

Appendix

SERVICES OF THE IAEA NUCLEAR DATA SECTION
TO NEUTRON PHYSICISTS AND NEUTRON DATA USERS¹

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The services of the IAEA Nuclear Data Section to neutron nuclear physicists and neutron data users are presented. The costfree availability upon request of bibliographic information, experimental and evaluated neutron data is stressed and discussed in detail.

The Nuclear Data Section (NDS) of the International Atomic Energy Agency was founded in 1964 and implements the Agency's nuclear data programme. In the formulation of this programme, the Agency is assisted by a permanent advisory body, the International Nuclear Data Committee (INDC) which meets annually and for which NDS acts as secretariat. The objectives of NDS are to promote the world-wide compilation and exchange of nuclear data information, to assess the requirements for nuclear data and to promote national and regional nuclear data programmes to fulfil these needs. One essential component of this programme pertains to the neutron data field. In the following the discussion will be restricted essentially to this component. In order to achieve the objectives of this component, NDS cooperates closely with three other neutron data centres: the National Neutron Cross Section Centre (NNCSC) at the Brookhaven National Laboratory in the USA; the Centre de Recherches Nucléaires (CRN) at the Institute of Physics and Energetics, Obninsk, in the USSR; and the Centre de Comptation de Données Neutroniques (CCDN) of the Nuclear Energy Agency (NEA) at Saclay in France.

Each of these four neutron data centres services one part of the world. The services areas are: for NNCSC: the USA and Canada; for CRN: the USSR; for CCDN: all Member States of the Organisation for Economic Cooperation and Development (OECD) in Western Europe and Japan; for NDS: all other countries in East Europe, Asia, Australia and New Zealand, Africa, Central and South America.

The servicing of an area consists in: the compilation of all bibliographic information and all experimental data pertaining to the neutron field; the fulfilment of requests from this area for bibliographic information, experimental and evaluated data.

In addition, NDS offers a Targets and Samples Programme, in support of nuclear data measurements in smaller countries in its area, performs or coordinates specific data reviews and data compilations, maintains request lists for nuclear data measurements for fission and fusion reactors and safeguards development, and organizes meetings in the field of nuclear data. All the services offered by NDS are *free of charge*.

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Bibliographic references to measurements, calculations, reviews and evaluations of neutron cross sections and other microscopic neutron data are compiled by the four neutron data centres and stored in the Computer Index of Neutron Data (CINDA) file which is operated and maintained by NEA/CODN and continuously updated and revised. Each year the content of the file is published by the IAEA as a book. The CINDA 74 book is a cumulative issue in two volumes, which supersedes all earlier issues. It contains the complete CINDA file, approximately 105000 entries, as of 17 March 1974. A supplement is envisaged to be published in December 1974; it will contain CINDA entries compiled between March and October 1974. The CINDA system recently revised by NEA/CODN now allows the inclusion of *index references* to computer libraries of numerical neutron data exchanged between the four neutron data centres (Fig. 1). It is also now possible to remove "noise" from the book by deleting unimportant progress reports after the publication of the final articles.

CINDA users may request (free of charge) computer retrievals from the CINDA file, for instance whenever they need the most recent information available (i.e. information which is not yet contained in the last CINDA publication) or they wish to examine information which cannot be conveniently selected from the book or they are requesting numerical, experimental or evaluated data and wish at the same time to know of other data which may not yet be in the centres' numerical data files. Retrieval outputs are available in any of these three sorts: "lab-sort" (entries are sorted by the 3-character laboratory code in alphabetic order, then by nuclide and quantity), "ZAQ-sort" (entries are sorted by element Z and mass-number A, then by quantity) or "Quantity-sort" (entries are sorted by quantity, then by nuclide ZA). More details on the specification of retrievals are to be found in [1].

Quantity	Energy (eV)	Lab	Type	33 Atrsenic		75		Data
				Min	Max	Date	Author/Comment	
(n,2n)	1.4+7	JYV	Exp	JU-RR-3:1970		Jun70	Largemanski+ TABLE OF EVAL AVG SIG	+
(n,2n)	1.4+7	KIL	Exp	RCA 13 4 160		Jun70	STEINNES AVERAGE FISS NEUT CROSS - SEC	+
(n,2n)	1.4+7	CIT	Exp	PRC 3 629		Feb71	Fink+ ACT SIG = 1016+ -102MB	+
(n,2n)	1.4+7	KFI	Theo	EXFOR00157002		Aug72	JPN SIGMA	+
(n,2n)	1.4+7	IBI	Exp	JRN-1318 R		Feb71	Decker+ CALCULATED CRD EXPL SIG VALUE	+
(n,2n)	1.3+7	IBI	Exp	JRN-1318 R		Apr71	Decker+ SIGMA AT 9 ENERGIES	+
(n,2n)	1.3+7	IBI	Exp	JRN-1318 R		Aug71	*SAME AS INR-1318	+
(n,2n)	1.3+7	IBI	Exp	JRN-1318 R		Feb72	9 DATA LINES	+
(n,2n)	1.4+7	KFI	Comp	JRC 7 365		Jun71	Nagy+ SIGMA GAM-E AND HALF-LIFE GIVEN	+
(n,2n)	1.4+7	HRK	Exp	QAWA 108 185		Nov71	Wagner+ ACTIVATION ALTRON	+
(n,2n)	1.5+7	JUL	Exp	NPA 185 614		May72	Ott+ ACT(EL) CRD TH+OTHR	+
(n,2n)	1.4+7	CCP	Exp	VE 15 1099		Jun72	Vidossich+ ACTIV/TBL CRD OTHERS+ THEO	+
(n,2n)	1.4+7	CCP	Exp	SNF 15 608		Dec72	- + ENGLISH OF VE 15 1099	+
(n,2n)	1.4+7	DEB	Eval	EXFOR007004		Mar73	Beedy+ COMPLETION+RECOM+VALUE/TBL	+
(n,2n)	1.5+7	DEB	Eval	REA 11 1 153		Jan73	- . SAME EVAL AS REA 11 (1973)	+
(n,2n)	1.4+7	KEK	Exp	IAEA-153 173		73	- . RECOM. LIMITS ONLY	+
(n,2n)	1.4+7	LOU	Exp	Prog INR-1464 12		Apr73	Meredith+ DETECTION LIMITS, ESCRD TH	+
(n,2n)	1.4+7	BIA	Exp	JIN 35 6 2065		Nov73	Arminowicz+ BRER+ACTIV/TABLE+GRAPH	+
(n,2n)	1.4+7	BRL	Exp	JSE 21 238		Nov73	SIGMA AT 14.6 MEV	+
(n,2n)	1.4+7	KRP	Exp	Actv 13 14		Jan73	Simpson+ ACTIV MEAS	+
(n,2n)	1.4+7	JAP	Exp	SCP 36 153		Nov65	Perdichin+ STATISTICAL MODEL	+
(n,2n)	1.4+7	JAP	Exp	PPA 63 1175		Jan70	Kimura+ SIG-7.3 B	+
(n,2n)	1.4+7	HAR	Exp	AREE-NR-527		Oct60	Comer+ LITTLE+FILE OSC REL HAR B	+
(n,2n)	1.4+7	HAR	Exp	AREE-NR-527		Jun70	SEE ALSO	+

Fig. 1. Example of the part of a page from the CINDA 74 book. References pertaining to the same work are blocked. Note the index references to the EXFOR experimental numerical neutron data library.

Since July 1970, the four neutron centres exchange the experimental data compiled in their service areas so that data entered at one centre are made available to the other three centres. Prior to transmission to another centre, the numerical measured microscopic data and associated bibliographic and physical descriptive information are coded in a computerized EXchange FORmat (EXFOR). The physical information necessary for the understanding of the experiment and the interpretation of the numerical data are presented in a convenient compact form. Keywords and codes make the information computer-intelligible. The EXFOR file includes in tabular form data which may be available in the usual literature only in graphical form. It also includes data which may not be published yet. At the present time, the EXFOR file contains 830 000 experimental data points divided amongst 1000 entries each one related to a single experiment or set of experiments performed in a laboratory by a research group. Upon request to NDS, retrievals from the EXFOR file are available in any desired computer medium (listings, magnetic tapes, punched cards...).

In addition to the EXFOR file, numerical data may be available in other computerized files not yet converted to EXFOR. They can also be obtained from NDS upon request.

For the future, NDS plans to improve its services to neutron data users by developing a computation format for the automated manipulation of data stored in EXFOR, such as plotting and renormalizing data sets.

Various files of evaluated neutron nuclear data are available from NDS, but whereas experimental neutron data are freely exchanged throughout the world, the exchange of evaluated neutron data is still somewhat restricted.

The following main evaluated data libraries are totally or partially available at NDS: the Lawrence Livermore Laboratory ENDF library in ENDF Format (complete); the U.S. Evaluated Nuclear Data File (ENDF/B) (7 materials* only); the United Kingdom Nuclear Data Library (UKNDL) (fairly complete); the Karlsruhe Evaluated Nuclear Data File (KEDAK) (complete); the Italian Fission Product Nuclear Data Library (complete); the USSR Evaluated Neutron Data Library (one full material only (U-238) + α / γ (²³⁵U) + angular distribution data for 43 materials); the Australian Fission Product Nuclear Data Library (complete).

In the past year NDS distributed 2000 data sets totalling 450 000 data points. NDS promotes data measurements in smaller countries of its service area by providing assistance in the supply of accelerator targets and samples. Under this programme, materials are loaned, free of charge, by Agency to Member States. The planned measurements should relate to requests for nuclear data measurements listed in the computerized World Request List for Nuclear Data measurements (WRENDAL) (Fig. 2). The 1974 edition of WRENDAL [2], the compilation of which is coordinated by NDS, contains 1190 requests for 632 data types needed in support of the fission reactor development programmes of 21 Member States of the IAEA and one International Organization. WRENDAL can therefore be very useful in the formulation of research programmes based on nuclear data measurements. Decisions for support of requests for targets and samples are based on four criteria: 1) Priorities in WRENDAL; 2) Availability of materials; 3) Feasibility of experiment; 4) Available funds (\$17 000 for the 1974 Programme). In addition to the specific services provided upon request which have been described, NDS coordinates and performs data reviews. Their objectives are to review, evaluate

* all cross sections for a given nuclide.

22 TITANIUM	NEUTRON	ABSORPTION CROSS SECTION
712007	500 EV 15.0 MEV 25.0%	3 FR J. Y. Barre CAD O: For Fast Reactor Calculations. M: Substantial Modifications.
22 TITANIUM	NEUTRON	CAPTURE CROSS SECTION
692065	100 EV 100. KEV 20.0%	1 UK G. G. Campbell WIN O: For Fast Reactors.
709005	500- EV 1.00 MEV 25.0%	3 FR J. Y. Barre CAD O: For Fast Reactor Calculations. M: Substantial Modifications.

Status: ALLEN + - NSAC-38 171 (1970), DATA 80 KEV TO 3 MEV.
ORL COATES - MEASUREMENT PLANNED.
HAR

Fig. 2. Example of the part of a page from the WRENDATA 74 publication. Individual requests for the same measurement are blocked, each having its specific requirements. Note the comment giving the status of the requested data.

and establish universally acceptable sets of standard neutron data and other nuclear data of primary importance for the development of nuclear technology such as thermal parameters of fissile nuclides, important nuclear data for reactors or neutron data for activation analysis. In order to review the status and requirements of nuclear data for various applications and develop commonly acceptable recommended data, NDS organizes numerous specialized meetings of nuclear data measurers, evaluators, and users. Concluding this short review of the services of NDS to neutron data users, it is worth mentioning that various information on non-neutron nuclear data which may often be needed in neutron experiments, is also available from NDS.

REFERENCES

[1] CINDA 74. *An index to the literature on microscopic neutron data.* 2. vol. Int. Atomic Energy Agency, Vienna, 1974.
 [2] WRENDATA 74. *World Request List for Nuclear Data Measurements.* Rep. INDC (SEC)-38/U. April 1974.
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