave from Purdue University, reports progress on the Engineering Compendium, as follows. "Volume II of the ENGINEERING COMPENDIUM ON RADIATION SHIELDING, on shield materials, published by Springer-Verlag under the auspices of the IAEA, is in the final stages of being set into print. The final page proofs should be out by about April 1. Indexing of the volume will occur as soon as the page proofs are ready, probably in April. The publishers hope to have the volume printed and ready to be released for sale by early summer, possibly in June."

SPECIAL NOTE TO CODE AND DATA CONTRIBUTORS

As a result of the numerous and varied types of computers and operating systems by which magnetic tapes can be prepared for transmitting information, it is essential that a description of how the tape is written be sent along with the tape, as well as a description of its contents.

A TAPE INFORMATION form is appended to this Newsletter for your use. It lists items which will help expedite the retrieval of information from tapes sent to RSIC. In particular, information about the number of files on the tape, the number of tracks and with what density the tape has been written would be appreciated. Please note that tapes can be written such that a "LABEL" identifying the tape is actually written at the beginning of the tape. In this case, it is necessary that you tell us that the tape is "LABELLED" and that you specify what the volume identification written in the LABEL is, and the "DSNAME" for each file.

Your cooperation is always appreciated.

SWEDISH NEUTRON DATA LIBRARY AVAILABLE FROM NNCSC

The National Neutron Cross Section Center (NNCSC) has announced that the contents of the Swedish Neutron Data Library, SPENG, have been added to their files (but they are not in ENDF format). This library is in part based on UKNDL, KEDAK, and ENDF. It is described in Report AE-RD-45 (1972), which has been distributed in Europe but not yet in the United States. The 28 materials of the Library (including two elements, F and Er, not in ENDF/B-III) are:

1-H-1	11-Na-23	40-Zr	92-U-235
1-H-2	13-Aℓ-27	42-Mo	92-U-238
2-He	14-Si	68-Er	94-Pu-239
3-Li-6	24-Cr	73-Ta	94-Pu-240
3-Li-7	25-Mn-55	74-W-186	94-Pu-241
5-B-10	26-Fe	79-Au-197	
5-B-11	28-Ni	(Fission Products of Pu-239	
9-F-19	29-Cu		

The SPENG Library is in a BCD card image format and is contained on a single magnetic tape. Anyone interested in receiving all or any part of the SPENG Library should submit a 2400 foot 7-track magnetic tape to NNCSC and should indicate which parts of the Library are desired.

CHANGES TO THE COMPUTER CODE COLLECTION

The general purpose Monte Carlo multigroup neutron and gamma-ray transport code system, MORSE, has proliferated into a series of codes through wide usage and continuing code development. A further diversity has been caused by differing geometry treatment. To simplify handling within RSIC procedures and to avoid confusion in publicizing changes to the MORSE system, we have separated the several versions into two packages. The original MORSE series of codes which describe the physical problem through 05R-GEOM routines remain in the CCC-127 code package with the code system designated as MORSE-G. The series which make use of the MAGI-developed combinatorial geometry will be packaged as CCC-203 and designated as MORSE-CG.

The following versions are currently available. In each case, we have indicated the computer on which that version is operable and the date on which it was most recently packaged or updated and repackaged.

CCC-127A/MORSE-G (CDC-1604, 1/70)	CCC-203A/MORSE-CG (UNIVAC-1108, 3/73)
CCC-127B/MORSE-G (IBM-360, 3/73)	CCC-203B/MORSE-CG (CDC-6600, 3/73)
CCC-127C/MORSE-G (CDC-6600, 3/73)	CCC-203C/MORSE-CG (IBM-360, 3/73)

The following code packages are announced as available. In some instances, changes to existing code packages are described; others are new additions. Unless otherwise noted, requests should be accompanied by a full reel (2400') of magnetic tape.

CCC-125B/RSAC — A FORTRAN IV version, written for the IBM 360, has been contributed by Aerojet Nuclear Company, Idaho Falls, Idaho. The original version of the code (CCC-125A) was written in MAP for the IBM 7044 by Phillips Petroleum Co. RSAC is a Radiological Safety Analysis Code. Reference: IDO-17261 and IDO-17151.

CCC-161/NMTC A CDC 6600 version has been contributed by Los Alamos Scientific Laboratory, Los Alamos, N. Mexico, and is packaged as CCC-161C. NMTC is a Monte Carlo Nucleon-Meson Transport Code System. Reference: ORNL-4606.

CCC-184/TASK The Generalized One-Dimensional Transport and Diffusion Kinetics Code, TASK, has been updated with I/O improvements which make the use of the "diffusion theory" option more tractable; to solve problems that have no delayed neutrons; and to allow the cross sections from the ANISN code to be input to TASK without removing the title cards in the cross-section decks. Reference: ORNL-TM-3811.

CCC-201/STRAGL Calculation of Energy Loss Straggling of Heavy Charged Particles, contributed by Los Alamos Scientific Laboratory, Los Alamos, New Mexico. FORTRAN IV; CDC 6600. Reference: Comp. Phys. Commun.; 2(7), 433-42 (Dec. 1971).

CCC-202/PELSHIE General Purpose Kernel Integration Shielding Code for Point and Extended Gamma-Ray Sources, contributed by the Atomic Energy Board, Pretoria, Republic of South Africa. FORTRAN IV; IBM 360. Reference: PEL-213.

CCC-205/TRAPP Transport of Alpha Particles and Protons with All Nuclear Reaction Products Neglected, contributed by the ORNL Neutron Physics Division. The calculation assumes all particles travel in a straight line and undergo a continuous slowing down. FORTRAN IV; IBM 360. Reference: ORNL-4763 and ORNL-TM-3813.

PSR-18/PLOTFB ENDF/B Data Plotting Code Package. This is a revision by the ORNL Mathematics and Neutron Physics Divisions of the original ENDF/B plotting package released by Brookhaven National Laboratory. FORTRAN IV; IBM 360.

PSR-42/DUFOLD Derivative Unfolding Code - Determination of Neutron Spectra from Ne-213 Pulse Height Data, contributed by Department of Nuclear Engineering, Kansas State University at Manhattan. FORTRAN IV, IBM 360. Reference: COO-2049-7.

PSR-47/ENLOSS Calculation of Energy Loss of Charged Particles, contributed by Atomic Energy Research Establishment, Harwell, England. FORTRAN IV; CDC 6600. Reference: AERE-7072.

PSR-48/ALC1 Cross Section Library Management Routine for Discrete Ordinates Codes ANISN, DOT, and DTF Series, contributed by the ORNL Neutron Physics Division. FORTRAN IV; IBM 360. Reference: ORNL-TM-4015.

PSR-49/DINT — A Multigroup Coherent-Incoherent Cross Section Data Generator for Photon Transport Calculations, contributed by Sandia Laboratories, Albuquerque, New Mexico. FORTRAN IV; CDC 6600. Reference: SC-RR-72-0684.

PSR-50/GAMBlT — Multigroup Neutron Cross Section Data Generator, contributed by Westinghouse Astronuclear Laboratory, Pittsburgh, Pennsylvania. The source is written in FORTRAN IV; the cross section libraries in binary for the CDC 6600. Reference: WANL-TME-1969.

PSR-51/SMUG — Multigroup Photon Cross Section Generator, contributed by the ORNL Mathematics and Neutron Physics Divisions. A module of the AMPX Code System for the generation of multigroup cross section data sets, SMUG is packaged as a stand-alone replacement for PSR-7/MUG. FORTRAN IV; IBM 360. Reference: CTC-17.

PSR-52/MACK — Calculation of Neutron Energy Release Parameters and Multigroup Neutron Reaction Cross Sections from Nuclear Data in ENDF Format, contributed by the University of Wisconsin, Madison, and the Oak Ridge National Laboratory. FORTRAN IV; IBM 360 and UNIVAC 1108. Reference: ORNL-TM-3994.

CHANGES TO DATA LIBRARY COLLECTION

Since being announced in the November 1972 RSIC Newsletter, some modifications have been made to the DLC-19/DECAYGAM Data Library. In particular, the documentation of this compilation of radioactive decay gamma-ray spectra has been augmented and improved. The abstract has been revised and a copy is attached to this issue in a form suitable for inclusion in the ORNL-RSIC-30, Vol. I "Abstracts of the Data Library Packages Assembled by the Radiation Shielding Information Center." This should replace the abstract distributed with the November 1972 RSIC Newsletter.

DLC-24/SINEX — A 100-Group Neutron Reaction Cross-Section Data Library Generated by SUPERTOG from ENDF/B, contributed by the ORNL Mathematics and Neutron Physics Divisions. The package includes a retrieval program to convert SINEX data into forms suitable for activity calculations in ANISN. FORTRAN IV; IBM 360. An abstract of DLC-24 is attached as the last pages of this newsletter for insertion in your copy of ORNL-RSIC-30.

PERSONAL ITEMS

The following persons have notified RSIC about address and/or career changes.

David T. Goldman has been named Deputy Director for the Institute for Basic Standards (IBS) at the National Bureau of Standards, U.S. Department of Commerce. IBS provides the United States with a central basis for a consistent system of physical measurement; coordinates that system with measurement systems of other countries, and furnishes essential service to the nation's scientific and technological community. Prior to his current appointment as Institute Deputy Director, Dr. Goldman was Program Analyst in the Office of the Associate Director for Programs. He continues to serve as an Adjunct Professor in Nuclear Engineering at the University of Maryland.

George C. Biro of Gibbs & Hill, Inc. has been appointed Adjunct Professor of Nuclear Engineering to New York University. He will teach radiation protection and shielding for graduate and undergraduate students. Dr. Biro will also remain in his position as Consulting Nuclear Engineer at Gibbs & Hill.

Michael Nagy has returned to his position as Dipl. Physicist of the Technical University Reactor Group in Budapest, Hungary. He spent several months last year working with the Radiation Shielding Group at CNEN, CSN, Casaccia, Italy.

H. G. Wahsweiler has informed us that Brown Boveri/Krupp in Mannheim, Germany has recently changed its name to Hochtemperatur-Reaktorbau GmbH. The mailing address is still the same.

The following changes of address have been noted: *Rudolph J. Henninger*, from the University of California at Berkeley to the Swiss Federal Institute for Reactor Research, Würenlingen; *H. E. P. Krug, Jr.* from Control Data Corporation, Minneapolis, Minnesota, to Illinois Power Company at Decatur; *J. E. Rauch* from Lockheed, Palo Alto, to Maxwell Laboratories, Inc., San Diego, California.

VISITORS TO RSIC

Visitors to RSIC during the month of February were: D. Foster, Business Equipment Co., Knoxville, Tenn.; C. Papastergiou, Greek R. Reactor Democostas; G. L. Simmons, Science Applications, Inc., Huntsville, Ala.; J. Strahl, NUS Corp., Rockville, Md.

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Kyoto University, Japan
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Oak Ridge National Lab., Oak Ridge, Tenn.

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Los Alamos Scientific Laboratory, Los Alamos N. Mex.

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Richardson, B. L.
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Kernforschungszentrum, Karlsruhe, Germany

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Roussin, R.W.
Oak Ridge, National Lab., Oak Ridge, Tenn.

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Devillers, C.
CEA CEN, Fontenay-aux-Roses, France

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Emmett, M.B.
Oak Ridge National Lab., Oak Ridge, Tenn.
FORTRAN; IBM 360
AVAIL: NTIS

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Rupp, T.D.; Nelson, F.C.
School of Aerospace Medicine, Brooks AFB, Texas
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Park, J.C.H.
Stanford Linear Accelerator Center, Stanford, Calif.
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Colonias, J.S.
Lawrence Berkeley Lab., Berkeley, Calif.
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TAPE INFORMATION

(Please fill in as applicable)

Tape Number _____ Number of files on tape _____

Track: ◯ 7-track ◯ 9-track

Density: ◯ 200 BPI ◯ 556 BPI ◯ 800 BPI ◯ 1600 BPI

Mode: ◯ BCD ◯ EBCDIC ◯ BINARY ◯ MIXED

Labelled tape: ◯ NL ◯ SL ◯ NSL

If labelled, please give label information

Tape blocked: ◯ NO, Record length _____

◯ YES, DCB parameters: BLKSIZE _____
LRECL _____
RECFM _____
TRTCH _____

Computer on which tape was written: ◯ IBM-360 ◯ CDC ◯ UNIVAC ◯ IBM 7090/94 ◯ GE ◯ Other _____

RSIC DATA LIBRARY DLC-19/DECAYGAM

1. NAME AND TITLE OF DATA LIBRARY

DECAYGAM: Radionuclide Gamma-Ray Energy and Intensity Compilation.

2. NAME AND TITLE OF DATA RETRIEVAL PROGRAMS

NUCDAT: Edit Program for Reading, Listing, and Editing Data on Magnetic Tape and Cards.

DKDATA: Subroutine for Retrieving Radionuclide Gamma-Ray Decay Data.

3. HISTORICAL BACKGROUND INFORMATION

Because of a need at Oak Ridge National Laboratory to resolve complex high-resolution gamma-ray spectra, an effort was begun to collect a modern computer-readable library of gamma-ray energies and intensities. The data were collected on punched cards, and over a period of time, underwent many revisions. The present version available on magnetic tape represents a collection from many sources and includes some unpublished compilations of Oak Ridge National Laboratory Nuclear Data Project. In addition to energies and intensities, the library includes natural abundances of stable nuclides from which radionuclides may be formed, half-lives, 2200 meter/sec cross sections, fission yields, and other quantities necessary for gamma-ray spectroscopy.

4. APPLICATIONS OF THE DATA

Radionuclide decay data have many applications. This compilation contains, for those radionuclides tabulated, all necessary data for qualitatively and quantitatively measuring photon emitting radionuclides as well as conducting activation analysis using gamma-ray spectrometry. The data are thus especially useful in these areas of endeavor. Gamma-ray energy and intensity data are necessary for shielding and gamma-ray heating calculations. Environmental dose calculations also depend on these data.

5. SOURCE AND SCOPE OF DATA

The sources of the data are recorded as Hollerith records on magnetic tape along with the data for each radionuclide. Presently, the data are tabulated for 514 radionuclides. Where possible, the intensity data have an absolute normalization; in some cases, however, the normalization is relative.

6. DISCUSSION OF THE DATA RETRIEVAL PROGRAMS

There are two retrieval programs provided, NUCDAT and DKDATA.

NUCDAT will read data from magnetic tape or cards, generate a new data tape from cards and produce a listing in two main tables. Table I is an unmodified listing of the input information arranged according to increasing atomic number. For each atomic number entries are arranged by increasing mass number. Table II, whose listing is optional, consists of a sorted list of the most intense gamma rays arranged according to increasing energy. Listed also in Table II along with each gamma-ray energy, is the radionuclide to which the gamma ray belongs, its half-life, type of radionuclide, and energies and intensities for several of the most intense gamma rays emitted by the radionuclide. These associated gamma rays are arranged by decreasing intensity to enable gamma-ray spectroscopists to easily compare lines in spectra with the most intense tabulated energies and thus rapidly identify the components of "unknown" spectra.

DKDATA is a subroutine which returns to the calling program information concerning the gamma-ray decay characteristics of a nuclide of specified atomic number and mass. This data is initially read from DLC-19 on first entry to the subroutine, and the pertinent data for all nuclides of interest are stored for use in subsequent calls.

7. CONTRIBUTOR

Analytical Chemistry and Neutron Physics Divisions, Oak Ridge National Laboratory, Oak Ridge, Tennessee.

8. DATA FORMAT AND COMPUTER

BCD or EBCDIC card images, IBM 360/91.

9. TYPICAL RUNNING TIME

To compile NUCDAT and edit the entire DECAYGAM library requires 1 minute on the IBM 360/91; DKDATA sample problem, 18 sec. on IBM 361/75.

10. REFERENCES

(1) F. F. Dyer and L. C. Bate, "A Compilation of Modern Nuclear Decay Data for High Resolution Gamma Spectroscopy," Paper to be presented at the IAEA Symposium on Applications of Nuclear Data in Science and Technology in Paris, France (March 1973).

(2) F. F. Dyer, "Input Instructions for the NUCDAT Retrieval Program for DLC-19/DECAYGAM," Informal Notes (February 1973).

(3) J. W. Wachter, "DKDATA: Subroutine for Retrieving Radionuclide Gamma-Ray Decay Data from RSIC Data Set DLC-19/DECAYGAM," ORNL-TM-4095 (February 1973).

11. CONTENTS OF THE LIBRARY

The library package contains the following items:

a. the documentation cited above,

b. a tape containing the DECAYGAM library, NUCDAT and DKDATA retrieval programs, sample input and output.

Persons requesting the library should send a full (2400 ft) reel of magnetic tape to the address listed below.

12. HOW TO OBTAIN LIBRARY

Inquiries or requests for the library may be mailed to:

DATA COORDINATOR
Radiation Shielding Information Center
Oak Ridge National Laboratory
P. O. Box X
Oak Ridge, Tennessee 37830

or telephoned to

Area Code 615; 483-8611, extension 3-6944, or to
FTS xx-615-483-6944.

13. DATE OF ABSTRACT

March 1973.

RSIC DATA LIBRARY DLC-24/SINEX

1. NAME AND TITLE OF DATA LIBRARY

SINEX: 100-Group Neutron Reaction Cross-Section Data Generated by SUPERTOG from ENDF/B.

2. NAME AND TITLE OF DATA RETRIEVAL PROGRAM

RESOLVE: A Program to List or Convert SINEX Data into Forms Suitable for Activity Calculations in ANISN.

3. HISTORICAL BACKGROUND INFORMATION

Since 1968 the Radiation Shielding Information Center has provided the DLC-2 100 group, P_8 expansion neutron cross section library generated with SUPERTOG[2] from the latest ENDF/B library available. The nature of this library is such that all individual reaction cross sections are lumped together because their identity is not necessary for doing a neutron transport with codes such as ANISN.[4] However, the need to calculate the spatial distribution of individual reaction rates has demonstrated the desirability of having available the individual multigroup reaction cross sections in a format consistent with the cross-section data used for the transport calculation. A recent modification to SUPERTOG allows the option to output these multigroup reaction cross-section data, and the result of processing the ENDF/B library has been preserved as DLC-24/SINEX. The name SINEX is an acronym for SUPERTOG Interpretation of ENDF/B X-Sections.

4. APPLICATIONS OF THE DATA

The data can be used in combination with 100 group neutron transport calculations (using, for example, the DLC-2 library) to determine the spatial distribution of individual reaction rates. In particular, the retrieval program allows the preparation of dummy materials based on DLC-24 which can be used in the activity calculation option in ANISN to calculate the desired reaction rates.

5. SOURCE AND SCOPE OF THE DATA

DLC-24 was generated by PSR-13/SUPERTOG from nuclear data in either point-by-point or parametric representation as specified by ENDF/B.[5] This data is averaged over each specified group width. For the top 99 groups, the explicit assumption was made that the flux (weighting function) has the shape of a fission spectrum joined at 0.0674 MeV by a 1/E tail. When resonance data were available, resolved and unresolved resonance contributions were calculated, using the infinite dilution approximation. For the thermal group (group 100), values for all materials except hydrogen were taken from the Maxwellian average values derived from the ENDF/B data. These are given in Ref. 6. The values for hydrogen are more consistent for hydrogen in water. It should be used in the latest version of DLC-2.

The library consists of 100 group reaction cross sections for neutron interactions as follows: total, elastic, inelastic, (n,2n), fission, (n,n'α), (n,n'3α), (n,2nα), absorption, (n,n'p), capture, (n,γ), (n,p), (n,d), (n,T), (n,He^3), (n,α), (n,2α), and nubar. The units are barns, except that nubar is the average number of neutrons per fission event. A table listing the reactions included for each material is found in Ref. 1.

The nuclides in DLC-24 are those which have been released as Category I ENDF/B by the National Neutron Cross Section Center, Brookhaven National Laboratory. The library contains data for H, D, He, 3-He, 6-Li, 7-Li, 9-Be, 10-B, 11-B, 12-C, 14-N, 16-O, 23-Na, Mg, 27-Al, Si, Cl, K, Ca, V, Cr, 55-Mn, Fe, 59-Co, Ni, Cu, 63-Cu, 65-Cu, Nb, Mo, 107-Ag, 109-Ag, 135-Xe, 133-Cs, 149-Sm,151-Eu, 153-Eu, Gd, 164-Dy, 175-Lu, 176-Lu, 181-Ta, 182-Ta, 182-W, 183-W, 184-W, 186-W, 185-Re, 187-Re, 197-Au, Pb, 232-Th, 233-Pa, 234-U, 235-U, 238-U, 238-Pu, 239-Pu,240-Pu, 241-Pu, 242-Pu, 241-Am, 243-Am, and 244-Cm.

6. DISCUSSION OF THE DATA RETRIEVAL PROGRAM

The data retrieval program can be used to list or selectively punch cards or write an unformatted tape in the ANISN cross-section formats. The purpose is to arrange the data so they can be read into

ANISN as a dummy cross section material which can be used in the ANISN activity calculation to calculate the desired reaction rate distribution in a system of interest.

7. CONTRIBUTOR

Oak Ridge National Laboratory, Oak Ridge, Tennessee.

8. DATA FORMAT AND COMPUTER

BCD or EBCDIC card image; IBM 360/65/75/91.

9. TYPICAL RUNNING TIME

To process 124 reactions and produce an unformatted tape for ANISN input required 10 seconds on the IBM 360/75.

10. REFERENCES

a. Documentation available with the library

(1) R. Q. Wright and R. W. Roussin, "Description of the DLC-24/SINEX 100 Group One-Dimensional Cross Sections Based on ENDF/B," Informal Notes (February 1973).

(2) R. Q. Wright, "Input Instructions for RESOLVE, A Program for Listing or Converting DLC-24/SINEX Data into ANISN Cross Section Input Formats," Informal Notes (February 1973).

b. Other documentation helpful in defining library

(3) R. Q. Wright, N. M. Greene, J. L. Lucius, and C. W. Craven, Jr., "SUPERTOG: A Program to Generate Fine Group Constants and P_n Scattering Matrices from ENDF/B," ORNL-TM-2679 (September 1969).

(4) W. W. Engle, Jr., "A Users Manual for ANISN," K-1693 (March 1967).

(5) M. K. Drake, Editor, "Data Formats and Procedures for the ENDF Neutron Cross Section Library," BNL-50274(T-601) (ENDF 102, Vol. 1) (October 1970).

(6) D. E. Cullen and P. J. Hlavac, "ENDF/B Cross Sections," BNL 17100 (ENDF-200) (November 1972).

11. CONTENTS OF THE LIBRARY

The library package contains the following items:

a. the documentation listed in section 10a above,

b. one reel of magnetic tape containing the library, retrieval program, and sample input and output.

12. HOW TO OBTAIN LIBRARY

Inquiries or requests for the library may be mailed to

DATA COORDINATOR
Radiation Shielding Information Center
Oak Ridge National Laboratory
P. O. Box X
Oak Ridge, Tennessee 37830

or telephoned to

Area Code 615; 483-8611, extension 3-6944, or to
FTS xx-615-483-6944.

13. DATE OF ABSTRACT AND CURRENT VERSION

February 1973.