International Atomic Energy Agency

INDC(NDS)-154
Distr. G + Sp.

INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

Report on the

7th IAEA CONSULTANTS' MEETING OF

NUCLEAR REACTION DATA CENTRES

Obninsk and Moscow, USSR
17 - 21 October 1983

Including

the 18th FOUR-CENTRES MEETING

of the NEUTRON DATA CENTRES

and

the 8th MEETING ON CHARGED PARTICLE NUCLEAR DATA COMPILATION

February 1984

IAEA NUCLEAR DATA SECTION, WAGRAMERSTRASSE 5, A-1400 VIENNA

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Abstract

This report summarizes the 1983 coordination meeting of the national and regional nuclear reaction data centers, convened by the IAEA at regular intervals. The main topics are

- the international exchange of nuclear reaction data by means of the "EXFOR" system,
- the futher development of this system,
- the sharing of the workload for speedy and reliable data compilation,
- the exchange of specialized and evaluated data libraries,
- the role of ENDF/B as an international format for the exchange of evaluated data,

with the goal of rendering data center services to data users in IAEA Member States by means of computer retrievals and printed materials.

Edited by

H.D. Lemmel

Reproduced by the IAEA in Austria
February 1984
84-02835

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GLOSSARY OF ABBREVIATIONS

BNL	Brookhaven National Laboratory, Upton, N.Y., USA
CAJaD	Center for Nuclear Structure and Reaction Data, Kurchatov Institute, Moscow, USSR
CDFE	Centr Dannykh Fotojad. Eksp., Moscow State University, USSR
CINDA	A specialized bibliography and data index on neutron nuclear data operated jointly by NNDC, NEA-DB, NDS and CJD
CJD	USSR Nuclear Data Center at F.E.I., Obninsk, USSR
CPL	Computer Program Library of NEA-DB
CPND	Charged-particle nuclear reaction data
CRP	Coordinated Research Programme of the IAEA Nuclear Data Section
CSEWG	US Cross-Section Evaluation Working Group
CSISRS	Cross-Section Information Storage and Retrieval System, the EXFOR-compatible internal system of NNDC
DOE	US Department of Energy
DOE-NDC	Nuclear Data Committee of DOE
ENDF	US Evaluated Nuclear Data File
ENSDF	Evaluated Nuclear Structure Data File
EXFOR	Format for the international exchange of nuclear reaction data
FEI	Fiziko-energeticheskij Institut, Obninsk, USSR
FIZ	Information Center of the Fed. Rep. of Germany for energy, physics, mathematics, Karlsruhe, Fed. Rep. of Germany
GKAE	UUSR State Committee on the Utilization of Atomic Energy, Moscow, USSR
IAEA	International Atomic Energy Agency
INDC	International Nuclear Data Committee
INDL	The IAEA Nuclear Data Library for evaluated neutron reaction data
INIS	International Nuclear Information System

IRDF	The International Reactor Dosimetry File, maintained by the IAEA/NDS
JEF	The Joint Evaluated File of neutron data, a collaboration of European NEA member countries and Japan
KACHAPAG	Charged Particle Nuclear Data Group, Karlsruhe, Fed. Rep. of Germany
LANL	Los Alamos National Laboratory, Los Alamos, N.M., USA
LEXFOR	Part of the EXFOR manual containing physics information for compilers
LIJaF	Leningrad Nuclear Physics Inst., Gatchina
LMFBR	Liquid-Metal Fast Breeder Reactor
NDS	IAEA Nuclear Data Section, Vienna, Austria
NEA	Nuclear Energy Agency of the OECD, Paris, France
NEACRP	Nuclear Energy Agency Committee on Reactor Physics
NEA-DB	NEA Data Bank, Saclay, France
NEANDC	Nuclear Data Committee of the OECD Nuclear Energy Agency
NEUDADA	Neutron Data Direct Access. Earlier data file of NEA, now included in EXFOR
NND	Neutron Nuclear Data
NNDC	National Nuclear Data Center, Brookhaven National Laboratory, USA
NNDEN	Neutron Nuclear Data Evaluation Newsletter
NRDC	the Nuclear Reaction Data Centers
NSDD	Nuclear structure and decay data
NSR	Nuclear structure references, a bibliographic system
OECD	Organization for Economic Cooperation and Development, Paris, France
ORNL	Oak Ridge National Laboratory, Oak Ridge, Tenn., USA
PhDC	Photonuclear Data Center, Washington, USA
PhND	Photonuclear data

RIKEN	Nuclear Data Group, RIKEN Inst. of Phys. and Chem. Res., Wako-Shi, Saitama, Japan
SGIP	Study Group for Information Processing, Sapporo, Japan
SOKRATOR	USSR evaluated neutron data library (and format), now included in INDL
SR	Status report of centers to this meeting
TP	Topical paper presented at this meeting
TRANS	Name of transmission tapes for data exchange in the EXFOR system
TUD	Technical University, Dresden, German Democratic Republic
WP	Working paper presented at this meeting
WRENDA	World Request List for Nuclear Data

The network of Nuclear Reaction Data Centers

National and regional nuclear reaction data centers, co-ordinated by the International Atomic Energy Agency, co-operate in the compilation, exchange and dissemination of nuclear reaction data, in order to meet the requirements of nuclear data users in all countries. A brief summary of the data centers network is given below.

The nuclear reaction data centers:

NNDC	- US National Nuclear Data Center, Brookhaven, USA
NEA-DB	- OECD/NEA Nuclear Data Bank, Saclay, France
NDS	- IAEA Nuclear Data Section
CJD	- USSR Centr po Jadernym Dannym (= Nuclear Data Centre), Obninsk, USSR
CAJaD	- USSR Centr po Dannym o Stroenii Atomnogo Jadra i Jadernykh Reakcikh (= Nuclear Structure and Nuclear Reaction Data Centre), Moscow, USSR
CDFE	- Centr Dannykh Fotojad. Eksp. (= Centre for Experimental Photonuclear Data), Moscow, USSR
RIKEN	- Nuclear Data Group, RIKEN Inst. of Phys. and Chem. Res., Wako-Shi, Japan
KACHAPAG	- Karlsruhe Charged Particle Group, Karlsruhe, FRG*)
FIZ	- Fachinformationszentrum Karlsruhe, FRG
SGIP	- Study Group for Information Processing, Sapporo, Japan
PhDC	- Photonuclear Data Center, Washington, USA

These data centres cooperate on the following projects:

1. Neutron Nuclear Data

1.a Bibliography and Data Index "CINDA":
Input prepared by NEA-DB, NNDC, NDS, CJD
Handbooks published by IAEA

1.b Experimental data exchanged in EXFOR format:
Input prepared by NNDC, NEA-DB, NDS, CJD

1.c Data Handbooks based on EXFOR published by NNDC

1.d Evaluated data exchanged in ENDF/B format:
NNDC, NEA-DB, NDS, CJD and others

1.e Computer retrieval services upon request of customers:
NNDC, NEA-DB, NDS, CJD

1.f WRENDA: compilation of requested data that are known with insufficient accuracy. Compiled by NNDC, NEA-DB, NDS, CJD, published by IAEA

2. Charged Particle Nuclear Data (including heavy-ion reaction data)

2.a Bibliography and Data Index published by NNDC*)

2.b Numerical data exchanged in EXFOR format:
Input prepared by KACHAPAG*), CAJaD, RIKEN, NDS, NNDC, SGIP

2.c Data Handbooks based on EXFOR published by FIZ/KACHAPAG*)

2.d Computer retrieval services upon request of customers:
NNDC, NEA-DB, NDS, CAJaD

3. Photonuclear Data

3.a Numerical data exchanged in EXFOR format:
Input prepared by CDFE, NNDC(PhDC), NDS

3.b. Bibliography published by CDFE

3.c Computer retrieval services upon request of customers:
NNDC, NEA-DB, NDS, CDFE

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*) Discontinued in 1982. Since then CAJaD has started to compile also European and US data.

LIST OF PARTICIPANTS

CJD:	V. Manokhin (Centre head) A. Blokhin A. Ignatjuk
CAJaD:	F. Chukreev (Centre head) G. Zhuravleva V. Vukolov A. Ignatochkin
CDFE:	B. Ishkhanov (Centre head) V. Varlamov V. Surgutanov
FEI:	A.I. Abramov
NNDC:	C.L. Dunford (Acting Centre head) V. McLane
NEA-DB:	N. Tubbs (Deputy Centre head)
NDS:	J.J. Schmidt (Centre head, Chairman) H.D. Lemmel (Scientific Secretary)
RIKEN:	A. Hashizume
TUD:	D. Hermsdorf
LIJaF:	I. Kondurov

Part-time participants:

GKAE:	Yu. Klimov A. Lebedev N. Zvonov
FEI:	B. Kuzminov M. Nikolaev A. Tsybulja

WP1

7th IAEA Consultants' Meeting of the
NUCLEAR REACTION DATA CENTRES (NRDC)

Obninsk/Moscow, USSR, 17-21 October 1983

AGENDA

Note: "WP" = working papers, see page 11
"SR" = status reports, see appendices

1. Introduction

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1.2	Election of Chairman	
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1.4	Adoption of Agenda	WP1

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SR1: NNDC
SR2: NEA-DB
SR3: NDS
SR4: CJD
SR5: CAJaD
SR6: CDFE
SR7: TUD
SR8: RIKEN
SR9: SGIP

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2.3	Review of actions and recommendations from the 13th INDC Meeting	WP3

3. Policy discussions

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3.3	Scope and activities of Data Centres	
3.4	Priorities of CPND and PhND compilation: Who compiles what; Need for recommended data	WP14 WP3
3.5	Continuation of the CPND bibliography	
3.6	Additional Data Centres to join the data centre cooperation	
3.7	Date and place of next NRDC Meeting	
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3.9	Planned meetings	

4. EXFOR

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4.3	Compilation of proton resonance data (= Recommendation by the BNL Level Density Meeting, endorsed by INDC)	WP3
4.4	Technical matters on charged-particle nuclear data and photonuclear data	
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5.2	Advantages and disadvantages of the ENDF/B format. New proposals	WP8, WP19 WP20
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6.2	CINDA: 5-years archival issue	WP11, WP3
6.3	CINDA rules	
6.4	Area 4 CINDA compilation	WP9
6.5	WRENDA	WP3
6.6	Completeness of neutron data in EXFOR	WP7, WP15
6.7	TRANS 4046-4048	WP13
6.8	Conversion of EXFOR 8 series to EXFOR 4 series (compare Memo 4C-4/38 of 19.8.83 giving a correspondence list)	
6.9	ISO-QUANT to REACTION conversion	

7. Topical discussions

8. Conclusions and Recommendations, Actions

LIST OF WORKING PAPERS

WP1 Proposed Agenda, see page 9.

WP2 Actions from previous meeting, see report INDC(NDS)-141.

WP3 Actions and recommendations from the 13th INDC Meeting, concerning the NRDC Network, see report INDC-39.

WP4 The NRDC Network, see page 5.

WP5 Pending EXFOR proposals, not appended. See EXFOR conclusions page

WP6 EXFOR: Frequent and/or important mistakes where improvement of check programs is recommended. See appendix.

WP7*) Completeness of neutron data in EXFOR. See appendix.

WP8 1983 Minutes ENDF/B Formats Subcommittee, not appended. See planned meeting on ENDF/B format.

WP9*) CINDA matters of area 4. See appendix.

WP10 Distribution of CP-Memos, EXFOR TRANS tapes, Dictionary tapes, Dictionary Listings. See EXFOR Manual p. 9.6 to 9.9

WP11*) CINDA 5-years archival issue, see Memo 4C-3/259 which is not appended.

WP12*) CINDA: New format of Supplement book, see Memo 4C-3/266 which is not appended.

WP13*) TRANS 4046-4048, not appended.

WP14 Importance for compilation of selected CPND and PhND. See appendix. (Note by editor: Included is a revision of the actual working paper received by K. Okamoto in March 1984.)

WP15*) Pending EXFOR retransmission. See Memo 4C-3/268 which is not appended.

WP16 USSR publications. Not appended, contents included in Minutes.

WP17 Memo CP-C/102 on LEXFOR: Errors. Not appended.

WP18 Neutron Data Publications at NNDC. See appendix.

WP19*) D. Hermsdorf, TUD: Recommendations for the use of formatting rules in ENDF/B. See Memo 4C-3/269 which is not appended.

WP20*) D. Hermsdorf, TUD: Remarks on data of nuclear reactions induced by fast neutrons and their representation in the format ENDF/B. See Memo 4C-3/270 which is not appended.

*) Of interest to the 4 neutron data centres only.

MEETING SCHEDULE

Monday and Tuesday plenary sessions at Obninsk. Part of Tuesday parallel meetings subgroups:

- Center heads: agenda item 3
- Technical staff: agenda item 4

Wednesday morning: Topical discussions (agenda item 8), and plenary session.

Wednesday afternoon: visit to CJD

Thursday and Friday visits and sessions at CDFE, Moscow State University, and CAJaD, Kurchatov Institute

MINUTES

(Note: The minutes are sorted by agenda items. The actual discussions may have been in different sequence.)

1. Introduction

J.J. Schmidt opened the meeting. He requested a minute of silence honouring the late Prof. L.N. Usachev and commemorated his merits for the international co-operation in the field of nuclear data.

B. Kuzminov welcomed the participants on behalf of the Fiziko-Energeticheskij Institute which celebrated the 30th anniversary of nuclear power in the USSR. He stressed the continuing importance of the nuclear data programme of the IAEA noticing still increasing requirements for more precise nuclear data not only in the field of nuclear energy but more and more also in non-energy applications.

V.N. Manokhin expressed the pleasure of the Centr po Jadernym Dannym for having the opportunity to host the meeting together with the two centers in Moscow. He introduced the meeting participants.

J.J. Schmidt was elected as chairman. The agenda was adopted with few modifications.

2. General items

2.1 Status reports

The participants presented the status reports given in the appendix. Some items arising in the discussions were included in these minutes under the appropriate agenda items in order to avoid duplication. Some additional items of interest follow:

CJD has a staff of 36, thereof 14 computer staff.

At TUD about 10 data requests per year are received from customers within the GDR. These requests are satisfied with the data files maintained at TUD.

CDFE receives per year about 300 requests for bibliographic information and 18 requests for numerical data.

I. Kondurov, Gatchina, gave a brief report on his NSDD activities. They finished the A=134 mass chain evaluation, A=133 and 180 are in progress. They contribute to and distribute ENSDF information. They are working on a special file for nuclear activation analysis.

CAJaD (see SR5) extended the compilation work to CPND from various countries. This was highly appreciated by the participants.

N. Tubbs (see SR2) emphasized the extended co-operation of the NEA-DB with non-OECD countries by extension of the evaluation newsletter NNDEN and by increased services of the Computer Program Library (CPL). He requested that there should be more input from non-OECD countries to the CPL.

In connection with the NDS report (SR3), it was requested to disseminate regularly early information on IAEA Meetings.

2.2 The meeting reviewed the actions and recommendations from the previous meeting, see INDC(NDS)-141. Some continuing actions were included in the new list of actions starting on page 23 of this document.

2.3 J.J. Schmidt reviewed some actions and recommendations resulting from the 13th INDC Meeting. In particular he announced the Agency's Advisory Group Meeting on Nuclear Standard Reference Data to be held in Geel, Belgium, in November 1984.

3. Policy discussions

Part of this agenda item was dealt with in a Discussion of Center Heads.

The main topics of the center heads' discussions concerned

- completeness and correctness of CINDA in order to publish in spring 1984 a high quality archival issue CINDA-B, requiring in particular an intensified workplan at CJD,
- speed and completeness of the EXFOR data transmission where some significant delays had been encountered,
- importance to improve the exchange and speedy release of evaluated data and of related computer codes.

For resulting actions and recommendations see page 23 and following pages. Additional parts of this agenda item were discussed in plenary, as follows.

3.4 Priorities of CPND and PhND compilation

a) CPND

J.J. Schmidt reported on an action requested by the INDC (see WP3 item 4) to analyze the user needs for compilations of CPND. This information is required by the INDC in order to estimate the impact to data users caused by the closing down of KaChaPaG and as justification to stimulate more CPND compilation.

The meeting considered the data needs for CPND and Photonuclear data as listed in INDC(NDS)-141 pages 75-77 (see WP14). All participants (except NEA-DB having no mandate for CPND) were asked to report to J.J. Schmidt as soon as possible about

- priorities of data needs
- completeness resp. incompleteness of existing data files
- estimate of resulting compilation workload required and whether this can be done by the existing centers or not.

See action 7.3.

F. Chukreev replied that of the items listed in WP14

- CPND for radioisotope production
- CPND for fusion, and
- CPND for neutron production

are considered as most important. He expresses concern that CPND compilation finds insufficient support in most countries, but that he is prepared to continue CPND compilation with widened scope as much as possible with the staff available. This is much appreciated by the meeting participants.

A. Hashizume reported that he is prepared to start Exfor compilation at RIKEN of CPND for the production of about 20 radioisotopes that he considers as most important. In addition, data for unwanted parallel RI production are needed to be compiled. After compilation of experimental data he plans data evaluation and to provide evaluated CPND in Exfor format. In contrast to the Study Group covering also differential data, RIKEN is interested in cross-sections and thick-target yields as function of projectile energy.

See actions 7.4 - 7.6.

F. Chukreev pointed out that there are some papers containing CPND and NND which should be compiled together by the same Exfor compiler. CAJaD has sent to CJD a tape with some neutron Exfor entries compiled from such papers. Action 6.6. It was agreed that for the time being CPND and NND compiled from the same paper, should not be transmitted in the same entry. Internally, of course, each center is free to decide what to do in addition to the agreed Exfor data transmission.

H. Lemmel reported about NDS activities on CPND compilation. Efforts to find a new CPND center in replacement of KaChaPaG had concentrated on FRG and Japan. A group at Cologne, FRG, had shown much interest but could not find financial support. More successful were the contacts with Japan. The meeting highly welcomed the participation of the RIKEN group and the presence of Dr. Hashizume at this meeting.

A. Ignatjuk stresses the importance of having proton-resonance data to be analyzed with NEA-DB computer codes used for neutron resonances. N. Tubbs confirms, but he is not sure whether there are enough proton-resonance data and sufficiently reliable data. (action 7.7)

F. Chukreev said that, according to a continuing action from previous meetings, (d,pf) and (t,df) data as required for neutron data evaluation, are compiled by CJD and CAJaD in co-operation. He was disappointed that there is no compilation manpower for these type of data in the other service areas, although these data are considered as important.

b.) PhND

See actions 8.1 - 8.8.

The 1979 Berman library could not be obtained by NNDC.

CDFE had no problems with the use of EXFOR for PhND. It was found regrettable that CDFE is the only center so far to compile PhND in a systematic manner. The main interest of CDFE is photon activation analysis, including photon activation cross-sections and spectra of secondary photons for identification of elements/isotopes. According to the data requests received from USSR institutes and universities, there is interest in data on (γ,γ'), (γ,n), (γ,p), (γ,α).

3.5 CPND bibliography

C. Dunford says that NNDC presently reviews the possibility of continuing the CPND Bibliography. It would be a supplement to the one discontinued in 1982 but produced in a different way: the "Nuclear Structure Reference" system has tags recently introduced by which retrievals for the bibliography of integral CPND are made possible. The meeting participants confirm that the Bibliography of integral CPND is an essential basis for the EXFOR compilation and encourage NNDC to continue. (Action 7.8)

3.7 Date and place of next NRDC Meeting

Continuing NRDC Meetings in intervals of 18 months, the next meeting would be in spring 1985 in Paris.

It was felt, however, that for the technical staff 18 months intervals are too long, and a meeting in Sept. 1984 in Vienna would be desirable. For center heads, who occasionally meet on other occasions, 2 year intervals may be sufficient.

See actions 1.12 - 1.14.

If the technical meeting is not possible, the old schedule should be maintained.

3.8 USSR publications

F. Chukreev reports that he has distributed the proceedings of all the All-Union Conferences since 1977. I. Kondurov is organizer of

these conferences. In view of the difficulties to obtain these proceedings in the Western countries, NDS and NNDC should send requests for proceedings to I. Kondurov. (Action 1.2)

It was noted that in USSR publications often the institute of the authors was missing, and CJD was asked to approach editors. (Action 1.3)

3.9 Planned meetings

See actions 1.9 - 1.11.

The next international nuclear data conference will be in Santa Fe, USA, 13-17 May 1985. M.K. Mehta, NDS, will be on the Advisory Committee to take care about participation from non-OECD countries.

N. Tubbs announces

- a NEANDC meeting on analysis codes for data reduction from transmission data, at a date not yet fixed
- a NEACRP meeting on the treatment of the resonance region in reactor calculations, perhaps in Jan. 1984
- The NEANDC meeting in Tokyo, March 1984
- in 1985 a meeting on optical model codes, the emphasis being influenced by JEF benchmarks.

F. Chukreev announces the annual nuclear spectroscopy conference in Alma Ata, April 1984.

V. Manokhin announces that the first volume of the 1983 Kiev conferences will be published in Nov. 1983, the last volume in March 1984.

4. EXFOR

See EXFOR Conclusions page 24
EXFOR Actions page 26
and WP6 page 73

4.3 Proton resonance data

The compilation in Exfor of proton resonance data had been recommended by the IAEA Advisory Group Meeting on Basic and Applied Problems of Nuclear Level Densities, BNL 11-15 April 1983 (see BNL-NCS-51694 p.25), for the purpose of obtaining level-density information required for neutron data evaluation. The 4 Centres had been urged to compile these proton resonance parameters so that they become accessible with similar ease and completeness as has been achieved for neutron resonance parameters in recent years.

This recommendation had been endorsed by the INDC at its 13th meeting, May 1983.

The neutron data centers, though presently not compiling such data, took note of this recommendation (see Exfor Conclusion no. 4.11).

The same level-densities meeting also requested compilation of (α,n) and (p,n) data for heavy nuclei (A above 70) and (p,α) and (α,p) data for higher nuclei, also energy and angular differential data of (p,n) and (α,n) reactions (see BNL-NCS-51694 p. 28-31), for the purpose of obtaining level-density information for neutron data evaluation.

5. Evaluated data

5.1 Status of ENDF/B formatted evaluations and related computer codes

V. Manokhin and A. Blokhin report on the progress on checking and correcting the Dresden silicon evaluation. CJD has implemented the code FIZCON and is implementing at Minsk and Dresden. On iron there is no newer version than that available at NDS. NDS should send to CJD the most uptodate versions of the codes CHECKER, FIZCON, PSYCHE.

C. Dunford reports that NNDC, though working on a CDC computer, tests the IBM version of the codes CHECKER, FIZCON, PSYCHE. They have a plotting code which could eventually be supplied for VERSATECH.

N. Tubbs reports on the JEF activities at the NEA Data Bank, see status report SR2.

CJD has FORTRAN4. FORTRAN77, which is quite different, is not available, so that CJD must modify codes received in FORTRAN77.

5.2 - 5.4 ENDF format

M. Nikolaev reported that the ENDF/B format was recognized as a good format, and that the USSR changed over from SOKRATOR format to ENDF/B format. Of the encountered difficulties many are pointed out in the format documentation ENDF-102 but without conclusions how to solve them. The main difficulty they had is the rule that the boundary between the resolved and unresolved resonance region must be the same for all l-states. They would prefer a formalism giving first the data for l=0, then for l=1 etc, though there would be other difficulties. As an interim solution they created artificial data for l=1. They have also used, artificially, three MAT numbers for U-238 s-wave, U-238 p-wave, and U-238 d-wave as separate "isotopes" of same abundance.

C. Dunford replied that this problem is solved in the US by introducing an artificial background cross-section to account for the missing p-wave part.

M. Nikolaev reported that Konshin recommends to use Reich-Moore parameters. C. Dunford replies that the format exists in ENDF/B but that, according to present procedure, this format should not be used because of the lack of corresponding computer codes. Whenever such codes become available, there will be a new situation.

It was concluded that, before introducing new format or procedures in ENDF/B, an estimate is required, how much more accurate data calculations would be. If an improved accuracy is not demonstrated, evaluators should be asked to bring their evaluations as accurately as possible into the agreed ENDF/B format.

D. Hermsdorf presented two papers on

- Recommendations for the use of formatting rules in ENDF format.
- Remarks on data of nuclear reactions induced by fast neutrons and their representation in the format ENDF.

Based on his experiences with the silicon evaluation he noted in particular:

- multiparticle reactions have insufficient possibilities for coding in ENDF format
- neutron-emission data cannot easily be coded in ENDF format
- for angular distributions of fast neutrons, the rules of file 6 should be re-activated to store energy-dependent Legendre coefficients
- charged-particles spectra from neutron-induced reactions are needed
- the ENDF formats and procedures manual requires editorial improvements

He requested an information system for news on the ENDF/B format and on related computer codes.

M. Nikolaev noted the following deficiencies:

- for U-238 more open channels are required in the unresolved energy region
- there seem to be some problems with the condition that all partial cross-sections must add up to the total cross-section throughout all energies
- the rules must be laid down for calculting the thermal cross-sections from the resonance-parameters

N. Tubbs reported that not all options of the ENDF format are used for JEF. In JEF parallel files are kept of pointwise data and resonance-parameter data.

F. Chukreev stated that it would be useful to include in ENDF charged-particle reaction data, in particular neutron-source data.

C. Dunford reported that the US Cross-Section Evaluation Working Group (CSEWG) will meet in May 1984 to decide upon ENDF format modifications to be adopted for ENDF/B-6. Changes will be adopted not on theoretical needs but only on the basis of strong arguments. Any change adopted has serious consequences in the ENDF computer codes.

M. Nikolaev agreed that the range of data to be included in ENDF/B should not be too wide. Reactor calculations should remain the primary purpose. ENDF/B is not really an exchange format but a format for data input into computer codes.

The meeting supported the INDC recommendation to have a specialists' meeting on the ENDF/B format. This meeting should be held in Vienna in the first week of April. Proposals should be submitted as early as possible so that they can be reviewed in time before the meeting.

5.5 Other evaluated data

J.J. Schmidt reported that the ARAMAKO file was used in many countries. NDS will send to CJD the ARAMAKO distribution list in order to stimulate the release of a more recent version of it. (Action 1.5)

6. Special matters on neutron data

6.1 - 6.4 CINDA

The improved format of the Supplement book (4C-3/266) was approved.

The schedule for the new archival issue CINDA-B (4C-3/259) was confirmed. The cutoff date between CINDA-A and CINDA-B will be optimized by NEA-DB.

On Cinda rules see CINDA conclusions and actions, page

For area 4 Cinda matters see appendix, WP9.

6.5 WRENDA

WRENDA 83/84 is in print. Further issues will be published in cycles of 4 years, according to an INDC recommendation (see report INDC-39).

6.6 - 6.9 Neutron data in EXFOR

See actions 6.1 - 6.11.

During the past year lack of manpower did not permit many completeness checks. A survey made by NNDC, see appendix WP7, indicated areas where completeness of compilation and speed of data transmission still require improvements. Attention is drawn to the graphical cross-section atlas for $\sigma(E)$ planned by NNDC, see action 6.1.

7. Topical Discussions

7.1 A. Ignatjuk: Level density models for nuclear data evaluations.

The Fermi-gas model being no longer sufficient, one must consider at least three effects: Shell effects, superconductivity effects, collective effects.

CJD will distribute the paper to meeting participants. (Action 1.4)

7.2 B. Kuzminov reported on recent nuclear data measurements for fast reactors and the evaluation of the experiments.

Measurements were done on the following facilities: 14-MeV neutron generators, 2.5 MeV cascade accelerator, 2 x 5 MeV Tandem accelerator, 5-MeV Van-de-Graaff, 2.5 MeV Van-de-Graaf.

7.3 A.I. Abramov reported on the measurements of (gamma,n) cross-sections on the microton.

7.4 A. Blokhin and A. Ignatjuk reported on comparisons of evaluations from different libraries.

8. Conclusions, Recommendations, Actions

These are structured as follows:

1. General actions
2. Conclusions about CINDA
3. Actions about CINDA
4. EXFOR conclusions
5. Actions about the EXFOR system
6. Actions about EXFOR neutron data
7. Actions about CPND
8. Actions about PhND
9. Actions about non-EXFOR data
10. Recommendations about evaluated data and codes

1. General actions

1.1	NDS	to check that all participants of this meeting receive copies of all papers presented
1.2	NDS NNDC	to send to I. Kondurov requests for unavailable proceedings of All-Union Conferences
1.3	CJD CAJaD	to ask USSR editors to quote the authors' institute in publications, in particular conference proceedings and Jadernye Konstanty
1.4	CJD	to distribute to participants A. Ignatjuk's paper on level density models
1.5	NDS	to send to CJD the distribution list of the ARAMAKO file in order to stimulate the release of a more uptodate version
1.6	NDS	to hold a meeting on the ENDF/B format in the first week of April
1.7	NND evaluators	to submit proposals for the ENDF/B format meeting
1.8	CAJaD	when issuing Jadernye Konstanty to indicate to NDS which articles should be translated into English (= action from Center Heads' Meeting)
1.9	NDS	to distribute regularly (e.g. all 6 months or when essential new information becomes available) a list of planned meetings in the field of nuclear data
1.10	All	to inform NDS regularly of planned meetings to be included in the list of above action
1.11	All	to send to the other centers (when appropriate through NDS) conference material whenever it becomes available (preprints of papers, proceedings, etc.)

1.12 NDS to hold a "technical NRDC meeting" in Vienna, at no cost to the Agency, at a tentative date 17-18 September 1984

1.13 All to inquire whether this proposed meeting is acceptable

1.14 NEA-DB to inquire to hold the next full NRDC Meeting in Paris, at a tentative date in October 1985, and to inform the other centers

2. Conclusions about CINDA

2.1 The quantity code POL is used for all polarization measurements on outgoing particles following scattering or any other reaction.

2.2 The quantity codes NG and SNG are clarified such that NG is used only for the (n,γ) total cross-section and the (n,γ) partial cross-sections leading to a metastable state. All other quantities referring to the (n,γ) reactions are coded under SNG.

2.3 The treatment of cross-section ratios is clarified as follows: If a ratio is relative to a quantity included in the EXFOR list of standards, no CINDA entry is made for the standard. If both (or none) of the reactions of the ratio are standards, CINDA entries are made for both reactions.

3. Actions about CINDA

3.1 NEA-DB to update the CINDA Manual with the clarified definitions of quantity codes POL, NG and SNG, and of cross-section ratios (compare conclusions 2.1-2.3)

3.2 CINDA Centers to support NDS in keeping the front matters in the CINDA books up-to-date, in particular to contribute regularly to the handbooks section

3.3 NEA-DB to optimize the cutoff criteria between CINDA-A and CINDA-B

3.4 CJD implement a plan to transfer Area 4 CINDA compilation activities currently being performed by NDS to CJD (action from Center Heads' Meeting)

4. EXFOR conclusions

4.1 The country code of Japan is changed to JPN. Compare Memo 4C-2/119.

4.2 "Vector COMMON" rules are confirmed to remain strict, in particular the rule that headings and units must be uniform for all independent variables under the "Vector COMMON" formalism.

4.3 Upon request of the Japanese Study Group codes for pions are introduced in Dictionaries 28 and 29 for REACTION SF2 and SF3:

PI pions, unspecified
PIP pions positive
PIN pions negative

4.4 The BIB Keyword INC-SOURCE is adopted instead of N-SOURCE starting with 1 January 1984. This applies to new transmission tapes; with respect to the master files held at the centers, each center may decide whether it keeps the old code or converts it throughout the file.

4.5 The proposed LEXFOR entries for Errors, Dosimetry Reactions, and Standards were adopted with minor modifications (compare Memo CP-C/102).

4.6 Bulky covariance matrices may have to be stored in a file separate from EXFOR. NNDC will formulate a proposal.

4.7 The NNDC proposal to code correlation factors in the form

ERR-ANALYS (ERR1,1.)

is adopted; NNDC will formulate a proposed Manual update.

4.8 The CAJaD proposal of Memo CP-A/31 concerning the sequence of General Quantity Modifier in REACTION SF8 is adopted.

4.9 The Lexfor entry on energy resolution was confirmed.

4.10 After discussion of working paper 6 about frequent mistakes found in EXFOR TRANS tapes, it was concluded that centers should possibly improve their check programs to avoid such erros. It was confirmed that the Multiple REACTION formalism must be used only in the cases mentioned in the Manual in Chapter 8 under REACTION.

4.11 It was recommended to compile in EXFOR proton resonance data as requested by neutron data evaluators. The neutron data centers, though presently not compiling such data, took note of this recommendation.

4.12 Tapes sent to CJD continue to require a dummy file of at least 100 records at the beginning of the tape.

4.13 CJD can accept a blocking factor up to 40. So can the other centers.

4.14 All centers now use 9-track tapes.

4.15 All centers should continue to attach outside labels to the tapes indicating contents and tape specifications.

4.16 CAJaD and NDS will transmit CPND data not only in the own series (A resp. D) but also revisions to B entries (previously KACHAPAG), but both centers should co-ordinate with each other to avoid duplications. NDS may also retransmit P entries (McGowan's file converted by KACHAPAG).

4.17 When data are retransmitted at subentry level, CAJaD and CJD continue to want to receive retransmissions of the entire entries. NDS will take care.

4.18 Item 2 on Manual page 9.8 ("1 file per tape") is dropped. But if there are more files on the tape this must be indicated clearly on the outside label.

4.19 It should be noted that the Lab and Ref Dictionaries in the CINDA books must not be used for compilation, because these are

- incomplete (they contain only the codes occurring in the book), and
- may contain superseded codes (if these still occur in the book).

5. Actions about the EXFOR system

5.1	NDS	to send to CJD updates of the EXFOR check program (in particular the procedure for the treatment of blanks in the record identification field)
5.2	NDS and NNDC	to check the status of improvements of Dictionary 3 (laboratories)
5.3	All	to contribute to the cleanup of Dictionary 3 (laboratories) and of the reference Dictionaries 5, 6, 7 and to keep them up-to-date
5.4	NDS	(= action 24 from previous meeting) to improve the wording in the EXFOR Manual about the use of REACTION-SF7 (particle considered) and to introduce examples for clarification
5.5	NDS	to send fast to CJD the presently existing parts of the code for producing the EXFOR computation format
5.6	NDS	to change in the Dictionaries the country code of Japan to JPN
5.7	NDS, NNDC, RIKEN	to obtain more information about other Japanese lab codes proposed:

2JPNINS (Inst. for Nucl. Studies, Tokyo Univ). The code INS is not free. Can it be included under the Tokyo University 2JPNTOK

2JPNISS (Inst. of Solid State Physics, Univ. of Tokyo).
- Should this be removed from the Dict. and included under 2JPNTOK

2JPNRCN (Research Center for Nuclear Physics, Osaka).
- The code is not free. Can it be included under 2JPNOSA (Osaka University)

5.8	NDS	to add pion codes to Dictionaries 28 and 29 (compare under EXFOR Conclusions)
5.9	NDS NNDC	to update Dictionary 2 and the Manual with respect to the changed BIB Keyword INC-SOURCE
5.10	NNDC	to update the Manual with the LEXFOR entries on Errors, Dosimetry Reactions, and Standards
5.11	NNDC	to formulate a proposal on bulky covariance files to be stored separate from EXFOR
5.12	NNDC	to formulate a proposal on the coding of correlation factors under ERR-ANALYSIS
5.13	NNDC	to update the Manual in Chapter 8 under REACTION SF8 according to Memo CP-A/31 about the sequence of General Quantity Modifiers
5.14	NNDC	to update Chapter 9 of the Manual according to EXFOR Conclusions 4.12-18
5.15	NDS	to send to CJD information and codes on the EXFOR computational format, even if still incomplete

6. Actions about EXFOR neutron data

6.1	NNDC NEA-DB NDS CJD	to compile with high priority neutron cross-section data $\sigma(E)$ for inclusion in the NNDC atlas, with special emphasis to - best experimental data - most recent experimental data even when old - the only existing data for a specific reaction or energy range
6.2	NNDC	to inform the other neutron data centers about "gaps" encountered in EXFOR
6.3	NDS	to inform TUD whether or not their EXFOR tape (mailed in May 1983) has arrived (Note by editor: Action fulfilled. The tape was misrouted within Agency and found after the NRDC meeting; it must have arrived in Sept. 1983)
6.4	NDS	to retransmit entry 30395 observing the uniformity of independent variables under "Vector COMMON"
6.5	All	to observe the correct use of the Multiple Reaction formalism; in particular, not to code average resonance parameters in the same subentry together with energy dependent resonance parameters

6.6	CJD	to transmit the neutron EXFOR entries compiled by CAJaD from papers that contain CPND and NND
6.7	NND Centers	to correct and re-transmit fast those EXFOR entries where retransmission was requested by a receiving center (Memo 4C-3/268 and others)
6.8	CJD	to continue to convert the EXFOR-8 series into EXFOR-4 series (though with lower priority than the compilation and transmission of new data)

(Following actions from Center Heads' Meeting):

6.9	CJD	review papers presented by NNDC and NDS concerning the status of CINDA and EXFOR compilation at CJD and distribute response as a 4-C Memo, as soon as possible
6.10	NDS NEA-DB CJD	inform NNDC on plans for the review of EXFOR completeness, as soon as possible
6.11	All Neutron Centers	give priority to the compilation of fission product yield data

7. Actions about CPND

7.1	CAJaD	when requesting data from US or Europe send copies of letters to NNDC or NDS who will assist in obtaining the data
7.2	All	(= action 36 of previous meeting) to review references for those charged-particle reactions that have equivalent neutron fission reactions such as (d, pf) and (t,df), and to compile them in EXFOR
7.3	All (except NEA-DB)	re WP 14 to report to J.J. Schmidt about - priorities of CPND and PhND data needs, - encountered completeness or incompleteness of data files - estimate of resulting compilation workload required and whether this can be done by the existing center or not
7.4	RIKEN	to announce the list of CPND reactions they intend to compile in EXFOR (Note by editor: see addendum to Status Report SR8)
7.5	NDS or CAJaD	to retrieve these data from EXFOR and send them to RIKEN (Note by editor: done)
7.6	RIKEN	to check the retrieved EXFOR data for completeness and fill the gaps, in order to have an uptodate data basis for data evaluation

7.7	CPND Centers an/or NND Centers	to possibly compile proton resonance data to be used for neutron data evaluation, and to investigate whether the accuracy of proton resonance data is sufficient for this purpose
7.8	NNDC	to possibly continue the Bibliography on integral CPND and to keep the others informed
7.9	NDS, NNDC, RIKEN	to assist CAJaD to obtain non-USSR data to be compiled in EXFOR
7.10	NDS	to contact H. Munzel about updating the EXFOR-B file

8. Actions about PhND

8.1	NNDC	(= action 23 from previous meeting) to try to obtain the 1977 Berman library of photonuclear data in any format (even Xeroxes of paper material)
8.2	NNDC	to inquire about US and Canadian activities in the field of photonuclear data and photon activation analysis, and to report to CDFE and other centers interested
8.3	NDS	to check whether the TRANS tapes G001 and G002 were transmitted to CAJaD
8.4	CDFE	to issue a list of institutes in the world that are active in the field of PhND (Note by editor: action fulfilled during meeting)
8.5	NDS	to add Prof. Ishkhanov to appropriate distributions of INDC documents, in particular - INDC Minutes - NDS reports to INDC - list of INDC documents (Note by editor: distr. "L, N, U assigned")
8.6	NDS	to observe developments on PhND activities and to inform CDFE
8.7	NNDC	to send to CDFE (Prof. Ishkhanov) regularly in printed form a retrieval from NSR (same retrieval as used to be sent to Fuller)
8.8	NDS and NNDC	to establish a distribution list for the PhND Bibliography phy by CDFE; the distribution would probably best be done through NDS to whom CDFE would provide a sufficient number of copies

9. Actions about non-EXFOR data

9.1	NDS	to check the tape 3050 from CJD which should contain in file 2 a file of 620-group data (Note by editor: file was found)
9.2	CJD	to re-transmit the tape with 620-group data (Note by editor: not needed)
9.3	CJD	to provide immediately to the other centers information about their GRUKON program package (which is considered as a valuable independent test compared to the RECENT/NJOY program package)
9.4	CJD	to transmit as soon as possible in 1984 to IAEA the neutron data processing code GRUKON and corresponding documentation
9.5	All	(= action 29 from previous meeting) to test the effect of particular interpolations chosen for cross-sections between the nuclear and the Coulomb threshold on calculated spectrum average cross-sections
9.6	NDS	to send to CJD most recent versions of CHECKER, FIZKON, PSYCHE

(Following actions from Center Heads' Meeting):

9.7	CJD	include a detailed reference list when submitting neutron data evaluation progress reports for inclusion in the NEA-DB Newsletter NNDEN
9.8	NDS	give priority to the translation of documents in the Russian language referenced in NEA-DB Newsletter NNDEN
9.9	CJD/ CAJaD	when publishing documentation of nuclear data evaluations make sure to include a reference to the numerical data file which includes these evaluated data

10. Recommendations about evaluated data and codes

10.1 Recommendations from Center Heads' Meeting: All evaluated nuclear data files exchanged should be accompanied by adequate documentation.

10.2 There should be more input from non-OECD countries to the Computer Program Library CPL of the NEA Data Bank.

SR1

National Nuclear Data Center
Status Report to the
Seventh Nuclear Reaction Data Centers Meeting
October 17-21, 1983

I. General

Since the last meeting of the Nuclear Reaction Data Centers in May 1982, two new part-time nuclear structure evaluators have been added to the staff. In addition, we have two visiting scientists from the People's Republic of China who will remain at the center for about one year working on nuclear structure evaluation. We hope to be able to add some additional staff in the neutron data area by the end of the year.

We have installed a VAX-11/780 with 2 megabytes of memory, an RP07 disk drive (456 megabytes), a TU 78 magnetic tape drive (125 ips, 1600/6250 BPI) and 8 terminal ports. The system will be released to the users in January 1984 and will run in parallel with the DECsystem-10 already in use. Equipment diagrams for the NNDC computer systems are attached. In the coming year we will be acquiring DISSPLA, VAX-11 DBMS and DATATRIEVE for the VAX and FORTRA-77 capabilities on both machines. The Vector Automation Interactive Graphics Terminal has become operational and a plotting system to be used in the production of the BNL-325 book of curves has been implemented.

II. WRENDA

The biennial review and updating of the U.S. Nuclear Data Request List was completed in January 1983. Future reviews will be made on a four-year cycle, although this does not preclude the inclusion of a few new requests in the mid-review period.

III. Bibliographies

The normal CINDA and NSR activity has continued. Three supplements and one cumulative issue of Recent References have been published since May 1983.

The Nuclear Structure Reference file has been incorporated into the RECON bibliographic retrieval system. The complete library was transmitted in December 1982 and updates are sent every 4 months.

The input procedures for NSR have been modified to identify integral charged particle data so that it is now possible to produce the index from the NSR library. There is a gap in coverage of about one year between the termination of the Charged Particle Bibliography and the entry into NSR. We hope to add the missing data to the NSR Library in the coming year.

The CINDA data exchange with NEA-DB has proceeded normally. In order to help insure that the NNDC and NEA-DB CINDA libraries remain identical, a comparison of the two libraries was done at NNDC and some differences were encountered. As a result, a complete reload was done by NNDC of the non-NNDC entries from the NEA-DB Library. NEA-DB will reload the NNDC entries early next year.

A CINDA index was prepared for the 1983 DOE-NDC Progress Report and f.. the IAEA Advisory Group Meeting on Basic and Applied Problems of Nuclear Level Densities.

IV. Data Libraries

In the periods from May 1982 through September 1983, 35 neutron data transmission tapes (TRANS 1135-1169) were sent containing 123 new data sets and numerous corrected data sets.

The conversion of the Area 1 entries to the REACTION formalism is expected to be completed by the end of the year. A comparison has been made between the 80000 series SCISRS-1 conversion data and data transmitted from Area 4. Data which were not identified as having been transmitted were converted to REACTION format and sent to CJD.

The new dictionary DBMS system was completed and is now in use for all CSISRS library codes.

A new checking code was written which handles format and code checking, but does not yet include consistancy checking.

Most of the coding for the new library system (based on the REACTION format) is completed. It will be implemented when the conversion to REACTION formalism is completed.

V. Evaluated Nuclear Reaction Data

Revision 2 to ENDF/B-V was released during the first half of 1983. The revision contained new evaluations for ^{7}Li and the W isotopes, ^{85}Rb, ^{87}Rb, ^{107}Ag and ^{109}Ag and revisions to 35 materials (14 major requiring review). The ENDF processing codes have been upgraded to Revision 2 formats and distributed.

Due to funding reductions, the schedule for production of ENDF/B-VI has slipped. Present plans call for the completion of the "standards" in the fall of 1984 and the completion of ENDF/B-VI in the fall of 1986.

The NNDC will continue to have responsibility for the production of ENDF/B-VI and for the evaluations for the materials ^{197}Au, ^{235}U, Ni and Cr.

VI. Nuclear Structure Data

T. W. Burrows conducted a three-week training session for nuclear data evaluators in the People's Republic of China which was attended by 15 scientists from various institutions throughout China.

NNDC has continued publishing the Nuclear Data Sheets and issues through Volume 38, number 3 have been sent to Academic Press.

VII. Customer Services

On-line retrievals from the CINDA and CSISRS data bases were initiated with Knoll's Atomic Power Laboratory to facilitate production of the Chart of the Nuclides.

The request statistics for January 1, 1982 through June 30, 1983 are attached.

VIII. Publications

The forth edition of "Neutron Cross Sections" Vol. 1, Part B, Resonance Parameters for Z=61-100, will be issued by the end of this year. Work on Volume II (Book of Curves) is expected to begin in early 1984.

The Proceedings of the IAEA Advisory Group Meeting on Basic and Applied Problems of Nuclear Level Densities is in press and should be issued at the end of October.

IX. Future Meetings

"Nuclear Data for Basic and Applied Science" May 13-17, 1985, Santa Fe, New Mexico.

Request Statistics
TABLE I

1 JANUARY 1982 to 1 JULY 1983
AREA 1

NUMBER OF REQUESTS FOR DATA AND OTHER INFORMATION*

Requestor	Experimental Neutron and Charge Particle Data	Evaluated Neutron and Charge Particle Data	Bibliographic Neutron and Charge Particle Information	All Programs	All Documents	TOTAL
USA-Government Agencies	81	48	10	19	111	269
USA-Educational Institutions	15	15	3	4	54	91
USA-Industry	39	47	3	6	120	215
Canada	1	3	0	0	5	9
Foreign (except Canada)	---	---	---	15	126	141
TOTAL	136	113	16	44	416	725

REQUEST STATISTICS
TABLE II

1 JANUARY 1982 TO 1 JULY 1983
AREA 1

REGULAR DISTRIBUTION OF DATA AND INFORMATION

A. Experimental Neutron Data: 28 Tapes (TRANS 1135 to 1162)

B. Evaluated Neutron Data: 2 Tapes - Gas Production File (ENDF/B-V Tape 533)
- ENDF Utility Programs (ENDF/B-V Tape 831)

C. Bibliographic Neutron Information: 17 Tapes - CINDA COVERAGE (C019 TO C037)

D. Bibliographic Charge Particle Information: 1 Tape - (Version 9/82)
Final Issue

*This page does not include regular distributions, see Table II.

Request Statistics

TABLE III

1 Jan. 1982 to 31 Dec. 1982

AREA 1

EXPERIMENTAL NEUTRON DATA

ELEMENT	TOTAL (TOT)	ELAS. SCAT. (EL)	INEL. SCAT. (INL)	OTHER SCAT. C/S	RES. PAR. (RES)	GAMMA & NEUTRON EMISSION (NG)	CHARGED PARTICLE EMISSION (NX)	FISSION (NF)	OTHER	TOTAL REQUES
1-H	12	13	0	8	0	2	0	0	2	37
2-He	8	10	5	6	1	8	8	0	4	50
3-Li	6	4	7	5	14	10	32	0	4	82
4-Be	1	1	2	0	0	3	4	0	0	11
5-B	6	5	3	8	15	9	28	0	14	88
6-C	10	6	2	3	0	2	15	0	0	38
7-N	0	0	0	0	0	0	5	0	0	5
8-O	3	3	3	6	14	5	16	0	2	52
9-F	1	0	0	0	0	1	3	0	0	5
10-Ne	0	0	0	0	0	0	1	0	0	1
11-Na	0	1	5	0	0	6	7	0	0	19
12-Mg	0	0	0	1	0	0	11	0	0	12
13-Al	0	0	3	0	0	3	20	0	1	27
14-Si	0	0	0	0	0	0	2	0	0	2
15-P	0	0	0	0	0	2	2	0	0	4
16-S	0	0	0	0	0	0	2	0	0	2
17-Cl	1	0	0	0	0	2	2	0	0	5
18-Ar	0	0	0	0	0	0	1	0	0	1
19-K	0	0	0	0	0	0	8	0	0	8
20-Ca	0	0	0	0	0	0	7	0	0	7
21-Sc	0	0	0	0	0	0	2	0	0	2
22-Ti	0	0	0	0	0	0	11	0	0	11
23-V	0	0	0	0	0	5	5	0	0	10
24-Cr	0	0	0	1	0	7	18	0	0	26
25-Mn	0	0	0	1	0	11	4	0	0	16
26-Fe	1	4	9	4	0	11	56	0	0	85
27-Co	0	0	0	0	0	6	3	0	0	9
28-Ni	2	2	0	4	2	7	25	0	2	44

TABLE III (Cont'd.)

ELEMENT	TOTAL (TOT)	ELAS. SCAT. (EL)	INEL. SCAT. (INL)	OTHER SCAT. C/S	RES. PAR. (RES)	GAMMA & NEUTRON EMISSION (NG)	CHARGED PARTICLE EMISSION (NX)	FISSION (NF)	OTHER	TOTAL REQUES
29-Cu	7	7	12	6	22	47	53	0	9	163
30-Zn	0	0	0	0	0	0	10	0	0	10
31-Ga	0	0	0	0	0	2	5	0	0	7
32-Ge	3	2	11	2	1	21	28	0	2	70
33-As	0	0	0	0	0	2	2	0	0	4
34-Se	1	5	5	0	0	0	4	0	0	15
35-Br	0	0	0	0	0	5	5	0	0	10
36-Kr	0	0	0	0	0	0	1	0	0	1
37-Rb	0	0	0	0	0	1	4	0	0	5
38-Sr	0	0	0	0	0	2	4	0	0	6
39-Y	0	0	0	0	0	4	2	0	0	6
40-Zr	0	0	0	0	0	5	12	0	0	17
41-Nb	0	1	0	1	0	1	3	0	0	6
42-Mo	0	0	0	0	0	11	8	0	0	19
43-Tc	0	0	0	0	0	1	3	0	0	4
44-Ru	0	0	0	0	0	6	4	0	0	10
45-Rh	0	0	0	0	0	2	8	0	0	10
46-Pd	0	0	0	0	0	5	6	0	0	11
47-Ag	6	6	6	8	42	27	36	0	4	135
48-Cd	17	18	12	12	102	32	40	0	10	243
49-In	4	6	8	8	34	17	23	0	4	104
50-Sn	0	3	2	0	0	0	4	0	0	9
51-Sb	0	0	0	0	0	6	0	0	0	6
52-Te	0	0	0	0	0	0	8	0	0	8
53-I	0	0	1	0	0	1	2	0	0	4
54-Xe	0	0	0	0	0	7	3	0	0	10
55-Cs	0	0	0	0	0	2	6	0	0	8
56-Ba	0	0	0	0	0	9	1	0	0	10
57-La	0	0	0	0	0	6	2	0	0	8
58-Ce	0	0	0	0	0	5	3	0	0	8
59-Pr	0	0	0	0	0	4	2	0	0	6
60-Nd	0	0	0	0	0	13	6	0	0	19

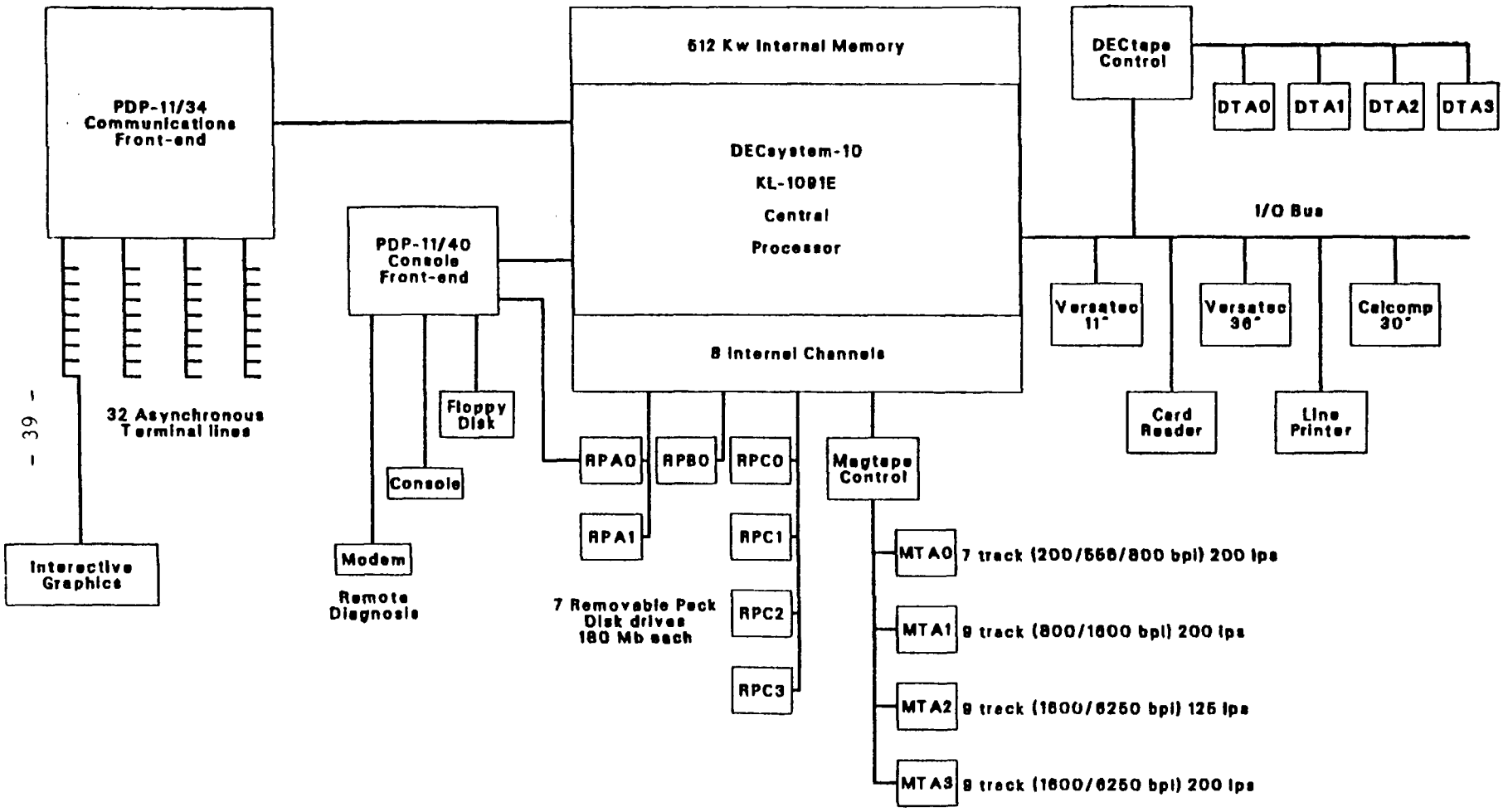
TABLE III (Cont'd.)

ELEMENT	TOTAL (TOT)	ELAS. SCAT. (EL)	INEL. SCAT. (INL)	OTHER SCAT C/S	RES. PAR. (RES)	GAMMA & NEUTRON EMISSION (NG)	CHARGED PARTICLE EMISSION (NX)	FISSION (NF)	OTHER	TOTAL REQUE
61-Pm	0	0	0	0	0	1	0	0	0	1
62-Sm	0	0	0	0	0	11	5	0	0	16
63-Eu	0	0	0	0	0	5	2	0	0	7
64-Gd	12	17	2	6	76	43	27	0	9	192
65-Tb	0	0	0	0	2	1	2	0	0	5
66-Dy	0	0	0	0	0	2	5	0	0	7
67-Ho	1	2	1	3	4	4	6	0	3	24
68-Er	0	0	0	0	2	0	2	0	0	4
69-Tm	3	3	1	1	6	7	3	0	1	25
70-Yb	0	0	0	0	0	0	4	0	0	4
71-Lu	0	0	0	0	0	0	2	0	0	2
72-Hf	14	14	8	14	18	24	8	0	24	124
73-Ta	0	0	0	0	0	1	4	0	0	5
74-W	0	0	0	0	0	2	4	0	0	6
75-Re	0	0	0	0	0	0	2	0	0	2
76-Os	1	0	0	0	0	0	2	0	0	3
77-Ir	2	2	1	0	6	6	3	0	1	21
78-Pt	0	0	0	0	0	0	2	0	0	2
79-Au	0	0	0	0	0	21	7	0	3	31
80-Hg	0	0	0	0	0	2	3	0	0	5
81-Te	0	0	2	0	0	6	12	0	0	20
82-Pb	1	2	9	0	7	9	22	1	2	53
83-Bi	1	1	1	1	7	1	4	1	2	19
88-Ra	0	0	0	0	0	0	1	0	0	1
89-Ac	0	1	1	0	0	1	0	0	0	3
90-Th	1	0	0	0	0	3	1	5	0	10
91-Pa	1	1	1	2	0	0	0	1	2	8
92-U-000	0	0	0	0	0	0	0	0	0	0
92-U-230	0	0	0	0	0	0	0	0	0	0
92-U-231	0	0	0	0	0	0	0	0	0	0
92-U-232	0	0	0	0	0	0	0	0	0	0
92-U-233	1	0	0	1	0	0	1	9	3	15

TABLE III (Cont'd.)

ELEMENT	TOTAL (TOT)	ELAS. SCAT. (EL)	INEL. SCAT. (INL)	OTHER SCAT. C/S	RES. PAR. (RES)	GAMMA & NEUTRON EMISSION (NG)	CHARGED PARTICLE EMISSION (NX)	FISSION (NF)	OTHER	TOTAL REQUEST
92-U-234	0	0	0	0	0	0	0	2	0	2
92-U-235	1	1	1	0	1	2	1	39	2	48
92-U-236	0	0	0	0	0	1	0	2	0	3
92-U-237	0	0	0	0	0	2	0	2	0	4
92-U-238	2	1	2	0	1	8	2	22	0	38
92-U-oxi	0	0	0	0	0	0	0	0	0	0
92-U-239	0	0	0	0	0	0	0	0	0	0
93-Np	1	1	0	1	6	6	1	6	1	23
94-Pu-000	0	0	0	0	0	0	0	0	0	0
94-Pu-238	0	0	0	0	0	1	0	0	0	[illegible]
94-Pu-239	5	5	4	1	2	7	5	27	8	64
94-Pu-240	0	0	0	0	0	2	0	6	0	8
94-Pu-241	0	0	0	0	0	3	0	9	1	13
94-Pu-242	1	0	0	0	0	3	1	6	0	11
94-Pu-243	0	0	0	0	0	0	0	0	0	0
94-Pu-244	0	0	0	0	0	1	0	3	0	4
94-Pu-245	0	0	0	0	0	0	0	0	0	0
95-Am	1	0	0	0	0	8	0	20	0	29
96-Cm	0	0	0	0	0	10	0	20	0	30
97-Bk	0	0	0	0	0	1	0	0	0	1
98-Cf	0	0	0	0	0	7	0	16	2	25
99-Es	0	0	0	0	0	2	0	1	0	3
100-Fm	0	0	0	0	0	0	0	2	0	[illegible]
TOTAL	138	148	130	114	385	558	740	200	122	2,5[illegible]

National Nuclear Data Center
Computer System

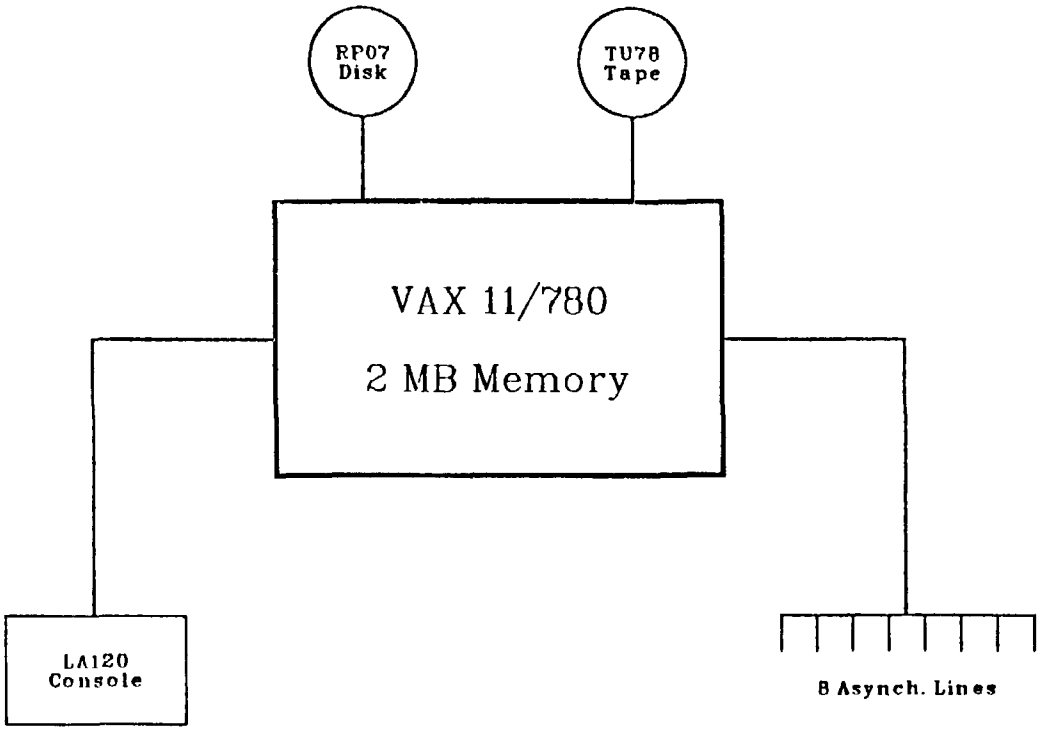


Brookhaven National Laboratory
Upton, N.Y. 11973

January, 1983

NNDC
VAX 11/780

Site Configuration



August, 1983

SR2

ORGANISATION FOR ECONOMIC
CO-OPERATION AND DEVELOPMENT

12th October, 1983.

NUCLEAR ENERGY AGENCY

NEA DATA BANK PROGRESS REPORT

Submitted to the 7th Meeting of

NUCLEAR REACTION DATA CENTRES

I. INTRODUCTION

The Data Bank has over the past eighteen months had a full workload, very well focused on its three main objectives : computer program testing and distribution, compilation of experimental and evaluated neutron data, and the Joint Evaluated File project (JEF).

During this period, the JEF-1 starter file increased in size from 70 to 297 nuclides, and work started on the first (and simpler) benchmark test calculations for fast neutron spectra. Computer program testing continued at a normal level, with an increase in the number of packages sent out to requesters in non-OECD countries. Data compilation and customer service effort has remained approximately constant over the last three years, though the September 1982 Antwerp Conference resulted in a higher proportion of new data among those compiled in these last twelve months.

II. NUCLEAR DATA SERVICES

Experimental data compilation and CINDA

The flow of neutron data for compilation was strongly affected by the September 1982 Antwerp International Conference on Nuclear Data for Science and Technology. Most of the new data available in the Data Bank service area which had not yet been presented was presented at that meeting: all the available data from the Conference have now been compiled, leaving only those papers for which no reply was received to our request for further information and data. Approximately 75 new EXFOR works were transmitted to the other neutron data centres, with about 50 retransmitted data sets.

The EXFOR Data Base contains data from some 5600 "works" corresponding to about 35,000 different nuclear quantity measurements. The number of new "works" added worldwide is expected to be about 250 for the year 1983. The only clear trend to be seen in the Data Bank Member countries is a strong interest in evaluation of data, as expressed in the JEF project.

The CINDA file has for some years shown a net growth of approximately 10,000 entries per year, and has now reached 190,000 entries. The 1982 Antwerp Conference itself generated about 850 new CINDA entries. It is now intended to prepare a third archival volume in 1984, covering a five- or six-year period beginning in 1977. Revision work for the Data Bank's service area will concentrate on the grouping together of different references to the same experiment, and on improving CINDA's usefulness as an Index to the EXFOR file.

The Data Bank prepared entries from its service area for the 1983-1984 issue of WRENDA: here again the level of activity was high. Out of a current total of 640 requests from Data Bank Member countries, 54 were new and 220 had been modified in some way.

Evaluated nuclear data files

Release of complete new data files has been somewhat slower than originally planned in the laboratories concerned, but all the major new files received in full for inclusion in the disc-based retrieval system: ENDL-82, JENDL-2 and KEDAK-4. The Data Bank has however received all the individual evaluations selected for inclusion in JEF, and has also received from Harwell and Winfrith the "thinned-out" files of pointwise data in ENDF-B/V format, based on IAEA's recalculation with the revised RECENT program of these data for ENDF-B/IV.

Translation of KEDAK data selected for inclusion in JEF was made with the help of ENEA Bologna, who provided the KTOE code and carried out a number of calculations in cooperation with Data Bank physicists.

Joint Evaluated File (JEF) project

The Steering Committee for Nuclear Energy gave its approval in October 1981 for the one-year pilot project which resulted in the production of the current JEF-1 file containing data for 275 nuclides, during 1982. In October 1982 the Steering Committee approved a three-year second phase project for the benchmark testing of JEF-1 and the assembly of a JEF-2 file, revised and including new evaluations in the light of the results obtained in testing JEF-1.

The main source of uncertainty in starting benchmarking work for 1983 has been the accuracy of resonance representation by the different versions of the processing codes for ENDF/B-IV and V data. A comparative study organized by IAEA Nuclear Data Section has done much towards removing the major discrepancies between the different codes available to the Data Bank.

A first stage set of calculations for the Karlsruhe zero-dimensional benchmarks, and for the simple one-dimensional benchmarks recommended by the JEF Scientific Coordination Group, have given encouraging results. These calculations will be continued.

Customer service for neutron data

During 1982 (January to December) 176 requests, equally divided between experimental and evaluated data, were answered for 97 requestors. This figure represents about one request per working day, a level which has held over the past ten years except for a peak in 1978-1979 at the time when some parts of ENDF/B-V were being released outside the United States. Requests are carefully defined in order to eliminate irrelevant data sets, but nevertheless 5 1/2 million logical data records were sent out over this year. Besides these data, which were mostly retrieved from the data bases or copied from magnetic tapes, 50 group cross-section libraries for various applications were distributed. Plots of data requested can be supplied from the VERSATEC plotter installed during the year, and in particular comparisons of experimental and evaluated data. Use of this service has been growing only slowing among general requestors so far, although the plotting facilities has been heavily used in preparing for specialists' meetings and in preparing data for review in the JEF project.

About 130 requests for data were filled in the first nine months of 1983.

Charged particle and nuclear structure data

The modest service offered on nuclear structure data, with copies of the Evaluated Nuclear Structure Data File (ENSDF) and its retrieval programs held on the CISI computer system for the benefit of network users, with alternatively the possibility of making requests directly to the Data Bank, has generated a small number of requests for data to be sent out from the Data Bank, plus regular use by the two French groups concerned of the retrieval programs through CISINET. The program for plotting detailed level schemes has been implemented, and is fairly well used. Several requests were answered for charged particle cross-section data.

III. COMPUTER PROGRAM SERVICE

In routine program testing, 108 programs were master-filed in 1982, while 1135 program packages were sent out in answer to requests. 246 of these went to non-OECD countries, a slight increase on 1981. The proportion of programs already tested at the time the request for them was received continued to rise, and has now reached 80% : this figure is probably the result of improved information about the programs available, and the new series of program abstract publications was completed by the issue of a third volume (programs received from the Radiation Shielding Information Centre, Oak Ridge).

IV. BENCHMARK TESTING OF COMPUTER CODES AND DATA

1. Nuclear model code intercomparisons

A preliminary report on the first exercise in this comparison (coupled channel calculation for U^{238}) compared only the results obtained with different versions of the JUPITOR code. A more recent analysis includes comparisons also with ECIS-79, CHUCK-2 and CCROT/CCVIB, which give generally good agreement.

The analysis of the spherical optical and statistical model exercise on Co^{59} is now complete and is being distributed as NEANDC-152"A"/INDC(NEA)4 and to participants. Pre-equilibrium conditions were included in some participants' submissions to this problem, but were not discussed in the present report. A supplementary exercise on the charged particle optical model is being distributed to participants, since this may help resolve some ambiguity in the choice of parameters for the charged particle reaction channels in the statistical model.

Specifications for the exercise on pre-equilibrium models were sent out in February 1983 to participants in the previous exercises, and it is hoped to receive results by the end of the year.

2. Nuclear data processing codes

The two major series of codes for transforming evaluated data in ENDF/B formats into a point-by-point representation and thence into group cross-sections have been subject to considerable revisions over the past twelve months, while in parallel a benchmark exercise organised by IAEA Nuclear Data Section is verifying the performance of different codes used for the successive steps in this process. The validity of the NJOY system is particularly important to the Data Bank because this system is presently being used for the production of the pointwise representation of the cross-sections in the resonance region in the point-by-point version of the JEF file.

Two members of Data Bank staff have contributed to this benchmark, in particular with calculations of 620-group cross-section sets for ENDF/B-V dosimetry data using the IBM version of NJOY.

3. The determination of average resonance parameters

This benchmark was carried out with two successive sets of resonance parameters. After the first exercise had shown unexpectedly large discrepancies, both between different codes, and between each code and the correct solution, a second exercise was broken down into linked problems of increasing complexity in order to help isolate the inadequacies in the codes used.

Following a workshop, and a "blind" test in which a new member of the Data Bank staff followed the authors' documentation to the bitter end, the report on the study was published as NEANDC-160-U (Data Bank Newsletter No. 27).

V. PUBLICATIONS DURING 1982 AND THE FIRST PART OF 1983

Regular issues of CINDA (prepared at NEA Data Bank for publication by IAEA), News from NEA Data Bank, the Neutron Nuclear Data Evaluation Newsletter, and two issues of the Newsletter/Bulletin were distributed in 1982, with one more in 1983 and another in preparation.

Two important occasional publications were distributed :

- The fully revised RSIC (Radiation Shielding Information Center, Oak Ridge, USA) computer program abstracts, with first supplements to the full collection (both US and NEA-IAEA) and a KWOC index.

- The proceedings of the November 1982 NEANDC Specialists' Meeting on Fast Neutron Scattering on Actinide Nuclei.

The full set of three volumes of Computer Program Abstracts (NESC, NEA/IAEA and RSIC) was made available on microfiche, while the same abstracts were made available on magnetic tape to several centres.

SR3

NDS Status Report to the 1983 NRDC Meeting
H.D. Lemmel, October 1983

1. Staff, budget, programme

The staff of the IAEA Nuclear Data Section (NDS) as of October 1983 is shown on the next page. During the past 18 months, there were only few changes.
N. Kocherov was replaced by V. Piksaikin from FEI Obninsk, USSR. D. Gandarias-Cruz from Cuba joined the Section working as the main Exfor data compiler, filling the post that was vacant after N. Dayday left the Section. M. Mehta from BARC Trombay (previously INDC member from India) joined the Section working primarily on research contracts and research coordination in developing countries. He filled the post that was vacant after R. Langley had left.

The difficult budget situation of the Agency continued. For the time being it seems that the nuclear data programme can be continued at zero growth. But a longterm prediction is hardly possible. The number of requests and the volume of requests received from developing countries continue to increase, though there may be some fluctuations. This depends, on the one side, on the development of nuclear data related programs in the developing countries, and on the other side on the rate that new data files become available. The People's Republic of China has become a member of the IAEA, and this will bring additional workload to the Section in both, data compilation and the data centre services.

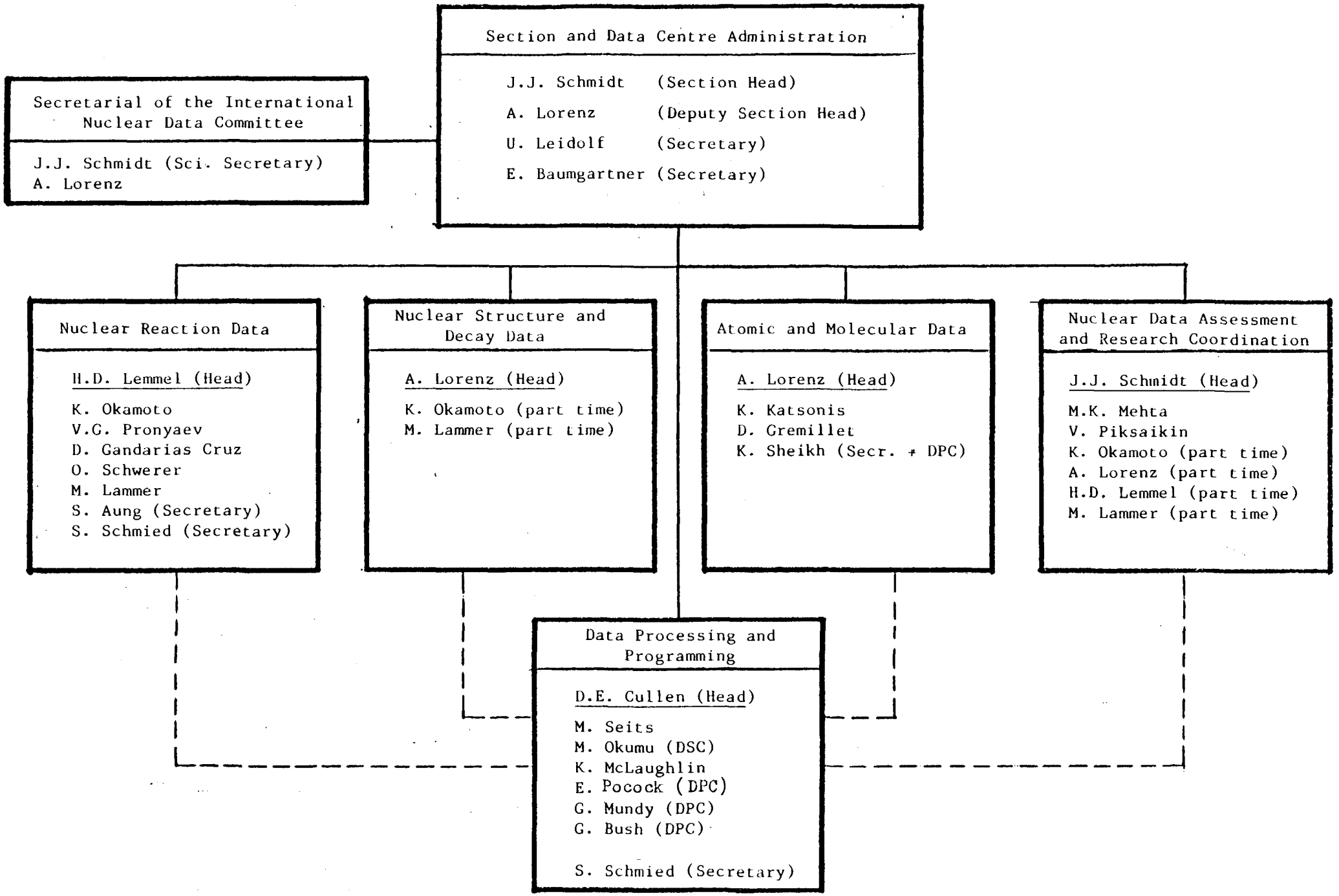
2. CINDA work at NDS (ML)

The coverage of journals is now satisfactory, although the subscription to some journal titles was cancelled by the IAEA library for budgetary reasons. However, co-operation with other libraries together with abstracting and indexing services ensures the current awareness of CINDA-relevant publications for NDS. The coverage of reports depends on delays in availability of reports (full size of microfiche), but CINDA-relevant papers are usually not missed. Greater emphasis is given to blocking and cleanup for the 1984 archival issue.

More than half of the CINDA work at NDS (not considering CINDA book production) is spent on area 4 entries. This is mainly due to the fact that CJD does not maintain its own CINDA file. Therefore all assignment of block-numbers for new entries, reblocking and revisions of old entries is done by NDS, the judgement of literature comprising the same work involving frequently the consultation of original Russian literature at the library. Literature coverage by CJD and coding of CINDA entries requires improvements to be discussed separately.

The revised book production introduced with CINDA82 has proven to be successful, saving a week time in the preparation until final publication. Another innovation - the shortened format for the CINDA supplement - will be implemented for the 83Supplement in the form outlined in memos 4C-3/263 and 4C-3/266.

ORGANIZATION CHART OF THE NUCLEAR DATA SECTION AS OF OCTOBER 1983



3. The EXFOR System

The EXFOR rules remained stable and the new formalisms for the coding of uncertainties and correlations did not create any problems.

The formal correctness of the EXFOR transmission tapes continued to improve though some further improvements are essential (they will be discussed separately).

The main problem remains the completeness of compilation and delays in the shipment of magnetic tapes, particularly with area 4.

The efforts to gain additional data centers for the EXFOR cooperation, were partly unsuccessful, partly successful. There was some hope that the work by Kachapag could be continued elsewhere in the Fed. Rep. of Germany. There was active interest at the Institut für Radiochemie at the University of Köln (Cologne), however we just heard that this institute is likely to be closed down.

In Japan we had intensified contacts with the "Study group" which transmitted two trial Exfor tapes with charged-particle nuclear data, mostly differential. These contacts will be further intensified.

We welcome particularly that a new Japanese group from RIKEN is represented at this meeting for the first time in order to join the Exfor cooperation in the field of production cross-sections for radioisotopes for biomedical purposes.

3.1 EXFOR TRANS tapes received (OS)

The latest TRANS tapes received from NNDC, NEA-DB, CJD and CAJaD are 1168, 2094, 4048 and A010, respectively. We continued to inform the originating center of the mistakes detected by our check program. The correcting of incoming TRANS tapes still absorbs some manpower, and further improvements of EXFOR check programs at all centers are a matter of priority. A summary of frequently occurring errors where NDS asks for modification of the respective centre's check program is given in a separate Working Paper. Another working paper lists the pending retransmissions requested by NDS.

NDS used to distribute corrected versions of Area 4 TRANS tapes to the other centres. The number of errors found in the last 3 tapes received recently, TRANS 4046 through 4048, was however so small that we see no need to continue this practice. We should like to congratulate CJD for this improvement. With TRANS 4048 we had a problem in reading the tape, which means that an entire block of records of subentry 40059.002 is missing in our master file. Therefore we ask CJD to retransmit to NDS this subentry (or the entire tape TRANS 4048, whatever is easier).

3.2 EXFOR/CINDA Dictionaries (OS)

Since May 1982, 8 dictionary updates and 3 transmissions of the entire

dictionary file have been made; the latest transmission (TRANS 9046) from October 1983 is in the mail at the the time of the present meeting. Dictionary 27 (Nuclides), 36 (Quantity, Reaction SF5-SF8) and 7 (Books and Conferences) were updated most frequently. An important progress was the obsoletion of the keywords of the ISO-QUANT family. Separately from the regular dictionary updates, NDS prepared a draft version of the new dictionary 7 (introduction of short expansions for books and conferences, as agreed at the last NRDC meeting) and sent it to NNDC for comments.

4. EXFOR Compilation (KO, DG)

4.1 EXFOR 3 Series: experimental neutron data area 3

During the period May 1982 to September 1983, 38 new EXFOR entries were transmitted originating from the following countries:

China (People's Republic)	7
India	6
Morocco	5
Hungary	4
Australia	2
Czechoslovakia	2
Pakistan	2
Yugoslavia	2
Bangladesh	1
Egypt	1
German Democratic Republic	1
Iraq	1
Romania	1
South Africa	1
Saudi Arabia	1
Taiwan	1
	38

The somewhat low number of compilation is due to temporary shortage of manpower and to training of a new compiler. Considerable efforts were devoted to many retransmitted entries, due to corrections of the large volume of Lucas Heights capture data, and due to additional publications or authors' comments after the first compilation. The revision of several entries with more than 18 data columns to the accepted maximum of 18 was finished but absorbed more manpower than anticipated.

Some backlog exists for

- fission product yield data
- clean up of old data, in particular from India
- about 10 Chinese works, where numerical values have been requested from the authors

After the People's Republic of China becoming an IAEA member state, it is expected that Chinese data will become available faster.

4.2 EXFOR V-Series: evaluated neutron nuclear data

NDS continues to compile selected important evaluated neutron data in the EXFOR V-Series, if such data are not convenient for compilation in ENDF/B format. Due to shortage of manpower and other assigned duties, however, there was no entry for the V-series in the past 1.5 year period.

4.3 EXFOR D-Series: charged-particle nuclear reaction data (CPND)

A remarkable result during this period was the EXFOR compilation of many numerical data (including private communications) on the $^{7}Li(p,n)$ reaction, which had been originally collected by H. Liskien, CBNM. The resulting entries are D0031 to D0041. Similar compilation work will continue as workload permits.

NDS also compiled CPND data for radioisotope production for medical purposes in 5 EXFOR entries. We are looking forward that this work will be continued by the RIKEN group, Japan.

4.4 EXFOR G-Series: photonuclear data

The second EXFOR-G entry (G0002) was compiled by NDS. This is photo-fission and photoneutron cross section for Np-237, a topic covered by CINDA. Neutron capture gamma rays with energies between 5.4 and 10.8 MeV were used as the incident gamma rays. Due to manpower restrictions, the compilation of photonuclear data has low priority.

4.5 EXFOR P-Series: McGowan's CPX file

Kachapag received McGowan's old CPX file, selected those data that were still useful, checked these data against publications, and converted them to the KACHAPAG internal format for publication in the "Physics Data" handbook. This file was converted by NDS to EXFOR format. Unfortunately, it could not yet be transmitted because we are still working on correcting some mistakes that we found in the data.

5. Evaluated data

The topic of ENDF/B format compilation and checking had been treated extensively at the last NRDC Meeting in Vienna. Since then the ENDF/B checking capabilities were improved by operating the code FIZCON and by improved graphical plotting facilities. The 1983/84 versions of the INDL

files will not include many new evaluations but many revisions to earlier evaluations. The main subfiles of INDL are

INDL/V - various evaluations
IRDF - dosimetry reactions
INDL/A - actinides
INDL/F - fusion reactions for INTOR

A continuing problem concerns those evaluated data that cannot be coded in the ENDF/B format for different reasons:

- data at high neutron energies
- data with Reich-Moore parameters
- the new Livermore library
- the need for having a joint format for neutron data and charged-particle data as required for some special purpose data files.

6. WRENDA (VPi)

WRENDA 83/84 is being published with some delay because of late receipt of KFK requests. Meanwhile the updated WRENDA master file has been produced. The edited format for publication and several special listings of modified, satisfied, or withdrawn requests are being prepared.

7. Publications

7.1 Fission Product Nuclear Data (FPND) (ML)

Issues 8 and 9 of the annually published report series "Progress in Fission Product Nuclear Data" were distributed as INDC(NDS)-130 (1982) and INDC(NDS)-143 (1983).

Issue 8 contained 166 pages of contributions and a total of 186 pages. Due to a cleanup of contributions, the size of issue 9 was reduced to 151 pages of contributions and a total of 172 pages. The number of countries contributing to the progress report has increased from 12 in the first issue (1975) to 30 in the 8th issue, the number of institutes from 32 (1975) to 100 (9th issue).

The 10th issue is envisaged to be published in July 1984. Circulars asking for contributions will be sent out in April 1984.

7.2 Handbook on Nuclear Data for Safeguards (ML)

NDS, with support from the Department of Safeguards of the IAEA, is planning to issue a handbook on nuclear data for safeguards. This handbook should contain sets of "best" evaluated nuclear data together with carefully assessed uncertainties, currently available from international nuclear data files.

Only such data will be included that are used or will be used in nuclear materials safeguards. If required, some non-nuclear microscopic as well as macroscopic data may also be included, if such data are available. In order to define the contents and scope of the handbook, a questionnaire together with a tentative list of data was sent out to safeguards experts in several IAEA member countries.

After collection of the replies the data to be included in the planned handbook will be defined and experts will be asked to recommend the best presently available files or tables containing the requested data. The data adopted will then be collected in the form of a computerized data base for the production of the handbook.

The main potential users of this planned handbook are scientists working on the development of safeguards methods and analyzing and evaluating safeguards data.

7.3 Standards

A handbook containing the INDC/NEANDC standard reference file is in print.

7.4 Nuclear Activation Data Handbook

The Nuclear Activation Data Handbook, a successor to the handbook published in 1974, is in progress and scheduled to be printed in 1984.

7.5 INDC reports

Please refer to the document INDC(SEC)-85 giving an index to all INDC reports. They continue to include progress reports from various countries, reports of NDS meetings, translations into English from selected USSR publications, and some original works from the NDS service area.

8. Customer Services

The services of NDS are advertised to its customers by the "IAEA Nuclear Data Newsletter" of which about 2000 copies are distributed about twice a year in intervals that depend on the rate at which important new material is received at NDS. Attached to the Newsletter is a return postcard by which data, reports or other information can be requested.

In order to improve the data services offered to NDS customers, the receipt of new data files or updates to older files, initiates a search of the standing requests filed in the computerized Request Log, resulting in the despatch of the new data to the requestor.

Documentation reports, issued in the IAEA Nuclear Data Services report series (with report code IAEA-NDS-...), which describe the format and content of data files, are now available for all data files kept at NDS. These reports, kept up-to-date and continuously improved, are sent together with the date files requested from NDS.

Data retrievals in the EXFOR, ENDF/B and some other formats are available in "standard format" for computer processing, or in "edited format" for easy reading, either on tape or in the form of listings. Graphical computer plots can also be provided. These services are provided primarily to the NDS service area.

9. Data Request and Dissemination Statistics

During 1982, NDS has received 713 requests, which amounts to approximately three requests per working day. For the definition of a "request" the reader is referred to report INDC(NDS)-124, p.18.

Averaged over the years 1980, 1981 and 1982, NDS received an annual average of 588 requests. Of these:

9.9 % were for experimental data
25.2 % were for evaluated data
7.6 % were for data processing programs, and
57.3 % were for reports.

With regard to request origin,

7.0 % originated in area 1 (USA and Canada)
20.6 % originated in area 2 (Western Europe and Japan)
67.3 % originated in area 3 (NDS service area)
5.1 % originated in area 4 (USSR).

Request statistics for each of the considered categories, and statistics showing the total number of requests handled by NDS for each of the last 18 years are given in Table I. Figure 1 shows the request statistics since 1965 in terms of number of requests per year averaged over 3 year periods (i.e., the number for 1982 is the annual average over the years 1980, 1981 and 1982).

Data dissemination statistics show what NDS has sent out as a result of requests received; numerical data are normally quantified in terms of "data sets".

A "data set" is defined as a set of numerical data of a given type for a given nuclide in a given energy range which resulted from a specific data measurement or evaluation. For evaluated data, a data set comprises all data given under one "MAT" number in a given evaluated data library; for EXFOR, a data set comprises all data combined in an EXFOR sub-entry (excluding the first BIB subentry). Averaged over the years until 1979, and considering both experimental and evaluated data, a data set comprises an average of 184 data points or data records which would represent a typical data set. As shown on Figure 2, the number of nuclear data sets distributed per year (including experimental and evaluated data) has increased exponentially during the last 18 years.

Table I

Data Request and Distribution Statistics 1965 - 1982

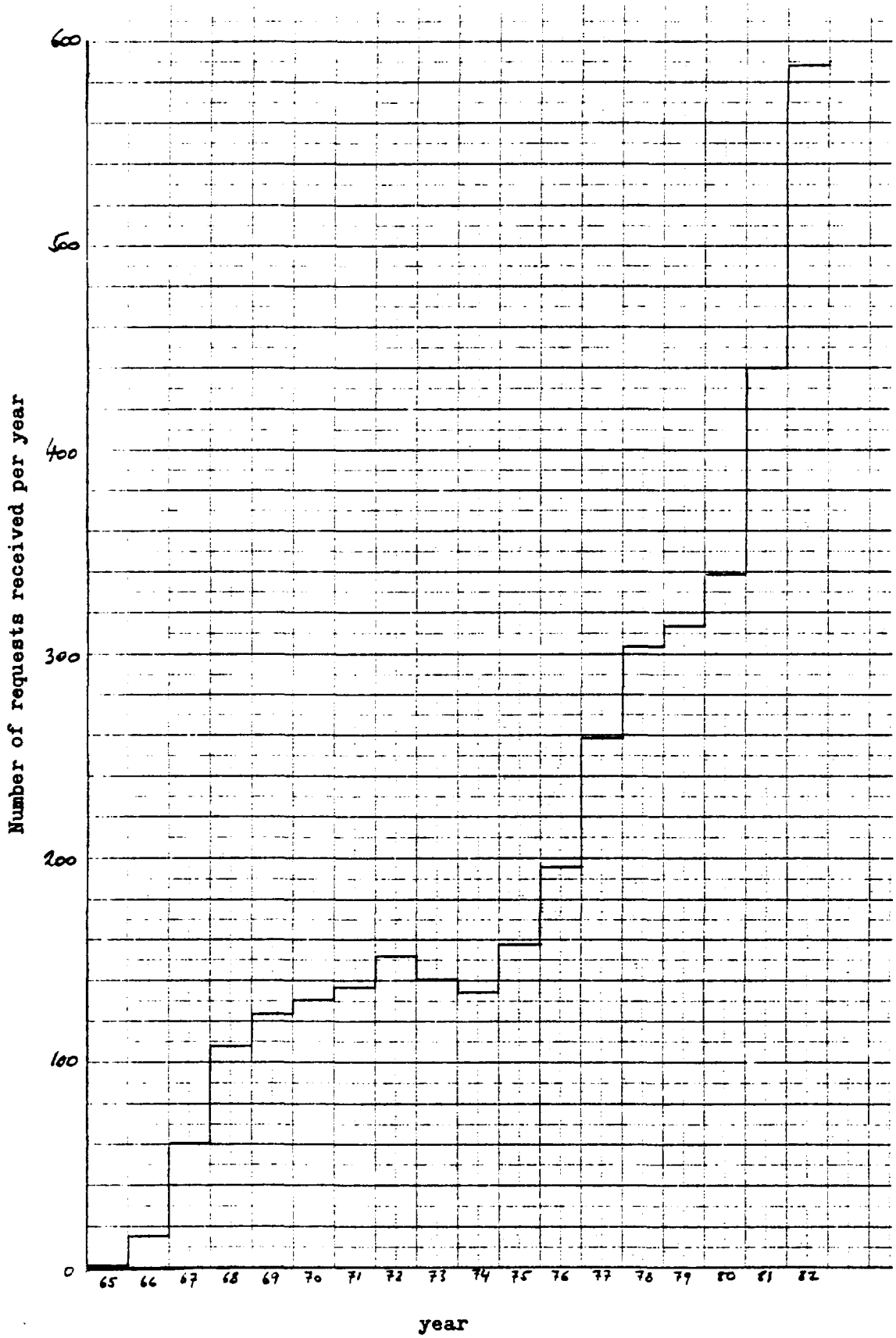
Year	Request Statistics (Number of Requests)							
	Experimental Data	Evaluated Data	Experimental and Evaluated Data	Documents	Other*	Totals per year	Totals (Averaged over 3 years)	Totals Cumulative
1965	3	-	3	-	-	3	1	3
1966	40	-	40	-	5	45	16	48
1967	118	-	118	9	8	135	61	183
1968	119	-	119	16	9	144	108	327
1969	48	15	63	25	5	93	124	420
1970	95	20	115	34	8	157	131	577
1971	76	33	109	43	8	160	137	737
1972	48	23	71	60	8	139	152	876
1973	43	22	65	54	6	125	141	1 001
1974	49	24	73	61	6	140	135	1 141
1975	43	49	92	114	3	209	158	1 350
1976	34	43	77	153	9	239	196	1 589
1977	45	49	94	232	3	329	259	1 918
1978	62	71	133	193	17	343	304	2 261
1979	63	93	156	95	18	269	314	2 530
1980	40	86	128	239	42	407	339	2 937
1981	59	185	244	369	31	644	440	3 581
1982	76	174	250	403	60	713	588	4 294

* Since 1978 this category contains exclusively data processing computer programs, all other, including bibliographies, are included under documents.

Figure 1

Nuclear Data Request Statistics

(each step represents a 3-year average)



The dissemination statistics for data, data processing codes and reports sent out during 1981 and 1982 are given in Table II.

Table II

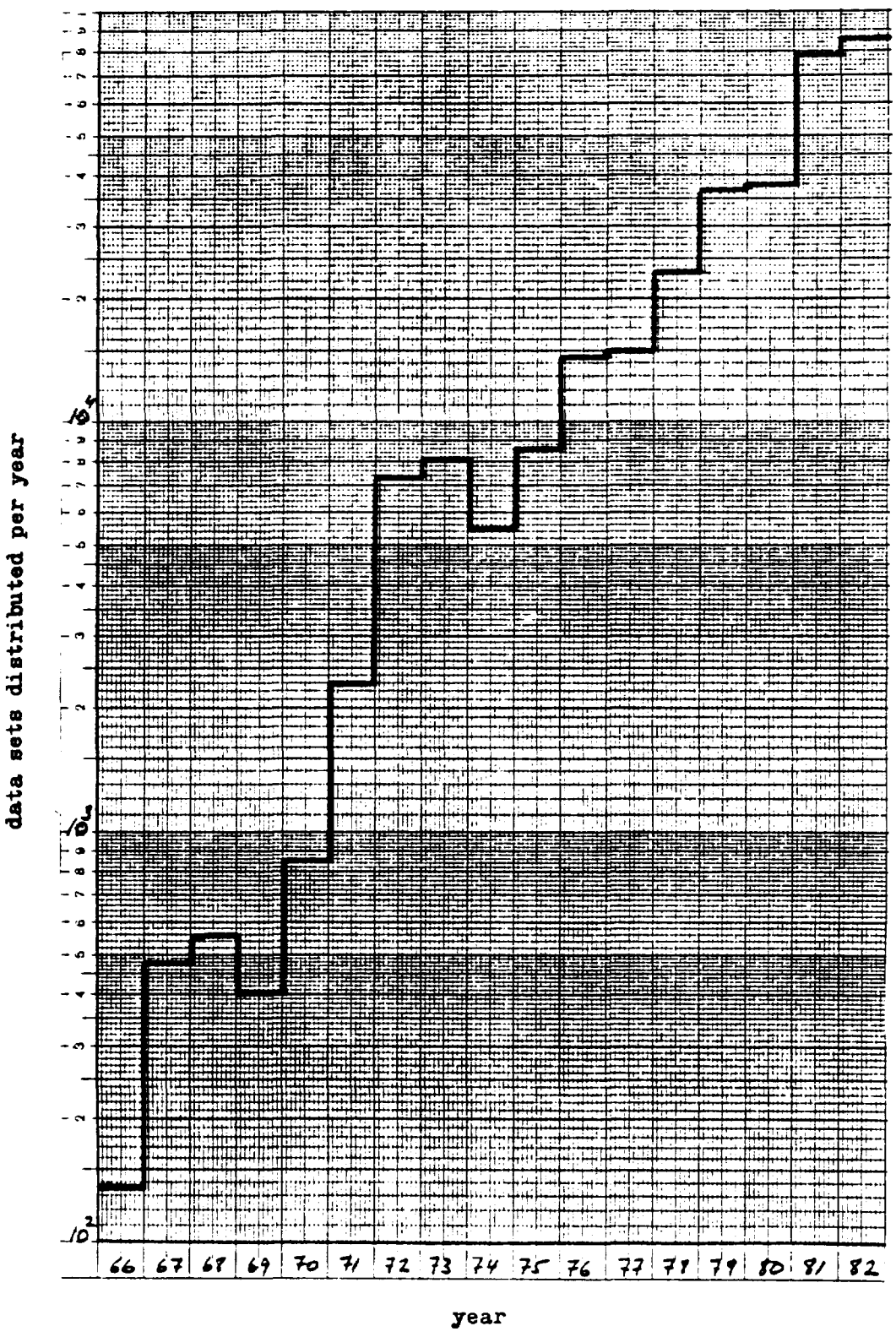
Dissemination of numerical data, data processing programs, reports and tapes: Statistics for 1982

Sets of experimental nuclear reaction data (EXFOR subentries)	59 052
Sets of evaluated nuclear data	25 200
Total number of data sets (Experimental + Evaluated)	84 252
Dispatch of complete (non-EXFOR) data libraries	25
Dispatch of data processing computer programs	340
Total number of tapes dispatched to send (above) data and programs	230
Number of individual reports sent on request	734
Number of reports sent on distributions* (bulk shipment)	13 970

* Reports sent on distribution consist of INDC reports which are issued in the course of the year by NDS or Member States; during 1982, 64 individual INDC reports were distributed by IAEA/NDS.

Figure 2

Numerical Data Sets Distributed per Year
(including experimental and evaluated data)



10. Programming and Systems Development

10.1 General

This period has been a time of consolidation and improvement under the present Agency policy of "zero growth" budget, coupled with the ever increasing size of the nuclear data libraries and number of requests from users for nuclear data. The only way in which it will be possible to maintain the quality of the data libraries and promptly respond to data requests will be by increased efficiency in the utilization of computer equipment.

In line with the above remarks, in an attempt to minimize the amount of manual data checking by NDS physicists, the data checking programs for evaluated data (in the ENDF/B format), EXFOR, CINDA and WRENDA have been significantly updated to improve automatic error detection. In addition, graphic output has been extensively used to detect errors in evaluated data. Work on the computation format for experimental data has continued and graphic output of experimental data will be available in the near future to allow error detection. In order to minimize the amount of effort and response time to answer data requests, the index files to the experimental and evaluated data files have been improved.

10.2 EXFOR Programming

The current EXFOR file maintenance programs, used to update the library and retrieve data from the library, may be considered up-to-date and require only a minimum of maintenance. The EXFOR checking program has been significantly improved to automate error detection. Work on the computation format has continued with the aim of developing a program support package to allow tabular and graphical presentation of a variety of experimental data, all in a common, comparable set of units.

10.3 Request and Dissemination Log System

The Request Log is designed to monitor the arrival of requests at NDS and the processing of requests through NDS, in order to insure that each request is answered promptly. The Dissemination Log is designed to monitor the flow of information out of NDS. Together, the request and dissemination logs allow us to determine what types of information are required by our users, and to quantify the output from our centre (see statistics under Section D.4.).

During this period the request and dissemination log system was improved to simplify use and improve the types of statistics that may be obtained from the system, e.g., request patterns by isotope, type of data, reaction.

10.4 WRENDA

The WRENDA file maintenance program system is essentially complete; minor improvements were introduced during this period, in particular

concerning retrieval criteria and output sort orders. The WRENDA checking program was updated in order to improve error detection.

10.5 The Data Index System

Instead of searching the large numerical data files maintained by NDS, many requests can be more economically satisfied by searching relatively small data index files in order to determine which data satisfy a given request. A Data Index System which indexes all of NDS's data files is being implemented. At present entries into the Data Index System are performed automatically for all EXFOR data when a TRANS tape is merged into our EXFOR master file.

For EXFOR data it is possible to retrieve data by reaction, author, institute, energy range, etc. In the case of evaluated data, retrievals are currently performed in two steps: retrieval of whole evaluations using the Data Index System, and selective retrieval by reaction using specially designed retrieval programmes. The index system is currently being extended to automate the handling of evaluated data, particularly those evaluations in the ENDF/B format.

10.6 Profile System

NDS maintains a PROFILE system, consisting of a computerized file of the names, addresses and the areas of interest for each of the centre's correspondents. Areas of interest are described by the use of one or more distribution/interest codes. This file is used routinely to produce reports, to selectively retrieve address lists, or print address labels for the mailing of publications and correspondence. During this period the PROFILE system has been extensively modified in order to improve the flexibility of the use of the address field.

There are currently 5 300 names and addresses stored in the PROFILE system master file; last year approximately 600 names were added, and about 200 corrections and/or changes per month were made.

10.7 CINDA Programming

The system of CINDA programs that are operational at NDS is used to check new or revised entries, retrieve from the master library and produce the CINDA book. Production of the CINDA book requires two steps: format conversion to a form that is acceptable to the photo-type-setting process, followed by the actual photo-type-setting. This system of computer programs has remained rather stable over the years and only minor improvements were done to improve error detection.

10.8 Evaluated Data Processing

The growing number of evaluated data libraries (e.g. UKNDL, KEDAK, ENDF/B etc.) requires that a growing number of programs be maintained and operated at NDS in order to allow for file maintenance, retrieval, checking, and correction of evaluated data. In addition, in order to allow the evaluated data to be used by our customers, the data handling programs are distributed with the data.

In order to avoid duplication of effort, programs developed at other data centres are adopted for use at NDS whenever possible. At present NDS maintains and distributes to customers only elementary file handling programs. All requests for more complex programs, such as multigroup processors, are referred to the IAEA Liaison Officer at the NEA Data Bank.

During this period additional computer programs were implemented at NDS in order to allow the introduction of procedures to improve the reliability of the evaluated data which are disseminated by NDS. In particular, format and physics checking codes in conjunction with graphic output have been used to significantly improve the evaluated data files. When minor problems are encountered, the format or data can be corrected on line. When major problems are encountered, they are reported to the originating evaluator or data center.

C J D PROGRESS REPORT

1. Since May 1982 CJD has transmitted into other centres the magnetic tapes with TRANS 4044 - 4048 containing 52 new entries and 14 corrected entries. The total number of the transmitted entries is 582.

2. In 1982 the work on putting into operation the programmes checking EXFOR format has been completed. The programmes were received from Nuclear Data Section and adapted to the computer EC 1033. That required to do some changes in programmes because of differencies in programming languages and computers, to write additional subroutines. The TRANS 4046 - 4048 have been checked using the programmes mentioned. The checking programmes gave us possibility to begin the checking and correction of the whole area 4 EXFOR library. For the time being the entries with code REACTION are in process of correction.

3. In CJD the following programmes were put into operation and are used for the work with data files in ENDF/B format:CHECKER-5, FIZCON, PSYCHE, CRECT, DICTION, MERGER, PRINP, PRINTE, SUMRIZ, CATALOG, RESEND, (LINEAR + RECENT), GROUPIE, SIGMA 1, INTER.

A short report about the functions of these programmes will be published in the nearest issue of "Jadernye konstanty".

The programmes for the production of group constants GRUCON (FEI), NJOY and RECENT are also put into operation and the comparison of the results obtained by means of these programmes was made. The essential differencies in results are not discovered.

4. The CINDA on magnetic tape is used to retrieve information. The program was written for this purpose.

5. In FEI the work on the evaluation of fission product capture cross section has been completed (for about 30 isotopes). The results of this work are presented to the Conference on Neutron Physics, in Kiev (1983), and also published (Partially) in "Jadernye Konstanty" (1, (50), 1983).

The reevaluation of the cross sections for natural Cr and Cr isotopes was done. The data are in process of putting on magnetic tape and checking. We suppose to complete this work early next year.

The results of the evaluation of neutron inelastic scattering cross sections of Cr and the comparison of these results with the ENDF/B data are published in "Jadernye konstanty" (4 (48), 1982).

CJD continues the work on the analysis of available evaluated nuclear data files. The objective of this activity is to develop proposals for improving files and to give recommendations on the use of files in evaluated data libraries. The great attention was paid to analysis of data files for the actinide and fission product isotopes, some structural materials and dosimetry reaction data. The results of this analysis should be useful for development of international evaluated data libraries.

6. Developing evaluation methods CJD paid a great attention to the method of simulteneous discription of level density, fission cross section and excitation functions of (n,xn) - reactions. The direct process contribution to the spectra of neutron inelastic scattering was thoroughly investigated.

7. The WRENDA - 81/82 requests from USSR have been revised and approved for the next edition. CJD supposes that the more certain definition of required accuracy should be made in all WRENDA requests as it was done in Usachev's requests.

8. After the last meeting the collections VANT, series "Jadernye Constanty" NN 46 - 53 and the Handbook "The threshold reaction cross sections induced by neutrons" (Energoizdat, 1982) were published.

L84-21568
Translated from Russian

SURVEY OF WORK BY CAJaD */ ON THE COLLECTION AND DISSEMINATION OF CHARGED PARTICLE NUCLEAR DATA

(Brief report to the Seventh Conference of CPND Centres)

G.M. Zhuravleva, N.V. Timofeeva,
and F.E. Chukreev

This review covers the period from May 1982 to October 1983.

1. Over this period CAJaD prepared and fed into the nuclear data center network magnetic tapes A008, A009 and A010 containing numerical data from 57 publications both by Soviet and foreign scientists.

2. The vast majority of these 57 publications dealt with the measurement of reactions of importance to controlled thermonuclear fusion and the preparation of radioisotopes.

3. The changeover to the compilation of both Soviet and foreign research data presented CAJaD with new problems that had not existed before. As you know, when compiling Soviet research data we aim at acquainting the authors of the articles with the prepared compilation and at pointing out inaccuracies that are both the fault of the compiler or the authors themselves and the publishers. When preparing data from Soviet authors for magnetic tape recordings we try to ask the authors for further details of the experiment and to clarify its accuracy. Almost all our attempts to obtain information of this kind from foreign groups have proved fruitless. Our requests go unanswered. The only group which has replied to us is Michel's group at Cologne University.

4. Broadening of the scope of our compilation activities has brought to light another fact that is new to us - we have discovered that a large number of different measurement units are used in articles by foreign authors. For example, for thin targets use is made of the normal cross-section (m barns or μ barns); yields ($Ci/\mu a \cdot h \cdot g/cm^2$) and ($Ci/\mu a \cdot h \cdot MeV$) and so on. This variation in unit systems not only hampers the work of making recordings on magnetic tape, but what is more important, it creates difficulties in subsequently applying the data in practice. The Nuclear Data Section would do well to take upon itself

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*/ USSR Nuclear Structure and Nuclear Reaction Data Center.

the task of addressing the editors of the relevant journals and the referees and drawing their attention to the unnecessary "variety" of units of measurement. The Section's authority is quite considerable and its proposals are always given attention, so it is to be hoped that this initiative on its part would be valuable.

5. Over the period under consideration CAJaD answered roughly 80 nuclear data inquiries.

(signed)

CDFE INFORMATION.

V.V.Varlamov, B.S.Ishkhanov, V.V.Surgutanov, A.P.Chernyaev.

Since early in 1982 till mid 1983 the Centre for Photonuclear Experiments Data of the Institute of Nuclear Physics of Moscow State University (CDFE) has carried out the following tasks:

1. The magnetic tape M003 including EXFOR-data from 20 papers of Soviet authors has been prepared and handed over to the IAEA funds (through CAJaD of the USSR State Committee on the Use of Atomic Energy).

2. The Index "Photonuclear Data 1976-1980", containing systematized information on experimental photonuclear papers published during these 5 years in the periodic scientific journals in the USSR and abroad, has been completed.

3. A regular issue of the annual CDFE Information Bulletin N 5 "Photonuclear Data - 1981" has been published and distributed, the preparation for publication of Bulletin N 6 "Photonuclear Data - 1982" completed.

4. Within the framework of the program of preparation of thematic reviews of photonuclear data, the Information Review on the photofission of heavy nuclei has been prepared; the Review examines the present-day situation with the yields and cross sections for the reactions of photo- and electrofission, the ahgular, energy, mass, and charge distributions of fission fragments, the characteristics of fission neutrons, the properties of spontaneously fissioning isomers.

Digital data from 165 papers published during 1952 - 1982 in the USSR and abroad have been tabulated and recorded on the magnetic tape in the EXFOR.

5. In collaboration with the Centre for Nuclear Data of the Leningrad Institute of Nuclear Physics of the USSR Academy of Sciences, the software for operation with international file of bibliographic information on nuclear structure NSR has been adapted to the Unified Series computer of CDFE.

6. The software has been developed for operation with the data recorded in the formats: EXFOR, ENSDF, NSR, and BIB (the internal format of CDFE).

7. A magnetic tape has been prepared which contains data on the characteristics of radionuclides produsedin the photonuclear reactions. It is intended for the automatic information provision

for studies in the field of the γ-activation analysis. The tape contains the information on the energies of γ-transitions, types of reactions in which radionuclides are formed, their halflifes, etc. The adopted format and the developed software make it possible to find, from certain given parameters (or ranges of their variation) other parameters, thus significantly facilitating the identification of experimental γ-spectra and raising the efficiency of the elemental and multielemental analyses.

8. In the last period CDFE has met about 300 requests for bibliographic information, information bulletins issued by the Centre and about 80 requests for digital data recorded in the various formats.

SR7

Status Report 1983 of activities in NRD done at
Technical University of Dresden, Section of Physics (TUD)

In TUD Neutron Nuclear Data are treated for the purposes of

(i) dissemination within GDR
(ii) evaluation in co-operation with FEI Obninsk, USSR
(iii) compilation of experimental data measured in GDR

Summarizing all activities in these fields, the following has been done

(i) - assistance for customers of NND within GDR (about 10 requests/year)

- implementation of ENDF/B processing codes (LINEAR, RECENT, GROUPI) originated by D.E. Cullen

(ii) - evaluation of Si has been finished; methods and results are published in reports INDC(GDR)-20/L and 22/L respectively

- numerical data are available on magnetic tape

- start of evaluation of NND for Pb; first results are published in a contribution to the Kiev Conference, 1983

- implementation of ENDF/B checking codes (CHECKR, FIZCON)

(iii) - compilation of NND for Nb and Bi in EXFOR acc. No. 32001 (ca. 1800 records) was finished and sent to the IAEA NDS.

Experiences obtained in formatting in ENDF/B have been summarized in a paper presented to the 7th NRDC Meeting. Using different computer codes in nuclear theory and NND processing, the participation in computer code comparisons is in progress or planned. In November, the results of a new pre-equilibrium model code AMAPRE will be sent to NEA-DB initiating this comparison (P. Nagel, H. Gruppelaar).

In addition, some activities done for NSDD and CPND in the Central Institute of Isotopes and Radiation Research, Leipzig, have to be mentioned. The Information Centre of the CIIRR has the main task to support customers to find relevant data.

All activities on Nuclear Data in GDR were published in abstract form in the progress report to the INDC printed as INDC(GDR)-23/G.

SR8

RIKEN Status Report

A. Hashizume

1. To begin to compile and to evaluate the data of the isotope productions for biomedical use at RIKEN (The Institute of Physical and Chemical Research, Saitama), we are going to make start two groups. One is a consultant group. Their function is to take contact and to cooperate with other groups in Japan such as JAERI and Hokaido University etc. Another group is a working group which will be consisted of physicists, chemists and physicians. The candidates for this group are neary fixed.

2. The computer which we use for data compilation and evaluation is M380 (Fujitsu). This computer has been renewed at the beginning of this year and operated for the center nachine in our Institute.

3. We are also interested in the usefulness of theoretical codes for practical applications. We are preparing to use DWBA analysis code and a code to obtain the excitation functions via compound nuclear reactions.

4. To fix the policy to compile the data of the isotope production for biomedical use, 40 reports on the reactions to produce ^{123}I and its predecessor are being studied as a test case and some features for biomedical use were obtained.

5. We are still learning EXFOR and our concern is how to take into account these features in EXFOR.

Addendum Dec. 1983

(Compare CP/D - 118)

Dr. A. Hashizume

RIKAGAKU KENKYUSHO

(THE INSTITUTE OF PHYSICAL AND CHEMICAL RESEARCH)

WAKO-SHI, SAITAMA, 351, JAPAN

RIKEN will compile for the first step the experimental information available on cross-sections and thick target yields for the production of the following isotopes,

1 ^{11}C(20.4m), 2 ^{13}N(9.96m),

3 ^{15}O(122s), 4 ^{18}F(110m),

5 ^{28}Mg(21.0h), 6 ^{52}Fe(8.27h) (^{52m}Mn(21.1m),

7 ^{67}Ga(78.3h), 8 ^{68}Ge(288d) (^{68}Ga(68.1m)),

9 ^{74}As(17.8d), 10 ^{77}Br(57.0h),

11 ^{82}Br(35.3h), 12 ^{77}Kr(74.7m),

13 ^{81}Rb(4.58h) (^{81m}Kr(13s)) 14 ^{82m}Rb(6.2h),

15 ^{111}In(2.83d), 16 ^{123}Xe(2.08h),

17 ^{127}Xe(36.4d), 18 ^{123}I(13.0h),

19 ^{124}I(4.2d), 20 ^{125}I(60.2d).

SR9

HOKKAIDO UNIVERSITY

DEPARTMENT OF PHYSICS
FACULTY OF SCIENCE
SAPPORO. JAPAN

April 21, 1983

Present Status of CPND study group

Data of 6.52 MB were newly accumulated from April, 1982 to March, 1983 and the quantity of data are totaly 16.12 MB at the present time.

The transformation program from NRDF to EXFOR, NTX, is now working. However two problems should be solved. The first is to registrate several terms to EXFOR, and our group will propose those to registre to IAEA. Next problem is to alter the original NRDF data to make the transformation easy. For example if the term of 'incident' or 'emitted' is always added to the energy of a particle, many errors of the transformation may decrease. The expression peculiar NRDF should be excluded in a comment. Because the content is always copied without any change in the case of the transformation. It should be emphasised that the transformation like this makes it possible to find out some errors included in a data base as the user finds out them in using the data base. The alternation is going on now and we expect to finish it until this August. Our data and it's DBMS are implemented on the second week of this May.

We plan to deposit CPND newly about 7MB until March of 1984.

H. Tanaka

Prof. H. Tanaka

SR10

Progress Report on Nuclear Data Activities of the Data Centre of the Leningrad Nuclear Physics Institute

I. Kondurov

The Data Centre of LNPI is not involved directly in compilation or evaluation of reaction data. The main direction of the activity is nuclear structure data. The Centre continues to produce keyword references of Soviet papers on nuclear structure and reactor data to be included in the NSR file. 250 references have been included in the file and published, about 500 are ready to be sent.

A-chain evaluation: A=134 is being published in Nuclear Data Sheets, A=133 is being prepared to be sent to Brookhaven.

Close to the subject of this meeting is a work done by the Centre on neutron activation analysis data. We have a programme that extracts decay data sets of all radiative nuclei produced in γ-reaction and their daughter nuclei from ENSDF. Then one can calculate a short list of γ-rays of this decays taking into account the conditions of irradiation, delaying and measuring of γ-radiation. This list can be used when analysing measured spectra manually or automatically.

Frequent and/or important errors where improvement of check programs is recommended (O.S.)

Area 1 entries

- Data lines out of order (independent variables are not monotonic).
- BIB section MONITOR code missing when MONIT is given in DATA section.
- NOSUBENT requires '*' in col. 80.
- Wrong nuclide given under DECAY-DATA (can probably not be checked by program).
- Spontaneous fission $\bar{\nu}$ should be coded (0,F),,NU rather than (N,0),,NU (which was used several times).

Area 2 entries

- The second REACTION code of a REACTION combination, if not fitting in the same line, must start in col. 12.
- EN, EN-MIN, EN-MAX must not be given under ERR-ANALYS. They may be explained under N-SOURCE or INC-SPECT.
- Reaction products are sometimes wrong or missing.
- No codes allowed under INC-SPECT.

Area 4 entries

- The incident energy (EN or equivalent) must always be present in the COMMON or DATA section, except for nuclear quantities identified by a zero in the projectile field SF2 under REACTION. In particular for average resonance parameters, level spacings etc., the range EN-MIN to EN-MAX was frequently missing.
- For resonance parameters, REACTION SF4 (product nucleus) should be blank unless an isomer has to be coded.

Area A entries

- Missing or wrongly used commas and decimal points in DECAY-DATA codes.
- The exponent in E-format numerical values must be right-adjusted in its respective field.
- In MONIT-REF codes, an accession-number in the first field must always include a subentry number. Refer to subentry 1 if no specific Subentry can be used.

Entries from all areas

- Subentry 001 often contains information that, contrary to the rules does not apply to all subentries. In particular, "ERR" column headings were occasionally explained in subentry 001 although they did not occur in all following subentries.

- Reaction products were found missing in the REACTION coding string, mainly for scattering data or monitor reactions.

Concluding remarks

Some of above items are serious:

- When the REACTION coding string is not perfect, this may have the result that the data are missed in retrievals. The Exfor user will get an incomplete retrieval.

- When the column-headings or the numerical data formats or the DECAY-DATA coding are not perfect, format conversions to "Edited Format" or "Computation Format" will blow up or will produce mistakes.

- When DATA records are found out of order (independent variables not monotonic or values repeated), the user has reason to mistrust the data.

The following is important to realize: If an energy value in a data table is repeated, this may be

either due to rounding or due to an insufficient number of digits given, (acceptable)

or because data were measured twice at the same energy, (O.K.)

or, as frequently, by mistake: a data record had been corrected and the superseded record, by mistake, was not removed from the file.

Consequently, repeated energy values (which are easy to detect) are quite important to be looked at:

either to remove the duplicated record,

or to give explanation: data as received from author, probably measured twice at same energy. Without such information, the data user will mistrust the data.

Repeated independent variables (or independent variables out of order) are essential to be included in check programs.

Other items mentioned in above lists of errors are obviously less important but all of them use up manpower when they are encountered.

WP7

Comments on the Status of Neutron Data Exchange

Dosimetry Fission Reactions

For several years, NNDC has been concerned about the flow of EXFOR compilations from the USSR Center at Obninsk, CJD. The transmittals which have been received have not come at reasonably regular intervals and have required considerable effort on our part to correct both format and content errors.

Our approach to analyzing the problem was to look at CINDA and the EXFOR lines in CINDA for Area 4. In so doing, we found extensive errors and gaps on CINDA and so have resorted to a CINDA-EXFOR intercomparison. We present here the observations and conclusions of this intercomparison for six important dosimetry fission cross sections. We also reviewed other reactions but because of the sparcity of information, no further significant results could be obtained.

Observations

1. Many data sets which are referenced in CINDA and which CINDA lists as containing data tables are not compiled in EXFOR. (There are 25 such data sets in CINDA).

2. There are 15 data sets in EXFOR for which no CINDA block exists.

3. There are numerous references in EXFOR which are not entered in CINDA, although the CINDA block for the experiment does not exist.

4. For many of the data which are coded in EXFOR, CINDA contains later reference which are not cited in the EXFOR data set.

5. There is only one CINDA reference with a publication date later than 1980.

6. Many of the data compiled in EXFOR are duplicated, sometimes two or three times.

Conclusions

1. There may be many data sets which are not referenced in CINDA or EXFOR.

2. Many of the data sets compiled in EXFOR may be out of date.

3. We will have to review carefully the USSR data in EXFOR before using it in the publication of the "Book of Curves".

4. There should be a review of the USSR CINDA entries before the publication of the archive volume.

USSR CINDA REFS. (1975 - 1982)

	# of Refs 81	# of Refs 82	CINDA # Blocks	# With EXFOR line	on EXFOR no EXFOR line	on EXFOR no CINDA block (all pre-1980)	Through 4048 (4046, 4047 Missing) Missing EXFOR Data TBL	GRPH	NDG	?
TH232NF	--	--	0	0	0	0				
U235NF	--	1	30	3	5	6	12+(1)	3	4	2
U238NF	--	--	7*	4*	1	1	(2)			
NP237NF	--	--	5	0	3	0	(1)			1
PU239NF	--	--	21*	4	8	6	7	1	1	
AM241NF	--	--	5	0	3	2	1+(1)			
TOTALS			68	11	20	15				

Total number of experiments identified: 83

Total number of experiments compiled: 46

*One CINDA block counted as 2 - diff. exps.
See CINDA errors

WP9

CINDA matters of area 4

by M. Lammer, October 1983

In order to reduce NDS workload on area 4 CINDA entries, several items need to be discussed.

Listed below are 3 main problem areas comprising most of the extra work at NDS, and a 4th item summarizing minor problems.

1) Incomplete coverage of literature, requiring a duplication fo scanning at NDS.

2) So far, CJD does not maintain its own area 4 CINDA file. Therefore, all the blocking of new entries and revisions of all entries is done at NDS.

3) The contents of CINDA entries submitted is not sufficiently reliable: in most (!) cases revisions by NDS are necessary. As NDS covers the translation series, and does the blocking for the translation CINDA entries, there is a continuous cross-check showing too many defaults in CJD entries (e.g. wrong quantity codes).

4) Minor problems:

   - the formal coding rules are not fully observed;
   - new codes are sometimes introduced (mainly for conferences) without accompanying explanation required for CINDA tables and EXFOR dictionaries;
   - coverage control entries are mixed with other CINDA entries and not coded on the special ZZ-sheets designed for this purpose.

ad 1) Only the more important journals of area 4 and "YK-" are covered; this is a fraction of the area 4 journal series listed in EXFOR dictionary 5. From those which are usually covered, occasionally single issues are left out. Report series (preprints) are practically not covered, except Jadernye Konstanty (YK-). NDS scans more USSR publications than CJD (e.g. complete coverage of JINR-reports, Dubna). We received no CINDA entries for 82KIEV.

The incomplete CINDA coverage by CJD is illustrated by the following table:

CINDA entries (excluding ZZ-entries, and exluding English translations) prepared by

	CJD		NDS		
year	sheet	number of entries	new	revisions	total
1980	CCP 1/80-13/80	78	335	131	466
1981	CCP 1/81-27/81	388	513	218	731
1982	CCP 1/82-25/82	114	1096	747	1843
1983(Jan-Sep)	CCP 1/83-15/83	158	980	489	1469
	EXFOR index lines	448			
	(without EXFOR lines 738!)				
Total		1186	2924	1585	4509

Examples: For 80KIEV CJD had submitted less than 50% of the entries found by NDS. Often "MANY" entries by CJD should not be coded as MANY but under all isotopes listed. (Thus the higher number of NDS entries is not only due to incomplete coverage.) See also table on last page.

ad 2) For the archival issue CINDA-A, CJD had already transmitted CINDA entries with block numbers (and serial numbers where required). This has been abandonned in the meantime. For NDS it is often difficult to identify blocks and to assign block-numbers, in particular for the EXFOR index lines. Often the references quoted must be consulted again for checking. Due to the shortage of manpower at NDS, this cannot be continued, and we must find procedures by which the blocking can be done at CJD, with minimum work at NDS.

These procedures will require sending to CJD more frequently the area-4 CINDA file. But also, improved CINDA work at CJD will be required to mark references as superseded or with the "no-book flag" as appropriate.

ad 3) The correctness of the entries submitted by CJD must be improved considerably. Examples:

- The comments "SIG(NEUT-E)" or "ANG ANISOTROPY" were found in entries with the quantities DEL/DIN or NFY which, obviously, cannot be correct. Such inconsistencies are easily detected, but the correction is time-consuming and requires consultation of the references. Note, that this example is not a single case.

- Sometimes not all CINDA relevant reactions in an article are indexed.

- Energy ranges often correspond to those given in the abstract which may be different from the actual measurement (in most cases: resonance parameters, or several quantities with different thresholds).

- "MANY" entries are made for evaluations covering several nuclides.

- CINDA relevant articles are missed, although other articles from the same issue are covered.

- Comments are very short.

- EXFOR index lines have blank energy fields, no ref dates and sometimes no comments. When I consulted the corresponding TRANS tapes in order to complete the information, I further found that

- A few EXFOR entries were <u>not</u> indexed for CINDA.

It seems that the defaults outlined above could be solved by the "double check" procedure employed at NDS particularly for EXFOR. This means in detail that the CINDA entries prepared by one physicist should be "double checked" by a second physicist at CJD. Similarly, the coverage control requires double-checking.

A problem related to all 3 items above is that in Soviet publications frequently the lab is not given. When I index such area 4 publications, this means some detective work to trace down the correct lab. I believe that CJD should be able to enter the correct lab also in those cases where it is not given in the publication.

<u>Table</u>: Summary comparison of entries prepared by CJD and NDS after 1980 for the 4 most important area 4 publications

Publication (Vol./issue)		no. of articles NDS	no. of articles CJD[c)]	no. of entries NDS	no. of entries CJD[c)]	
AE	(48/1 - 53/4)	34	16	160	36	a)
IZV	(44/1 - 46/10)	12	1	21	1	a)
YF	(31/1 - 36/6)	41	17	201	47	a)
YK-	(nos. 34 - 49)	69	53	987	245	b)

Comments:

a) Difference mainly due to articles and quantities missed by CJD.
b) Difference mainly due to single "MANY" entries prepared by CJD for evaluations of many nuclide-reaction combinations.
c) Inculded in these numbers are entries which are actually wrong (mainly YK-) but do not make much difference.

WP14

Importance for compilation of selected CPND and Photonuclear Data

(Revised INDC(NDS)-141 Appendix 11, 1982)

K. Okamoto, March 1984

Items	No. of Reactions	Remarks
RI production for biomed. appl.	~ 50 Production of the following isotopes: β^+ emitter: ^{11}C, ^{13}N, ^{15}O, ^{18}F. Radionuclei generator: ^{28}Mg (^{28}Al), ^{52}Fe(^{52m}Mn), ^{68}Ge(^{68}Ga), ^{77}Br(^{77m}Se), ^{81}Rb(^{81m}Kr). Other commonly used RI: ^{67}Ga, ^{74}As, ^{77}Br, ^{82}Br, ^{77}Kr, ^{82m}Rb, ^{111}In, ^{123}Xe, ^{127}Xe, ^{123}I, ^{124}I., ^{125}I, ^{201}Tl Standard reactions for monitoring beam current: ^{7}Be, ^{11}C, ^{22}Na, ^{24}Na, ^{48}V, ^{64}Cu, ^{65}Zn. Specified reactions: $^{19}F(p,n)^{19}Ne$, $^{16}O(\alpha,n)^{19}Ne$, $^{16}O(d,n)^{17}F$, $^{15}N(p,n)^{15}O$, $^{78}Se(p,n)^{78}Br$.	Mostly daughter nuclei as specified in INDC(NDS)-123, cross-section and thick target yield.
Neutron source	~ 10 $^{2}H(d,n)$, $^{1}H(t,n)$, $^{3}H(p,n)$, $^{3}H(d,n)$, $^{2}H(t,n)$, $^{7}Li(p,n)$, $^{45}Sc(p,n)$, $^{51}V(p,n)$, $^{9}Be(p,n)$ + others $^{3}H(t,n)$ + spallation n-sources, $^{9}Be(d.n)^{10}B$ $^{12}C(d.n)^{13}N$	Mainly monoenergetic source Additional geographical application
Cancer therapy	~ 20 Charged particle reactions on tissue (H, C, N, O + others) Neutron source properties for Neutron therapy	Reactions for secondary CP (p,d,α,t..) in neutron For example, the cross-section and the angular and energy distribution of the emitted neutrons for $^{9}Be(\alpha,n)$

Items	No. of Reactions	Remarks
Fusion CPND	Charged Particle Reactions for DT, advanced and exotic fuels D-D, p-T, D-T, T-T, D-^{3}He, T-^{3}He, ^{3}He-^{3}He, D-^{4}He, p-^{6}Li, D-^{6}Li, ^{3}He-^{6}Li, ^{6}Li-^{6}Li, p-^{7}Li, D-^{7}Li p-^{9}Be, p-^{10}B, p-^{11}B, ^{4}He-^{11}B, etc.	^{3}He-^{3}He,p-^{6}Li, ^{3}He-^{6}Li,p-^{9}Be and p-^{11}B are so called "clean" fusion plasma reactions with small or neglible neutron emission <$V\sigma$> fusion reaction rate over a Maxwellian distr. of reacting ions as function of ion temp.(KT) (Unit cm^{3}/sec) is to be included. Ref. EXFOR D0016 and others. Memo CP-D/82
Neutron product.	Many (α,n) and others	as general
	(α,n) for fusion reactor fuel cycle, (fuel reprocessing) ^{6}Li, B, ^{13}C, ^{14}N, Nat$_{O}$, ^{17,18}O, ^{19}F, Mg, Si, etc.	up to A ≅ 40 (because high (α,n) threshold)
	(α,n) for safeguards (non destructive analysis) ^{6}Li, ^{9}Be, C, O, ^{19}F, Mg ^{27}Al, Ca, etc.	α energy 100 keV ~ 6.5 MeV
Material Analysis	Many	Activation half-life of product between "day" and "sec"
Astrophysics		Mostly e^{-}, p, low Z particle reactions
Proton scattering	Whole A as target	Supplementing neutron data Ref. A.B. Smith and A. Ignatyuk
Analysis of CP Transport	Projectile/target combinations of the particles p, d, t, ^{3}He and α	A≤4 E≤20 MeV
	Elastic scattering cross section (including differential data)	See UCRL-50400 Vol. 15 Part F
Nuclear physics	All Z, A	For nuclear structure; detailed level scheme

Items	No. of Reactions	Remarks
Nuclear physics (continued)	(d,p), (d,pf) and (p,d) as useful information for the equivalent (n,γ), (n,f) and (n,2n)	Entry for CINDA
Inverse react.	A few, such as $^{13}C(\alpha,n)^{16}O$ $^{3}H(p,n)^{3}He$	Entry for CINDA
CP fiss. react.	~ 20 (d,pf) and (t,df)for fissile nuclei	"negative" energy For calculation of neutron fission cross section
PIXE, DIXE	Many	Proton (deuteron) induced X ray emission
Photo-fission		Entry for CINDA $E_\gamma \leq 15$ MeV
RI production for Biomed. Appl.	A few (γ,n) reactions such as $^{12}C(\gamma,n)^{11}C$ $^{14}N(\gamma,n)^{13}N$ $^{16}O(\gamma,n)^{15}O$ $^{19}F(\gamma,n)^{18}F$	Testing in neutron reactors reactors Ref. C. Dunford Cross Section and yield
Photo-neutron prod. cross section for bore-hole logging	Many (γ,n)	Initially upto about 30 MeV Krakow Meeting Nov. 1983
Photo-induced neutron multiplicities-neutron reactor	Many	Ref. C. Dunford
Photoactivation	(γ,γ'), (γ,n), (γ,p), (γ,d)	Action from 7th NRDC Mtng Obninsk/Moscow, Oct. 1983 (B.S. Ishkhanov)
Material Analys.	(γ,n) for activation in structural material	E<20 MeV see U.S. contribution to WRENDA Ref. C. Dunford
Cancer Therapy	Photonuclear reactions with tissue materials (H, C, N, O + others)	Cancer therapy dose measurements Ref. C. Dunford
Determination of level densities	Many For heavy nuclei (A>70) - (α,n), (p,n) For lighter nuclei (p,α),(α,p) (as well as (n,α) and (n,p))	IAEA/AGM on Basic Applied Problems of Nuclear Level Densities, Upton NY, 1983

WP18

Neutron Data Publications at the NNDC

Work has continued on the current edition of "BNL-325" being publishe Academic Press in the series-Neutron Cross Sections. Volume 1, Par Neutron Resonance Parameters and Thermal Cross Section, Z=1-60, was publi two years ago. The evaluations for Part B, Z=61-96, have been completed reviewed. We expect the manuscript to be submitted to Academic Press by end of 1983.

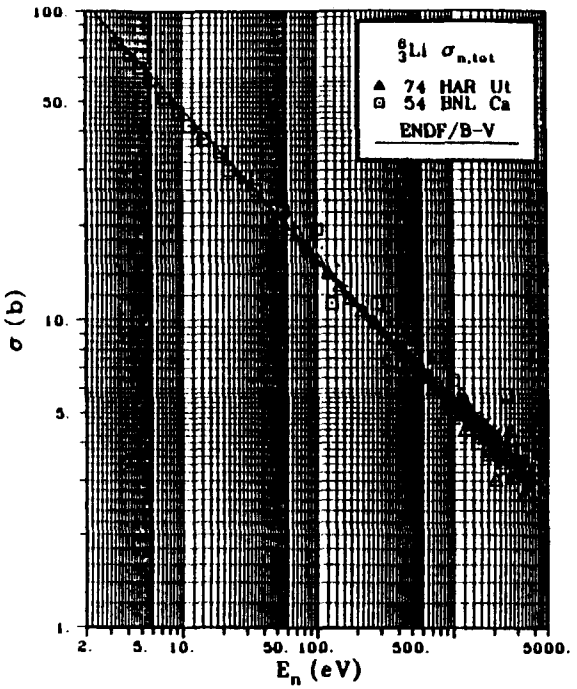
Production of Volume 2, the book of curves, will probably begin at beginning of 1984, provided the planned hiring for the neutron compilation activity has been completed. We ask that measurers and centers supply us with new data which should be included in the publicatio March 1, 1984. The major milestones for the project will be:

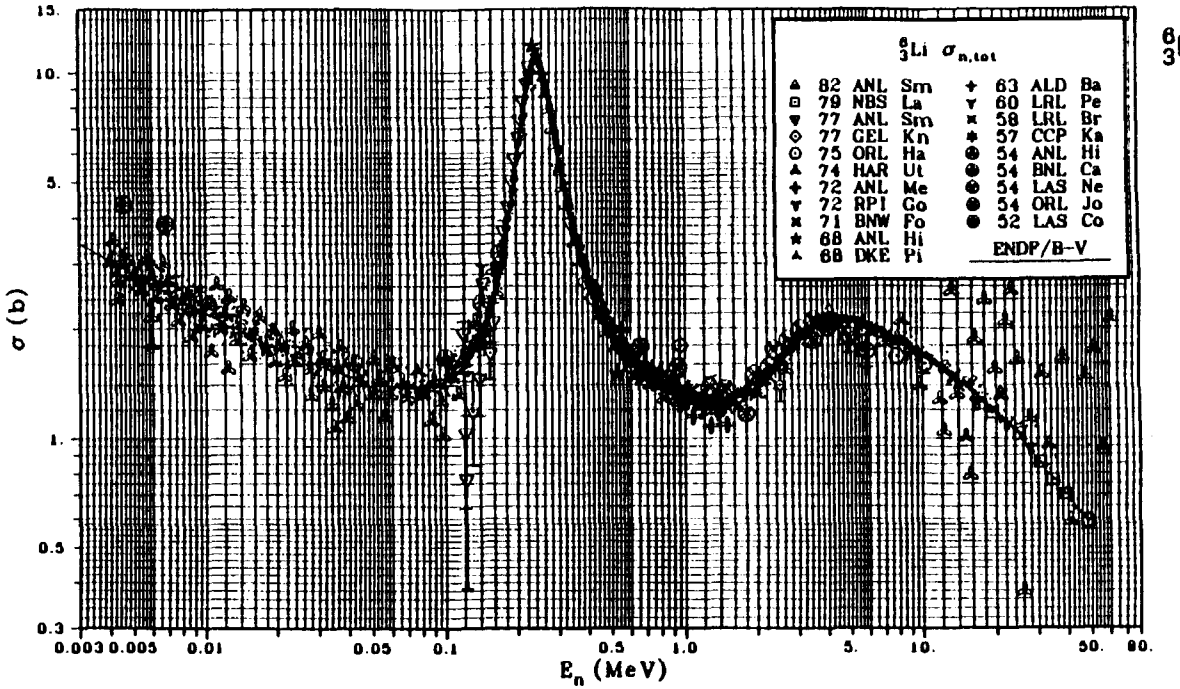
1.	Check for important missing data and ask for them from authors or other data centers	April 1, 1
2.	Complete first pass plots and identify data problems	Oct. 1, 19
3.	Final library updates completed	Dec. 1, 19
4.	Final pages produced	July 1, 19

The computer program development necessary for the production of Volu has been completed. Attached you will find a sample set of pages for Lit 6. The plots are produced directly from data retrieved from the CSISRS base in the computation format. Where available, data from ENDF/B-V has overlayed on the experimental data. The layout for each graphical pag controlled by a human readable and editable data file.

Initial copy will be produced on a VERSATEC printer/plotter directly attached to the NNDC's DEC-10 computer. Final copy will be produced on a high resolution cathode ray tube ploter (FR80) operated by the publications group at Brookhaven National Laboratory. The output of this device is a photo-ready full-size postive-film page. The attached examples are XEROX copies made from the FR80 output. Note that the plots will now contain grids. This feature has been made possible by the advanced technology of the FR80 device.

For neutron reactions which are not included in ENDF/B-V, it will be necessary to generate "eyeguide" curves to represent the experimental data. A computer program has been written to facilitate the production of such curves. It utilizes our interactive graphics terminal (Vector Automation) on the DEC-System 10 computer. Essentially, one can sit at this terminal and enter nodes interactively. Spline curves can be passed through these nodes either directly or following a least-squares adjustment of the y-values of the node. When a satisfactory "eyeguide" has been generated, the data for the curve is stored in a disk file in ENDF format, ready for input into the publication program.

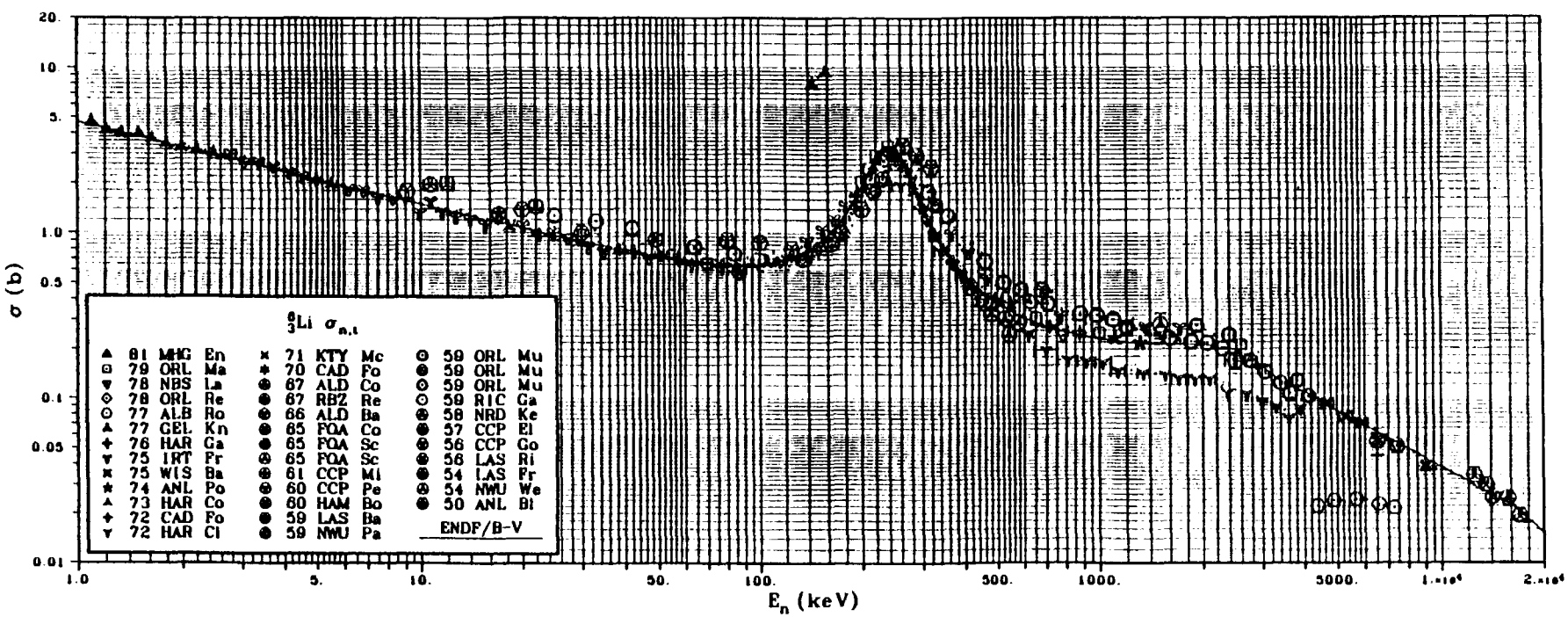




$^{6}_{3}$Li

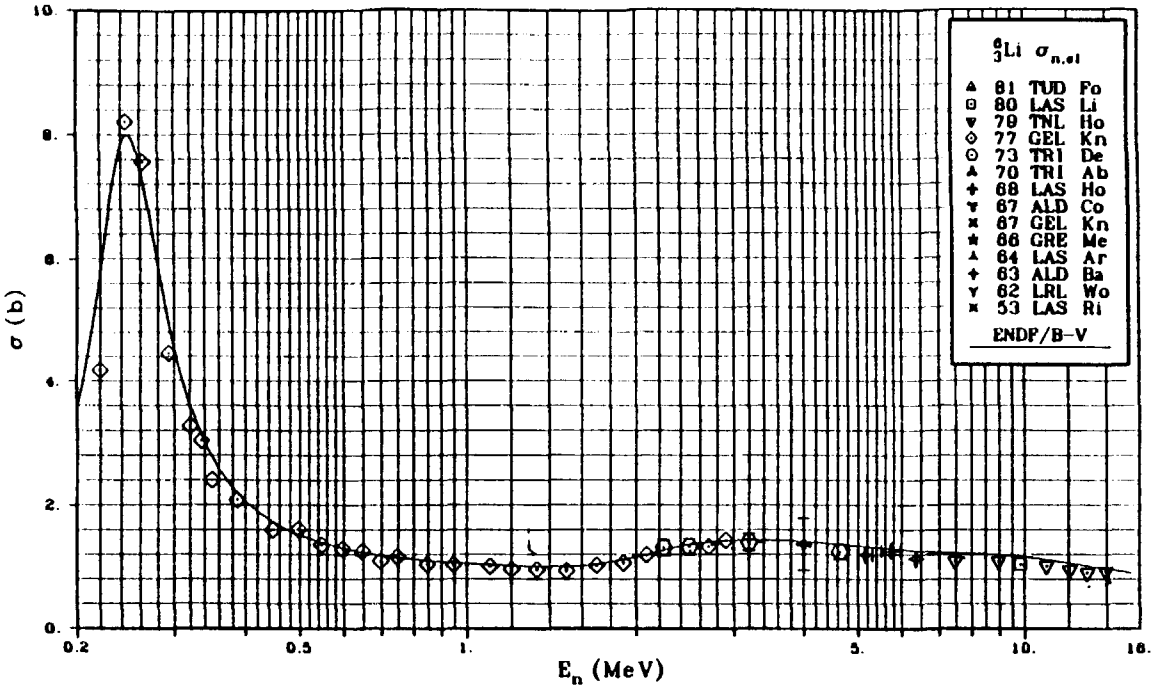
$\sigma_{n,tot}$

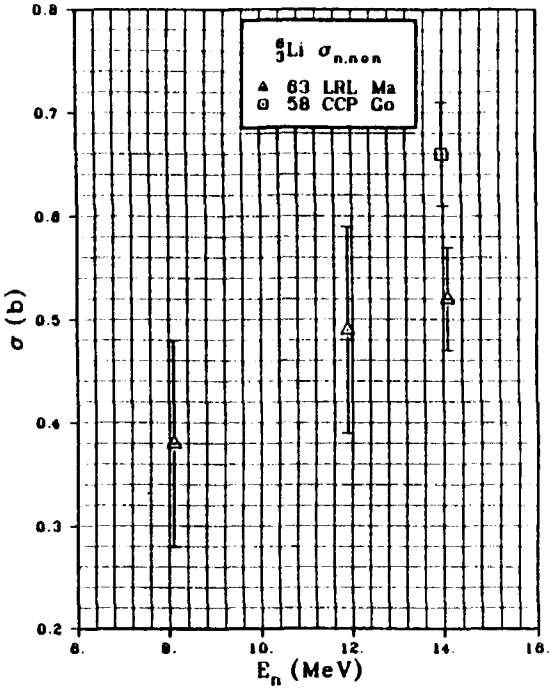
$\sigma_{n,t}$

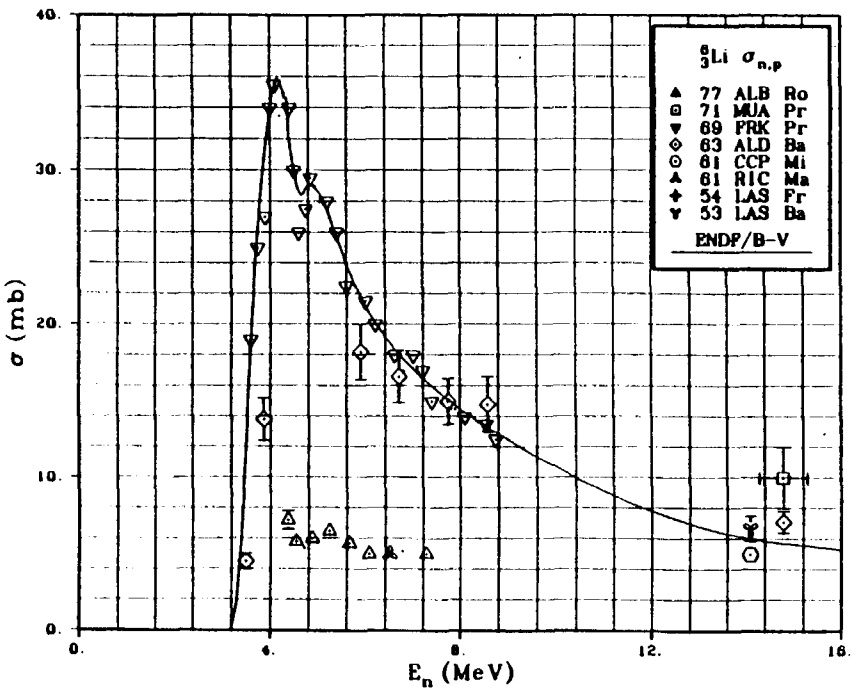


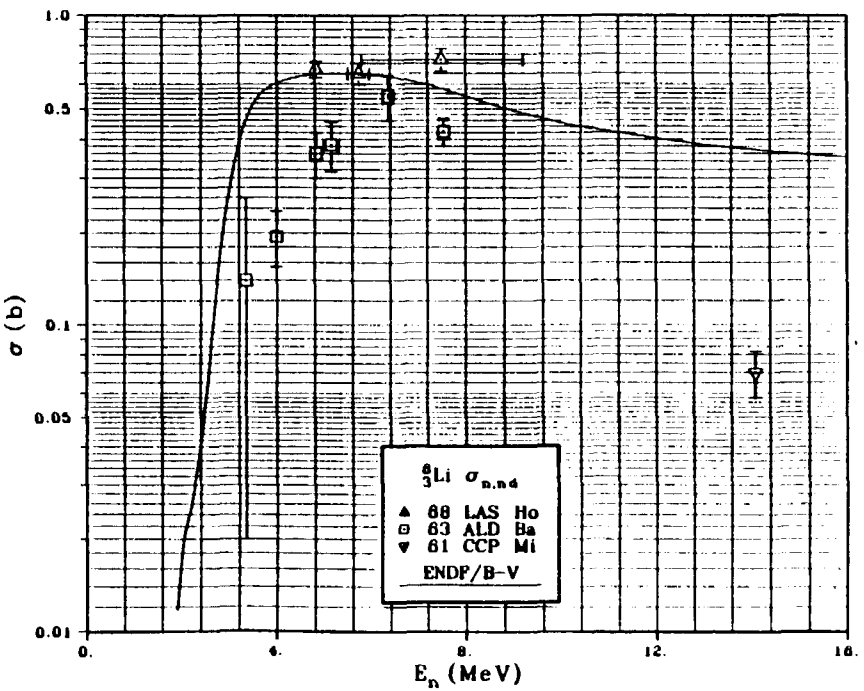
$^{6}_{3}Li$

$\sigma_{n,el}$
$\sigma_{n,non}$
$\sigma_{n,p}$
$\sigma_{n,nd}$









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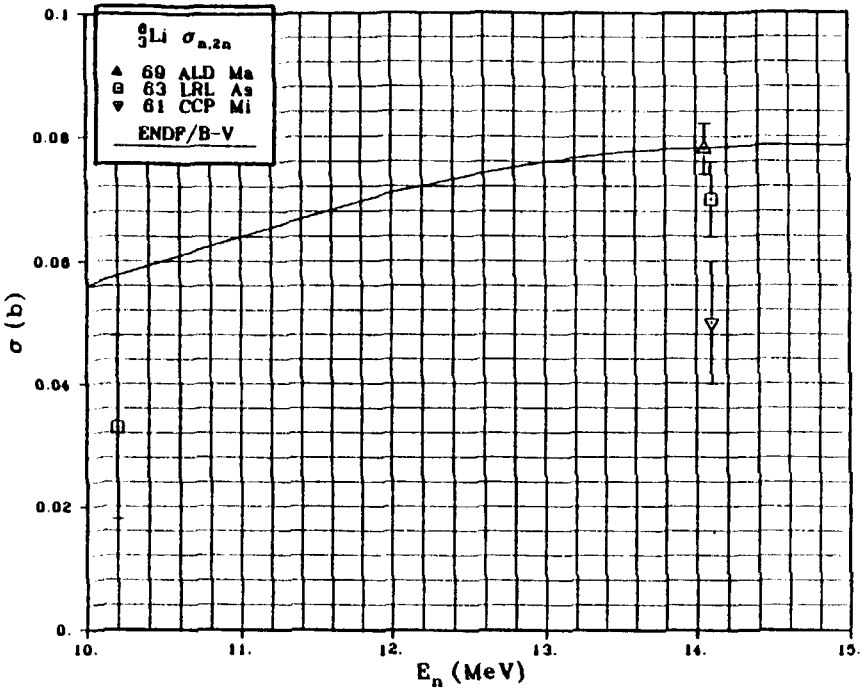
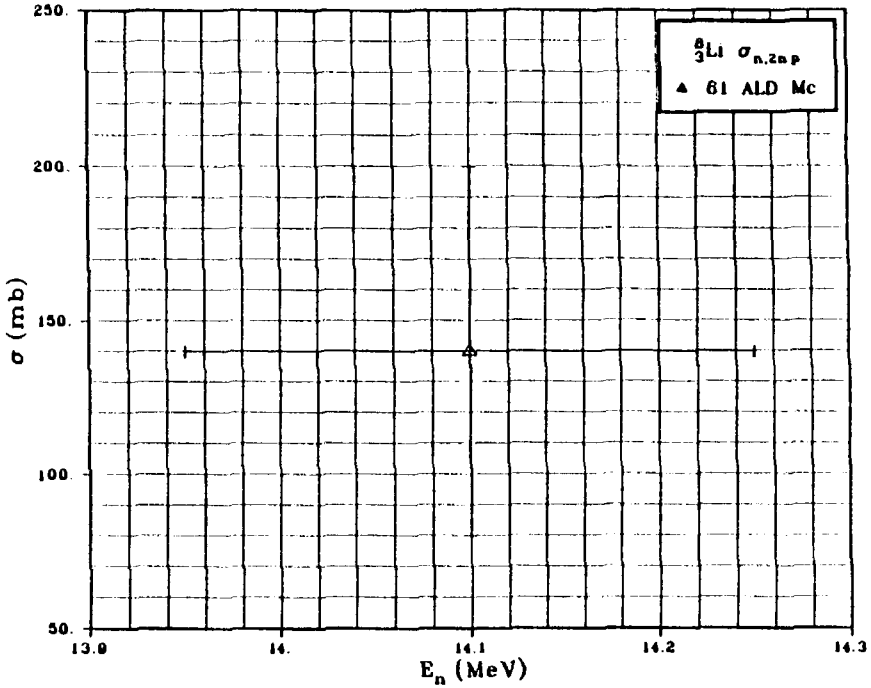




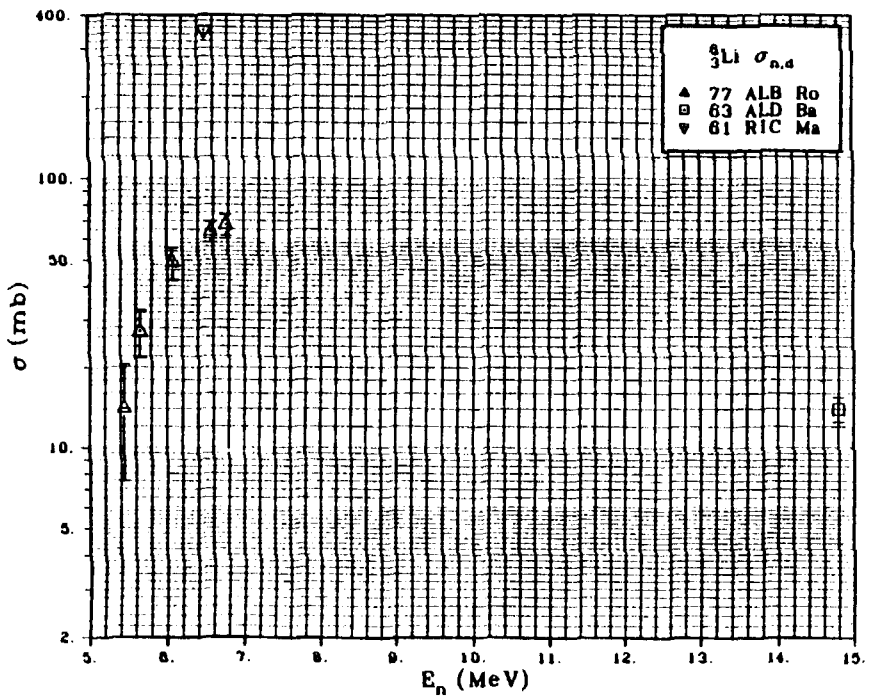
$^{6}_{3}$Li

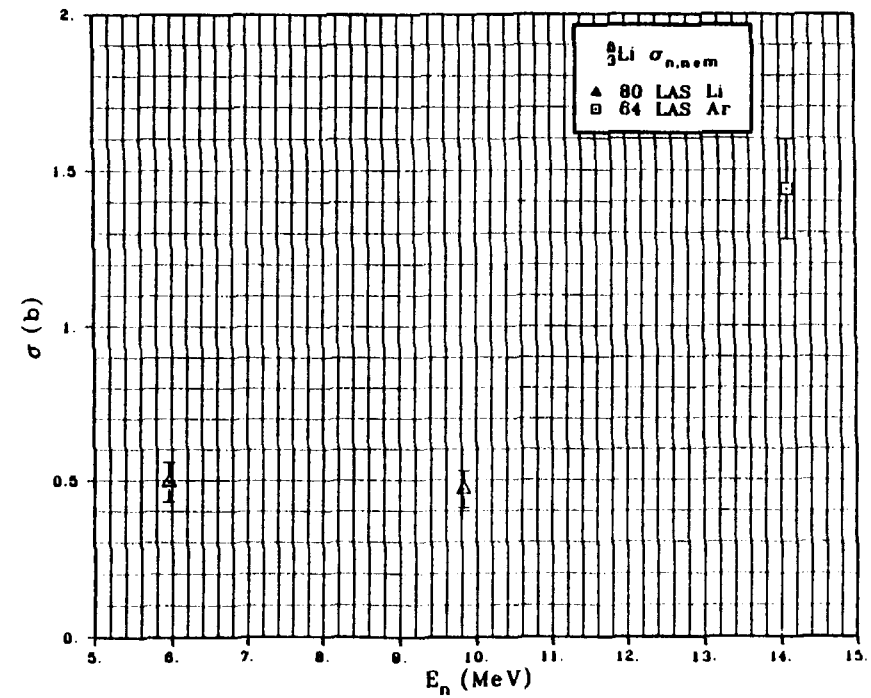
$\sigma_{n,2n}$

$\sigma_{n,2np}$

$\sigma_{n,d}$

$\sigma_{n,nem}$





Yr	Lab	Author	Reference	Points	Range			Standard
			$^6_3$Li $\sigma_{n,tot}$					
82	ANL	Smith, et.al.	NP/A 373, 305	198	0.548 MeV	to	4.747 MeV	
79	NBS	Lamaze, et.al.	79KNOX 48, 7910	391	2.990 MeV	to	49.64 MeV	
77	ANL	Smith, et.al.	ANL-NDM-29	186	0.119 MeV	to	0.348 MeV	
77	GEL	Knitter, et.al.	EUR-5726E, 1	223	80.00 keV	to	2.992 MeV	
75	ORL	Harvey, et.al.	75WASH 1, 244	185	24.60 keV	to	10.25 MeV	
74	HAR	Uttley, et.al.	UTTLEY	3261	71.90 eV	to	60.89 MeV	^{6}Li $\sigma_{n,t}$
72	ANL	Meadows+	NSE 48, 221	987	0.100 MeV	to	1.499 MeV	
72	RPI	Goulding+	GOULDING	507	0.700 MeV	to	29.82 MeV	
71	BNW	Foster Jr+	PR/C 3, 576	237	2.258 MeV	to	14.88 MeV	
68	ANL	Hibdon, et.al.	68WASH 1, 159	704	10.00 keV	to	1.360 MeV	
68	DKE	Pineo, et.al.	68WASH 1, 153	125	43.80 keV	to	0.646 MeV	
63	ALD	Batchelor+	NP 47, 385	6	3.350 MeV	to	7.540 MeV	^{1}H $\sigma_{n,el}$
60	LRL	Peterson+	PR 120, 521	4	18.10 MeV	to	27.70 MeV	
58	LRL	Bratenahl+	PR 110, 927	5	7.010 MeV	to	13.98 MeV	
57	CCP	Katsaurov+	AE 1 (SUP.5), 71	2	2.500 MeV	to	14.00 MeV	
54	ANL	Hibdon, et.al.	ANL-5175, 7	31	10.30 keV	to	0.315 MeV	
54	BNL	Carter	CARTER	80	3.350 eV	to	6.800 keV	
54	LAS	Nereson	LA-1655	26	2.820 MeV	to	9.700 MeV	
54	ORL	Johnson+	PR 96, 985	179	0.391 MeV	to	4.155 MeV	
52	LAS	Coon, et.al.	PR 88, 562	41	33.00 keV	to	14.12 MeV	
			$^6_3$Li $\sigma_{n,t}$					
81	MIG	Engdahl, et.al.	NSE 78, 44	1	0.945 b	at	22.80 keV	
79	ORL	Macklin, et.al.	NSE 71, 205	106	70.00 keV	to	3.000 MeV	^{235}U $\sigma_{n,f}$
78	NBS	Lamaze, et.al.	NSE 68, 183	86	2.789 keV	to	0.782 MeV	^{1}H $\sigma_{n,el}$
78	ORL	Renner, et.al.	BAP 23, 526(B13)	3	0.219 MeV	to	0.273 MeV	
77	ALB	Rosario, et.al.	NP/A 275, 453	11	4.370 MeV	to	7.270 MeV	^{1}H $\frac{d\sigma_{n,el}}{d\Omega}$
77	GEL	Knitter, et.al.	EUR-5726E, 1	84	85.00 keV	to	0.500 MeV	
76	HAR	Gayther	GAYTHER	112	3.000 keV	to	0.809 MeV	^{6}Li $\sigma_{n,t}$
75	IRT	Priesenhahn+	75WASH 1, 232	152	2.433 keV	to	1.711 MeV	^{1}H $\sigma_{n,el}$
75	WIS	Bartle	75WASH, 688	23	2.160 MeV	to	9.660 MeV	
74	ANL	Poenitz	ZP 268, 359	67	.91.00 keV	to	1.500 MeV	
73	HAR	Coates, et.al.	EANDC(UK)-151, 10	159	1.038 keV	to	0.327 MeV	^{6}Li $\sigma_{n,t}$
72	CAD	Fort, et.al.	EANDC(E)-148	118	14.00 keV	to	1.700 MeV	
72	HAR	Clements+	AERE-R-7075	68	0.156 MeV	to	3.900 MeV	^{6}Li $\sigma_{n,t}$
71	KTY	Mc Pherson+	71KNOX 2, 611	32	10.00 keV	to	0.287 MeV	^{6}Li $\sigma_{n,t}$
70	CAD	Fort	70HELSINKI 1, 253	40	81.80 keV	to	0.517 MeV	
67	ALD	Cox, et.al.	JNE 21, 271	7	10.70 keV	to	0.102 MeV	
67	RBZ	Rendic, et.al.	ZFK-130, 143	2	2.700 MeV	to	14.40 MeV	^{1}H $\frac{d\sigma_{n,el}}{d\Omega}$
66	ALD	Barry	66WASH 2, 763	3	25.00 keV	to	0.100 MeV	^{235}U $\sigma_{n,f}$
65	FOA	Conde, et.al.	AF 29, 45	1	0.840 b	at	0.100 MeV	
65	FOA	Schwarz+	NP 63, 593	31	2.900 keV	to	0.148 MeV	^{6}Li $\sigma_{n,t}$
65	FOA	Schwarz+	NP 63, 593	52	0.161 MeV	to	0.588 MeV	^{1}H $\sigma_{n,el}$
61	CCP	Mikailina+	SPN, 185	1	27.00 mb	at	14.10 MeV	
60	CCP	Perelygin+	AE 9, 488	1	0.215 b	at	2.150 MeV	
60	HAM	Bormann+	ZN/A 15, 200	2	2.500 MeV	to	14.10 MeV	
59	LAS	Bame Jr+	PR 114, 1580	29	9.000 keV	to	0.342 MeV	^{235}U $\sigma_{n,f}$
59	NWU	Pardo, et.al.	BAP 4, 216(AB6)	1	3.700 b	at	0.270 MeV	
59	ORL	Murray, et.al.	PR 115, 1707	14	1.200 MeV	to	3.820 MeV	^{237}Np $\sigma_{n,f}$

Yr	Lab	Author	Reference	Points	Range			Standard
			$^6_3$Li $\sigma_{n,t}$ (cont.)					
59	ORL	Murray, et.al.	PR 115, 1707	10	3.600 MeV	to	7.960 MeV	^{237}Np $\sigma_{n,f}$
59	ORL	Murray, et.al.	PR 115, 1707	11	1.720 MeV	to	4.130 MeV	^{238}U $\sigma_{n,f}$
59	RIC	Gabbard+	PR 114, 201	126	25.00 keV	to	4.066 MeV	
58	NRD	Kern, et.al.	PR 112, 926	35	12.50 MeV	to	18.25 MeV	
57	CCP	Elpidinskii+	AE/S 5, 75	1	0.170 b	at	2.500 MeV	
56	CCP	Gorlov, et.al.	DOK 111, 791	24	9.100 keV	to	0.730 MeV	
56	LAS	Ribe	PR 103, 741	11	0.880 MeV	to	14.10 MeV	
54	LAS	Frye Jr	PR 93, 1086	1	28.00 mb	at	14.10 MeV	
54	NWU	Weddell, et.al.	PR 95, 117	2	1.500 MeV	to	2.000 MeV	^{6}Li $\sigma_{n,t}$
50	ANL	Blair, et.al.	ANL-4515, 7	13	0.142 MeV	to	0.624 MeV	^{235}U $\sigma_{n,f}$
			$^6_3$Li $\sigma_{n,el}$					
81	TUD	Foertsch+	ZFK-443, 13	1	1.143 b	at	7.750 MeV	
80	LAS	Lisowski+	LA-8342	2	5.960 MeV	to	9.830 MeV	^{1}H $\sigma_{n,el}$
79	TNL	Hogue, et.al.	NSE 69, 22	7	7.470 MeV	to	13.94 MeV	^{1}H $\frac{d\sigma_{n,el}}{d\Omega}$
77	GEL	Knitter, et.al.	EUR-5726E, 1	40	0.220 MeV	to	3.000 MeV	^{1}H $\frac{d\sigma_{n,el}}{d\Omega}$
73	TRI	Demanins+	INFN/BE-73/2	8	1.980 MeV	to	4.640 MeV	^{1}H $\sigma_{n,el}$
70	TRI	Abbondanno+	NC/A 66, 139	1	0.754 b	at	14.20 MeV	^{12}C $\sigma_{n,el}$
68	LAS	Hopkins+	NP/A 107, 139	3	4.830 MeV	to	7.500 MeV	^{1}H $\sigma_{n,el}$
67	ALD	Cookson+	NP/A 91, 273	1	1.030 b	at	10.00 MeV	^{3}H $\frac{d\sigma_{n,n}}{d\Omega}$
67	GEL	Knitter, et.al.	EUR-3454E	14	1.000 MeV	to	2.300 MeV	^{1}H $\frac{d\sigma_{n,el}}{d\Omega}$
66	GRE	Merchez+	66PARIS 1, 393	1	0.850 b	at	14.10 MeV	^{1}H $\sigma_{n,el}$
64	LAS	Armstrong+	NP 52, 505	1	0.883 b	at	14.10 MeV	
63	ALD	Batchelor+	NP 47, 385	6	3.350 MeV	to	7.540 MeV	^{1}H $\sigma_{n,el}$
62	LRL	Wong, et.al.	NP 33, 680	1	0.730 b	at	14.00 MeV	
53	LAS	Ribe, et.al.	LA-1589	1	0.690 b	at	13.05 MeV	^{1}H $\frac{d\sigma_{n,el}}{d\Omega}$
			$^6_3$Li $\sigma_{n,non}$					
63	LRL	Mac Gregor+	PR 130, 1471	3	8.100 MeV	to	14.10 MeV	^{1}H $\frac{d\sigma_{n,el}}{d\Omega}$
58	CCP	Gorbachev+	AE 4, 191	1	0.660 b	at	14.00 MeV	
			$^6_3$Li $\sigma_{n,abs}$					
70	ANL	Meadows+	NSE 40, 12	1	0.938 kb	at	0.025 eV	
			$^6_3$Li $\sigma_{n,p}$					
77	ALB	Rosario, et.al.	NP/A 275, 453	9	4.370 MeV	to	7.270 MeV	^{1}H $\frac{d\sigma_{n,el}}{d\Omega}$
71	MUA	Prasad, et.al.	NC/A 3 (3), 467	1	10.00 mb	at	14.80 MeV	^{56}Fe $\sigma_{n,p}$
69	FRK	Presser, et.al.	NP/A 131, 679	34	3.600 MeV	to	9.000 MeV	^{1}H $\sigma_{n,el}$
63	ALD	Barry	JNE 17, 273	7	3.500 MeV	to	14.80 MeV	^{1}H $\frac{d\sigma_{n,el}}{d\Omega}$
61	CCP	Mikailina+	SPN, 185	1	5.000 mb	at	14.10 MeV	
61	RIC	Mainsbridge+	WASH-1034, 29	1	5.000 mb	at	6.500 MeV	
54	LAS	Frye Jr	PR 93, 1086	1	6.000 mb	at	14.10 MeV	
53	LAS	Battat, et.al.	PR 89, 80	1	6.700 mb	at	14.10 MeV	^{63}Cu $\sigma_{n,2n}$

Yr	Lab	Author	Reference	Points	Range	Standard
			$^6_3$Li $\sigma_{n,nd}$			
68	LAS	Hopkins+	NP/A 107, 139	3	4.830MeV to 7.500MeV	^{1}H $\sigma_{n,el}$
63	ALD	Batchelor+	NP 47, 385	6	3.350MeV to 7.540MeV	^{1}H $\sigma_{n,el}$
61	CCP	Mikailina+	SPN, 185	1	70.00mb at 14.10MeV	
			$^6_3$Li $\sigma_{n,inl}$			
53	LAS	Ribe, et.al.	LA-1589	1	0.680b at 14.10MeV	^{1}H $\frac{d\sigma_{n,el}}{d\Omega}$
			$^6_3$Li $\sigma_{n,2n}$			
69	ALD	Mather, et.al.	AWRE-O-47/69	1	78.10mb at 14.08MeV	^{238}U $\sigma_{n,f}$
63	LRL	Ashby, et.al.	PR 129, 1771	2	10.20MeV to 14.10MeV	^{252}Cf $\nu_{s,f}$
61	CCP	Mikailina+	SPN, 185	1	50.00mb at 14.10MeV	
			$^6_3$Li $\sigma_{n,2np}$			
61	ALD	Mc Taggart	ACO/UK-1337	1	0.140b at 14.10MeV	^{1}H $\frac{d\sigma_{n,el}}{d\Omega}$
			$^6_3$Li $\sigma_{n,d}$			
77	ALB	Rosario, et.al.	NP/A 275, 453	5	5.450MeV to 6.770MeV	^{1}H $\frac{d\sigma_{n,el}}{d\Omega}$
63	ALD	Barry	JNE 17, 273	1	14.00mb at 14.80MeV	^{238}U $\sigma_{n,f}$
61	RIC	Mainsbridge+	WASH-1034, 29	1	0.350b at 6.500MeV	^{252}Cf $\nu_{s,f}$
			$^6_3$Li $\sigma_{n,nem}$			
60	LAS	Lisowski+	LA-8342	2	5.960MeV to 9.830MeV	^{1}H $\sigma_{n,el}$
64	LAS	Armstrong+	NP 52, 505	1	1.440b at 14.10MeV	^{252}Cf $\nu_{s,f}$