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INDC INTERNATIONAL NUCLEAR DATA COMMITTEE

Report on the Consultants' Meeting on

CO-ORDINATION OF THE NUCLEAR REACTION DATA CENTERS (Technical Aspects)

IAEA Headquarters, Vienna, Austria
26-28 May 1997

Edited by

O. Schwerer and H. Wienke

October 1997

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

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Contents

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Introduction

The IAEA Nuclear Data Section convenes in annual intervals coordination meetings of the Network of the Nuclear Reaction Data Centers. The last meeting, with center heads and technical staff present, took place in Brookhaven, USA, 3-7 June 1996. See the report INDC(NDS)-360. The present meeting was attended by technical staff only to discuss technical matters of the nuclear data compilation and exchange by means of the jointly operated computerized systems CINDA, EXFOR, ENDF and others.

The cooperation of the Network of Nuclear Reaction Data Centers is described in the report INDC(NDS)-359. A list of the centers and a brief (incomplete) summary of their functions within the network is given on the following pages.

At this meeting, ten member centers of the network (representing USA, Russia, China, Japan, Hungary, OECD-NEA and the IAEA) were represented. In addition, observers from Belgium and the new Ukrainian Nuclear Data Centre were participating.

Main items of the Agenda (see page 13) included: status reports of all centers requested, covering the progress since the last meeting; further development of the EXFOR database (new experimental quantities, coding rules, quality control) and of the common EXFOR/CINDA dictionaries; amendment of the agreement on charged-particle data compilation responsibilities; cooperation with the European NACRE group in the area of nuclear data for astophysics; nuclear data distribution via Internet and on CD-ROM; evaluated data libraries and citation guidelines for electronic databases; and others. The Nuclear Data Group of the Russian Federal Nuclear Centre, Sarov, which was represented for the second time at a network meeting, has been welcomed as a regular contributor to the EXFOR database of experimental charged-particle reaction data.

The main results of this meeting's technical discussions are summarized in more than 80 actions and conclusions which can be found on page 17.

The Network of Nuclear Reaction Data Centers

National and regional nuclear reaction data centers, coordinated by the International Atomic Energy Agency, cooperate 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	-	Centr Jadernykh Dannykh (= Nuclear Data Centre), Obninsk, Russia
CAJaD	-	Centr po Dannym o Stroenii Atomnogo Jadra i Jadernykh Reakcikh (= Nuclear Structure and Nuclear Reaction Data Centre), Moscow, Russia
CDFE	-	Centr Dannykh Fotojadernykh Eksperimentov (= Centre for Experimental Photonuclear Data), Moscow, Russia
CNDC	-	China Nuclear Data Centre, Beijing, China
ATOMKI	-	ATOMKI Charged-Paritcle Nuclear Reaction Data Group, Debrecen, Hungary
RIKEN	-	Nuclear Data Group, RIKEN Institute of Physical and Chemical Research, Wako-Shi, Japan
JCPRG	-	Japan Charged-Particle Nuclear Reaction Data Group, Hokkaido University, Sapporo, Japan
JAERI	-	Nuclear Data Center of the Japan Atomic Energy Research Institute, Tokai-Mura, Japan
NDG-RFNC	-	Nuclear Data Group, Russian Federal Nuclear Centre, Sarov, Russia
(KACHAPAG)	-	(Karlsruhe Charged Particle Group, Karlsruhe, Germany. Discontinued in 1982, its responsibilities were taken over by CAJaD)

1. Neutron Nuclear Data

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

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

1.c Data Handbooks based on EXFOR
published by NNDC (last issue in 1984)

1.d Evaluated data exchanged in ENDF format:
NNDC, NEA-DB, NDS, CJD, CNDC, JAERI and others. Main data libraries:

BROND-2 (Russia)	IRDF-90, Rev. 92(IAEA)
CENDL-2 (China)	JEF-2 (NEA)
ENDF/B-6 (USA)	JENDL-3 (Japan)

Online services by NNDC, NEA-DB and NDS

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

1.f International data evaluation cooperation coordinated by NEA-DB

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

2.a Bibliography NSR published by NNDC
Online services by NNDC, NEA-DB and NDS

2.b Numerical data exchanged in EXFOR format:
Input prepared by CAJaD, RIKEN, CNDC, ATOMKI (from 1992), NDS, NNDC, JCPRG, NEA-DB, NDG-RFNC (from 1996)
Online services by NNDC, NEA-DB and NDS
Coordination of compilation: CAJaD

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

3. Photonuclear Data

3.a Numerical data exchanged in EXFOR format:
Input prepared by CDFE, occasional contributions from NNDC, NDS
Online services by NNDC, NEA-DB and NDS

3.b Bibiliography published by CDFE and JAERI

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

LIST OF ACRONYMS

ATOMKI	Nuclear Research Institute, Debrecen, Hungary
BNL	Brookhaven National Laboratory, Upton, N.Y., USA
BROND-2	Russian evaluated neutron reaction data library, version 2
CAJaD	Center for Nuclear Structure and Reaction Data, Kurchatov Institute, Moscow, Russia
CDFE	Centr Dannykh Fotojad. Eksp., Moscow State University, Russia
CENDL-2	Chinese evaluated neutron reaction data library, version 2
CENPL	Chinese evaluated nuclear parameter library
CINDA	A specialized bibliography and data index on neutron nuclear data operated jointly by NNDC, NEA-DB, NDS and CJD
CJD	Russian Nuclear Data Center at F.E.I., Obninsk, Russia
CNDC	Chinese Nuclear Data Center, Beijing, China
CP...	Numbering code for memos exchanged among the NRDC
CPND	Charged-particle nuclear reaction data
CRP	Coordinated Research Programme of the IAEA Nuclear Data Section
CSEW	US Cross-Section Evaluation Working Group
CSISRS	Cross-Section Information Storage and Retrieval System, the EXFOR-compatible internal system of NNDC
EFF	European evaluated nuclear data file for fusion applications
ENDF-6	International format for evaluated data exchange, version 6
ENDF/B-6	US Evaluated Nuclear Data File, version 6
ENSDF	Evaluated Nuclear Structure Data File
EXFOR	Format for the international exchange of nuclear reaction data
FEI	Fiziko-Energeticheskij Institut, Obninsk, Russia
FENDL	Evaluated nuclear data file for fusion applications, developed by IAEA-NDS
IAEA	International Atomic Energy Agency
IFRC	International Fusion Research Council
INDC	International Nuclear Data Committee
INIS	International Nuclear Information System, a bibliographic system
IRDF	The International Reactor Dosimetry File, maintained by the IAEA-NDS
ITER	International Thermonuclear Experimental Reactor

JAERI	Japan Atomic Energy Research Institute
JCPRG	Japan Charged-Particle Nuclear Reaction Data Group, Sapporo, Japan (previously Study Group for Information Processing)
JEF	The Joint Evaluated File of neutron data, a collaboration of European NEA member countries and Japan
JENDL-3	Japanese Evaluated Nuclear Data Library, version 3
LEXFOR	Part of the EXFOR manual containing physics information for compilers
NDG-RFNC	Nuclear Data Group, Russian Federal Nuclear Center, Sarov, Russia
NDS	IAEA Nuclear Data Section, Vienna, Austria
NDS	The journal Nuclear Data Sheets
NEA	Nuclear Energy Agency of the OECD, Paris, France
NEA-DB	NEA Data Bank, Paris, France
NEANDC	NEA Nuclear Data Committee
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
NRDF	Japanese Nuclear Reaction Data File
NSDD	Nuclear structure and decay data
NSC	Nuclear Science Committee of the NEA
NSR	Nuclear structure references, a bibliographic system
OECD	Organization for Economic Cooperation and Development, Paris, France
PC	Personal Computer
PhND	Photonuclear data
RI	Radievyj Institut, Sankt Peterburg, Russia
RIKEN	Nuclear Data Group, RIKEN Inst. of Phys, and Chem. Res., Wako-Shi, Saitama, Japan
TRANS	Name of transmission tapes for data exchange in the EXFOR system
USDOE	U.S. Department of Energy
WRENDA	World Request List for Nuclear Data
4C...	Numbering code of memos exchanged among the four Neutron Data Centers

IAEA Consultants' Meeting on
Co-ordination of the Nuclear Reaction Data Centers
(Technical Aspects)

IAEA Headquarters, Vienna, Austria
26-28 May 1997

AGENDA

1. **General**
1.1 Opening, adoption of the agenda, announcements
1.2 Brief status reports of the centers
1.3 Brief report on the 1997 INDC Meeting
1.4 Review of general Actions from the 1996 NRDC Meeting
1.5 Communication between the centers
    Distribution of memos, TRANS tapes, dictionaries
    Media for data exchange

2. **Dictionary matters**
2.1 Review of Actions
2.2 Wildcards for REACTION SF7
2.3 Additional sorting flags for dictionary 36

3. **General EXFOR matters**
3.1 Review of Actions
3.2 List of TRANS tapes received
3.3 Notification of new data brought to the meeting
3.4 Pending EXFOR matters (dictionary updates, coding rules)
3.5 EXFOR corrections (mistakes, pending retransmissions)

4. **CPND compilation**
4.1 Review of old Actions
4.2 Proposed review of responsibilities
4.3 Nuclear astrophysics data: cooperation with NACRE

5. **Photonuclear data**
5.1 Review of Actions
5.2 New developments in compilation and evaluation

6. **Neutron data**
6.1 General compilation situation
6.2 Fission-Product Yield data (incl. review of Actions)

7. **CINDA**
7.1 Review of Actions
7.2 General compilation situation
7.3 CINDA 2000
7.4 Future of CINDA book

8. **Evaluated data libraries**
8.1 Review of Actions

9. **Citation Guidelines for electronic databases**
9.1 Review of Actions

10. **Computer matters and Online Services**
10.1 Review of Actions
10.2 Web development
10.3 Sharing of EXFOR/CINDA processing codes

11. **Closing items**
11.1 Conclusions and actions of this meeting
11.2 Next NRDC meeting: May/June 1998 in Vienna?
11.3 Other business

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CONCLUSIONS and ACTIONS

Action	on	General matters
1)	*All*	Include NDG-RFNC (Sarov) in distribution list of CP memos.
2)	*CONCLUSION*	NDG-RFNC is assigned the center identification character 'F'.
3)	*Recomm. All*	Investigate putting an invitation for experimentalists on the Centers' webpages to submit references for new data.
4)	*Recomm. All*	Contact publishers of magazines of applied fields (e.g. geophysics, astrophysics, etc.) about publishing articles on data centre services.
5)	*CONCLUSION*	The next (full) NRDC meeting is planned for the second half of May 1998 in Vienna.
6)	*All*	Send the preferred date for the next NRDC meeting to NDS.
		EXFOR/CINDA dictionary system
7)	*McLane*	Look into the possibility of adding additional sorting flags to dict. 36, in particular for: - special emission quantities; - special quantities for fission; - ternary fission; - single level RP, multilevel RP.
8)	*Schwerer*	Send old dictionary 36 (with all sorting flags) to McLane.
9)	*McLane*	(old #13 continuing) Change title of dict. 19 to old one and remove the word 'codes' from the other titles.
10)	*McLane*	Prepare version of dict 36 including wildcards. Prepare test entries, which include the wild cards, to test the new dictionary 36 and send to NDS along with the dictionary.
11)	*Schwerer*	Send dictionaries 36 and test entries to the other data centers to test their programs.
12)	*CONCLUSION*	It is agreed to add the wildcard '*' and '*FP' in dictionaries 36. '*FP' stands for fission fragment code, '*' stands for all codes from dict 33 and those from dict 27 which have a 3 or 'Z' in column 15.

13)	*McLane*	Check whether the heading "for photonuclear data only" needs to be removed from the program DAN2X4 and to check dictionaries 24, 32,36.

EXFOR Manuals

14)	*All*	(old #25 continuing) Send comments and corrections on the "EXFOR Basics" manual to McLane.
15)	*McLane*	(old #26 continuing) Add example entries to the "EXFOR Basics" manual.
16)	*McLane*	Put the updated version of the EXFOR manual (in PostScript) on the NNDC open area (including LEXFOR).
17)	*All*	(old #28 continuing) Proof-read the rewritten EXFOR manual and send comments to V. McLane.

EXFOR, general

18)	*CJD*	(old #31 continuing) Update lab dictionaries for Russian institutes continuously as necessary.
19)	*McLane, Varlamov*	(old #32 continuing) To provide LEXFOR entry for energy spectra of particle pairs and PAR,SIG,P/T.
20)	*McLane*	Check the status of EXFOR entries on 'correlation' entries (replacing COR by DA/CRL).
21)	*McLane Chukreev*	(old #55 continuing) Update check programs to allow embedded blanks in dictionary 7 codes.
22)		(superseded by #42).
23)	*Statement*	A new version of CAJaD's check program TEST-EXF was distributed at the meeting.
24)	*McLane*	(old #70 continuing) To make a benchmark test of TEST-EXF.
25)	*CONCLUSION*	Reaction SF9 may be omitted if the data are experimental, also for CPND. For MONITOR omitting SF9 may also mean that it is not known whether the data are experimental.
26)	*CONCLUSION*	The proposal on momentum transfer, as given in memo CP-C/232 is approved. For momentum transfer the heading MOM-TR (instead of WVE-NM) is used with the units 1/FM (=1/fermi).

27)	*Schwerer*	Add the names of elements 104-109 (see WP 5 item 2) to the dictionaries as soon as they are official.
28)	*CONCLUSION*	The proposal on INC-SOURCE codes in dict. 19 (Memo CP-C/225) is approved.
29)	*CONCLUSION*	The proposal on Thick Target Yields (Memo CP-C/224 with further discussions in CP-C/233) is approved with one modification: the code TTT (for thick target yield per unit time) is replaced by TTY,,DT.
30)	*McLane*	Distribute revised version of memo CP-C/224 on thick target yields.
31)	*CONCLUSION*	Codes on Polarization as proposed in Memo CP-C/230 are approved.
32)	*All*	Comment on Memo CP-C/230.
33)	*McLane*	Send to Schwerer list of those 'provisional' Polarization codes which were entered in dictionaries in January 1997 and should now be deleted.
34)	*McLane*	Change Lexfor and EXFOR Manual: MISC-ERR is allowed in COMMON (but MISC is not).
35)	*CONCLUSION*	The proposal of memo CP-A/77 on INC-SPECT is not approved.
36)	*CONCLUSION*	Unit B*KEV is not approved because it is identical to MB*MEV.
37)	*Lammer*	(old #43 continuing) Check existing codes for fission quantities for possible overlap with the case of memo CP-C/209 and existing EXFOR entries for necessary revisions.
38)	*Lammer*	(old #45 continuing) Reply to items 1, 2 and 4 of memo 4C/57 (codes PR,NU,FF,PRE,FY/DE, and PAR/IND,FY,G for dict. 36) and propose solutions for the remaining questions on entry 40420 in a CP memo.
39)	*CJD*	(old #46 continuing) Retransmit entry 40420 accordingly, after fulfillment of the previous action.
40)	*Recomm.*	Compilers should check, if possible, with the experimentalists, before compiling data received from a third party.
41)	*CONCLUSION*	Compilers should check with ENSDF before arbitrarily adding metastable states to dict. 27.
42)	*McLane*	Submit a memo introducing a new flag 'V' in dict. 27 to identify virtual products (e.g. Be-6, He-2).
43)	*Recomm.*	Compilers should look for equivalent units before proposing new ones for dict. 25.
44)	*McLane*	Investigate the possibility of including separate index lines for the ELEM/MASS formalism in the indexing program.

45)	*NNDC* *NDS*	(old #71 continuing) EXFOR retrievals by fission-product nuclides should be possible. While the old NDS EXFOR index provided this possibility, it is not yet possible in the VAX EXFOR retrieval system, which should be updated accordingly.
46)	*Recomm.*	EXFOR TRANS tapes should not exceed 100000 lines.
47)	*CONCLUSION*	The alter flags in column 80 are no longer compulsory except for the SUBENT line.
48)	*CONCLUSION*	Centers are free to add evaluated, calculated or derived data to any EXFOR entry (using the proper modifiers in REACTION SF9).
49)	*Lammer*	(old #72 and #74 continuing) To revise the LEXFOR entry on FP yields. Submit a proposal on the coding of mass yields as a CP memo with information on corresponding measurements.

EXFOR corrections

50)	*NNDC*	(old #34 modified) Send an index of the remaining entries from the EXFOR 6000 and 8000 series to respective centers.
51)	*NEA-DB,* *CJD*	(old #35 continuing) Go through these entries and decide which entries need conversion to EXFOR.
52)	*NDS*	(old #40 continuing) Retransmit entry 22242 with an EXFOR N-series number.
53)	*NDS*	To issue a memo on pending EXFOR retransmissions.
54)	*All*	Check the list of requested EXFOR corrections (distributed at this meeting by V. McLane individually to the other centers) and make the necessary retransmissions.
55)	*CAJaD*	To retransmit TRANS A039 with NOSUBENT records for deletion of subentries A1125003 and A1403002,3.
56)	*NDS*	Send to RIKEN the deletion of ENTRY R0010.

CPND compilation

57)	*Statement*	Dr. Angulo is going to send the NACRE experimental data to NNDC for inclusion in EXFOR after the compilation has been published in ADNDT.
58)	*McLane*	To compare the NACRE compilation with the existing EXFOR files and to arrange with the other centers for conversion to EXFOR where necessary.

59)	*All*	To compare CPND EXFOR with the Landolt-Börnstein compilation when the EXFOR file is more complete (including all Arzamas and NACRE data).
60)	*NDS*	(old #90 continuing) Obtain the Chinese data that were sent to T. Benson/IAEA.
61)	*CAJaD*	(old #94 continuing) Create a FINAL version of the EXFOR area B file, using - CAJaD master file - NDS master file - TRANS B012 through B015 in the versions modified by NDS.
62)	*NDS*	(old #38 continuing) Distribute corrected Münzel data after final corrections by CAJaD.
63)	*NEA-DB*	(old #98 continuing) To keep the NRDC network and specifically the CPND centres informed about developments for intermediate energy CPND.
64)	*NDS*	Correct last year's agreement on CPND responsibility: - (New data:) JCPRG will be responsible for data from Japan. - Replace everywhere 'Sapporo' by 'JCPRG'.
65)	*CONCLUSION*	The 1996 agreement on CPND compilation responsibilities is amended as follows: '1989' is replaced by '1980' and '1988' by '1979'. (See Appendix I).

Photonuclear data

66)	*Statement*	NDG-RFNC is compiling also photonuclear data (which are transmitted in coordination with CDFE).
67)	*Statement*	Dr. Martins from Univ. Sao Paolo has started compiling photonuclear data in EXFOR in the framework of an IAEA CRP.
68)	*McLane*	To put the photonuclear bibliographic file on the NDS open area and inform the other data centers.

CINDA

69)	*Lammer*	(old #83 continuing) Distribute the list on who is covering what for CINDA to other centres.
70)	*NDS,NEA,CJD*	Cover conference proceedings for CINDA.
71)	*NEA-DB*	Review the NEA CINDA checking code and investigate the possibility of adopting the NNDC codes.opting the NNDC code.

72)	*All*	To send comments on the CINDA 2000 proposal (Memo CP-C/234) to V. McLane by 30 June 1997.
73)	*Konieczny*	To submit proposal for the CINDA database on CD-ROM and on diskette.
74)	*All*	After receiving above proposal inquire about the need for the CINDA book in the respective service areas.

Evaluated data libraries

75)	*All centers concerned*	Compile and maintain a list of known errors in the evaluated libraries for which they are responsible and make this list available to the users of the online system.
76)	*All centers concerned*	To circulate the parameters being used for producing pointwise cross sections including the code name, version number and input deck.
77)	*Recomm. All*	All centers responsible for evaluated data libraries should try to make the documentation available online.
78)	*Manokhin*	To select the most important cases from his collection of important discrepancies in evaluated data libraries and send to NDS for publication as an INDC report.
79)	*Recomm.*	If a data library has an official (national or international) approval, this should be mentioned in the documentation.
80)	*NEA-DB*	(old #103 continuing) Possibly release a version of JEF-PC to the network centres for their internal use free of charge.

Citation Guidelines

81)	*Recomm. NNDC*	(old #111 continuing) Write and publish a NUDAT Manual (as BNL-NCS report).
82)	*Recomm. All*	(old #113 continuing) For the online services, the keyword "citation" should be clearly visible within each database.
83)	*Recomm. All*	(old #114 continuing) For FTP servers, a file AAACITE.TXT should be created for each data file type.
84)	*CONCLUSION*	(old #115 modified) Guidelines for contents of data library documentations Future documentations should include: - A good abstract; - Uses/applications of library; - Procedures used for generating the contents of the library; - Description of network responsible for contributing to and/or for maintaining the library;

- Quality control procedures, and reference to codes, benchmarks, etc., used;
- Contents, or reference to contents;
- Citations for other databases or computer codes used in producing the library;
- How to obtain data contained in library.

Computer matters

85)	*Konieczny*	Send ORACLE design specification developed at NEA for CINDA and EXFOR to V. McLane.
86)	*Recomm.*	The production of a CD-ROM containing the complete EXFOR library with graphics interface, plotting and retrieval codes is recommended.
87)	*NNDC, NEA NDS*	To investigate possibilities of finding and funding a suitable programmer for this task.

Appendix 1

Agreement on Charged-Particle Data Compilation Responsibility

(amended 27 May 1997)

Compilation Centers

NNDC	NEADB
JCPRG	RIKEN
CAJaD	CNDC
ATOMKI	

Area of Responsibility

New Data (1980→)

NNDC will be responsible for data from the U.S. and Canada.
JCPRG will be responsible for data from Japan.
ATOMKI will be responsible for data from Hungary and Jülich.
CAJaD will be responsible for the rest of the world.

Old Data (→1979)

JCPRG will be responsible for data from Japan.
CAJaD will be responsible for all other data.

Data Compilation

New Data (1980→)

A center wishing to compile data (C1) will contact the center in whose area of responsibility the data were produced (c2) with a list of the data sets to be compiled. C2 will inform C1, as quickly as possible, whether the data either have been compiled or are in the process of being compiled by another center.

If the data are not compiled or being compiled, C2 will either agree to compile them with priority, or ask that C1 compile the data and send them to C2 to be included in the next regular C2 transmission file.

Old Data (→1979)

A center wishing to compile data (C1) will contact all other centers with a list of the data sets to be compiled. The center responsible for the data (Sapporo or CAJaD) will inform C1, as quickly as possible, whether the data either have been compiled or are in the process of being compiled by another center.

If the data are not compiled or being compiled, C1 will compile the data and include in the next regular C1 transmission file.

Progess Report of the IAEA Nuclear Data Section

(Note: This report is an extract taken from the 1995/1996 report to the INDC, see INDC(NDS)-366)

I. Nuclear Data Section Staff and Budget

As a result of budget cuts in 1995-96, the Section lost 3 positions compared to 1994. The authorized staff level was reduced from 22 (status as of December 1994) to 19 (status as of December 1996). The present authorized staff consists of 10 Professional (P-Staff), 5 Support (G-Staff) and 4 Secretarial (G-Staff). Of these, 2 Professionals (3 Professionals until May 1996) and 1 Secretary are assigned to the Atomic and Molecular Data Unit.

During the period 1995-96, except at the very beginning of 1995, the Section did not operate at its full strength. Fairly large difference between the authorized staff level and the actual staff level is caused by several factors, of which the most important is the Agency fixed-term contract policy for P-staff and related high P-staff turnover coupled with slow hiring procedures.

The post of the Section Head was vacant for 11 months after Charles Dunford left in July 1995. It was filled by Douglas Muir in June 1996. In the interim period Pavel Oblozinsky served as acting Section Head. Nikolai Kocherov retired in April 1995, his position was occupied by Robert Langley of the Atomic and Molecular Data Unit until May 1996. This position has now been returned to the Nuclear Data Development Unit. Gordon Mundy retired in October 1995, and his position was lost. Hans Lemmel retired in November 1996 after 32 years of outstanding service.

The budget for the Nuclear Data Section in 1995-1996 was reduced by about US$ 250,000 and US$ 350,000, respectively, compared to 1994. To make the budget comparison in different years meaningful, we follow the current Agency practice. The figures given in the table below consider the constant exchange rate of 12.7 AS for 1.0 US$ and take into account the price increase. Thus, the budget in 1995 was US$ 2,312,000, in 1996 it was US$ 2,271,000 including 3.5% price increase, mainly reflecting increased salaries.

BUDGET AND STAFF SUMMARY 1995 -1998

	1995	**1996**	**1997**	**1998**
Authorized Staff Level	20	19	19	19
Actual Staff Level	18.9	18.0	*17.8**	*18.5**
Staff Cost Budget	1,652,000	1,630,000	1,600,000	1,600,000
Programmatic Budget	660,000	641,000	645,000	614,000
Total Budget US$ *Price increase*	**2,312,000** -	**2,271,000** 3.5%	**2,245,000** *0.5%*	**2,214,000** 0.0%

* *Estimates*

Staff costs represent approximately 73% of the budget, leaving 27% percent for programmatic activities. In 1995-96, the Nuclear Data activity amounted to approximately 75% of the total budget. The remaining 25% was devoted to Atomic and Molecular Data activities.

The actual expenses are at the moment available for 1995 only. They, on the first look, differ substantially from the original budget. This is largely due to changes in exchange rates. Thus, the 1995 adjusted budget was US$ 2,819,700 (exchange rate, 10.03 AS for 1.0 US$), and the actual expenditures were US$ 2,749,937. As indicated by the actual staff level, the Section underspent planned staff-cost money. On the other hand, the Section overspent planned equipment money (purchase of DEC Alpha computer), and it overspent research contract money (individual Research Contracts).

In the period 1997-1998, we anticipate unusually high (half of all professional positions) staff turnover. In February 1997, Michal Herman filled in the post vacated by Nikolai Kocherov/Robert Langley. Anatoly Pashchenko left in March 1997, his position was filled by Racquel Paviotti Corcuera in July 1997. The important position of the Data Center Unit Head should be filled by late summer 1997. The critical post of the DEC Alpha computer manager, held by Ramon Arcilla, will be vacated in February 1998. Harm Wienke's contract will expire in October 1998.

The 1997-1998 budget was submitted on the level equal to that of 1996. The approved budget is somewhat below the 1996 budget. This is caused by the fact that there was an overall cut across the Agency of non-staff travel and staff travel money (10%), of printing money and general expenses. The assumed small price increase of 0.5% in 1997 is explained by the fact that staff salaries will be not inflation-adjusted. No price increase for 1998 is foreseen at the moment.

II. DATA CENTER OPERATION

A. Data Compilation

Data compilation in CINDA and EXFOR continued on schedule. See the Table 1 for a list of countries versus neutron reaction data in EXFOR.

In the years 1995/1996 seven EXFOR tapes were transmitted to the other centers containing

73	new entries
263	data tables (= subentries)
4489	data lines

coming from Bangladesh (1 entry), Brazil (2), China (31), Czechia (1), Finland (1), Germany (14), Hungary (19), Slovakia (1), Thailand (1), USA (1), and Vietnam (1).

In addition, these EXFOR tapes included revisions of 14 earlier entries.

The handbook CINDA95 was published as cumulative issue (1988 - 1995), CINDA96 was published as supplement to CINDA95. Some delays were experienced, due to the reprogramming necessary for the introduction of the new Archive EXFOR-CINDA dictionaries.

The acquisition and documentation of evaluated data files continued as publicized in

Nuclear Data Newsletter No. 21, July 1995
Nuclear Data Newsletter No. 22, November 1996.

Important NDS products in this 2-year period were

- the Neutron Metrology File NMF-90, which presents the updated International Reactor Dosimetry File IRDF integrated with PC codes; see IAEA-NDS-171;

- and the official release of Version 1 of the Fusion Evaluated Nuclear Data Library, FENDL-1.

Summaries of available nuclear data libraries are contained in the updated reports

IAEA-NDS-7 Rev. 96/11	(available libraries), and
IAEA-NDS-107 Rev. 11	(joint index to BROND, CENDL, ENDF/B, JEF, JENDL), IRDF, EFF and FENDL).
IAEA-NDS-150 Rev. 96/8	"Online Nuclear Data Service", User manual, by C.L. Dunford and T.W. Burrows.

Table 1: EXFOR neutron reaction data of area 3 by country
(by 31 December 1996)

Country	Data lines	Subentries	Entries
Algeria	3	2	1
Argentina	3053	103	30
Australia	7327	475	75
Bangladesh	1620	102	20
Bolivia	1	1	1
Bulgaria	40	30	13
Brazil	4332	101	21
Chile	145	29	10
China*)	7570	737	206
Colombia	1	1	1
Croatia	15	15	1
Czechoslovakia	862	100	29
Czech Republic	151	6	3
Egypt	3678	132	24
German Dem. Rep.	23144	410	47
Hungary	2737	649	110
India	2583	988	177
Iran	2	2	2
Iraq	1672	31	11
Israel	266	59	24
Korea, Rep.	12	9	3
Malaysia	4	2	1
Mexico	143	21	4
Morocco	401	114	12
Myanmar (Burma)	2	2	1
New Zealand	25	6	2
Pakistan	1816	103	21
Poland	5127	559	95
Romania	1751	156	38
South Africa	7181	187	21
Saudi Arabia	22	18	2
Slovakia	65	6	2
Sudan	3	3	1
Thailand	909	47	3
Vietnam	24	22	5
Yugoslavia	3108	419	66

Note: If a publication contains cross-section measurements for 3 target nuclides, the data would be compiled in 1 "Entry" with 3 "Subentries" (tables).

*) Including 14 entries from Taiwan, China containing 46 Subentries with 621 data lines

B. Data Services

1. Services by mail

The request statistic for mail shipment requests is given in Tables 2 and 3 for the categories

- bibliographic information
- documents
- experimental data
- evaluated data
- data processing codes.

For the purpose of the present statistics, any query for one of these categories defines a request. If an incoming letter asks, for example, for both experimental and evaluated data, it is counted as 2 requests. In the past 5 years, requestors from 95 countries have been served by mail shipment.

While the number of requests per year was fluctuating around 700 - 800 until 1995, a decrease by about 40% can be seen for 1996. Probably the main reason for this is the delay in publishing the Nuclear Data Newsletter in 1996 which reached the users only in December. In past years always a large fraction of the requests received came in direct response to the Newsletter, while the requests stimulated by the 1996 Newsletter started coming in only in January 1997. Efforts will be made to publish 2 issues of the Newsletter per year. Target publication dates are March and September of each year, starting in 1997.

Table 2: Data Request Statistics 1986 - 1996 for services by mail

	Bibliographic information	Documents	Expt. Data	Eval. Data	Data processing codes	Total
1986	11/25	405/1430	46/56	86/173	40/91	588/1775
1987	21/48	725/2166	27/28	87/147	167/214	1027/2603
1988	5/19	681/1590	34/47	110/191	77/109	907/1956
1989	10/17	564/1418	32/38	96/222	61/94	763/1789
1990	2/3	424/1916	20/32	188/360	26/32	660/2343
1991	0/0	426/1324	31/41	260/435	25/44	742/1844
1992	0/0	507/1422	27/32	237/303	142/161	913/1918
1993	0/0	299/801	18/20	190/294	73/100	580/1215
1994	0/0	524/1567	17/23	226/293	64/92	831/1975
1995	0/0	452/1155	8/16	228/357	18/28	706/1556
1996	0/0	242/554	12/14	147/205	11/13	412/786

Note: The notation, e.g. 86/173 under Eval.Data, means that on 86 incoming requests 173 evaluated data libraries have been sent out.

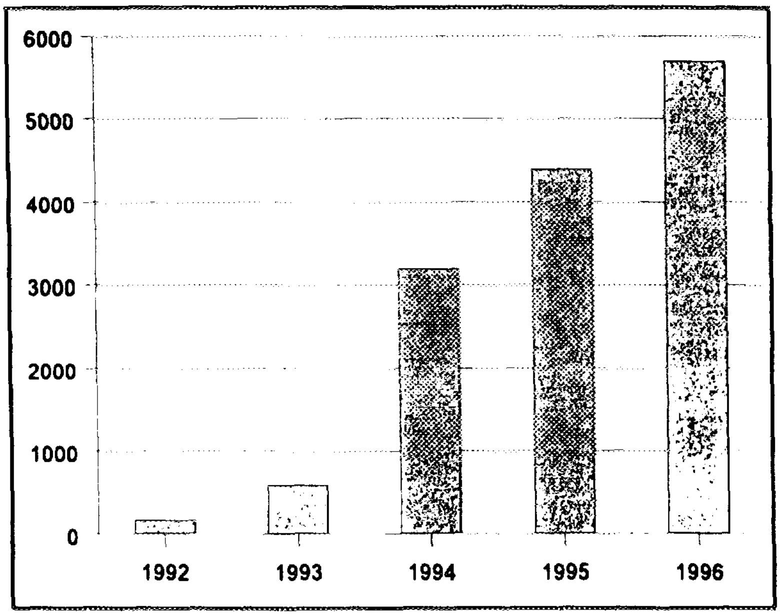
Table 3: Shipment of Tapes and Diskettes by Year

Year	Magnetic tapes (including DAT types)	PC diskettes	Sum
1990	214	(no records)	-
1991	457	(no records)	-
1992	143	(no records)	-
1993	125	367	492
1994	168	486	654
1995	140	463	603
1996	68	621	689

2. Online nuclear data services

The usage of the Telnet-based online nuclear data service NDIS has again increased by about 25% from 1995 to 1996 as can be seen from Table 4. In 1996, 5700 retrievals were made. By January 1997, there are registered users from 46 countries (see Table 5); the breakdown of retrievals by geographical region, in comparison with the mail services, is given in Table 6.

Table 4: Retrieval statistics for the Nuclear Data Information System (NDIS)



Development of the retrieval statistics of the nuclear data Online (Telnet) Services, which are presently used by 42 Member States

Table 5: Registered Users of NDIS by Country (January 1997)

Country	Users ("Names")	Country	Users ("Names")
Algeria	1	Japan	3
Argentina	11	Korea, Rep.	7
Australia	16	Latvia	1
Austria	22	Mexico	4
Belgium	4	Netherlands	4
Brazil	12	New Zealand	1
Bulgaria	5	Norway	1
Canada	6	Poland	17
Chile	1	Romania	6
Colombia	1	Russia	32
Croatia	4	Slovakia	7
Cuba	1	Slovenia	2
Czech Republic	19	South Africa	7
Denmark	1	Spain	9
Finland	6	Sweden	1
France	7	Switzerland	3
Germany	23	Thailand	3
Hungary	26	Turkey	1
India	6	United Kingdom	12
Ireland	1	U.S.A.	47
Israel	10	Venezuela	2
Italy	15	Yugoslavia	1
Jamaica	1		
		45 countries	359 users*)

Table 6: Nuclear Data Services in 1992 - 1996 by Geographical Region

	Services by Mail		Online Services (NDIS)	
Region	# of countries	percentage of requests	# of countries	percentage of retrievals
OECD countries (incl. Japan)	20	29	17	35
former USSR	6	9	2	25
East Europe	12	16	9	33.3
Asia, Australia	16	25	6	0.3
Africa and Near East	27	11	2	3.1
Latin America	14	10	6	3.3
	95	100%	42	100%

*) This total includes 1 user from Taiwan, China

In November 1996, a dedicated Nuclear Data Webserver started its operation on the NDS DEC Alphaserver computer. The new WWW pages offer

- direct WWW access to a number of databases, documents and nuclear data utility programs;
- a Web version of the catalog of nuclear data libraries available from NDS (IAEA-NDS-7 called on the Web the "IAEA Nuclear Data Guide"), with many internal and external hypertext links;
- a Web version of the latest Nuclear Data Newsletter;
- general information on the NDS services and programs, and a direct link to the Telnet-based service NDIS.

The URL address of the Webserver is: **http://www-nds.iaea.or.at/**

Many of these new features were developed in cooperation with NNDC. For the future, the introduction of more WWW interfaces is planned, gradually replacing part of the Telnet-based retrieval possibilities. Considering the poor networking and computing infrastructure in many developing countries, it is not expected that the conventional services can be eliminated any time soon. Even users in developed countries have experienced periods of unsatisfactory overall network transmission speed. The transmission speed has fluctuated dramatically, and the underlying reasons for this are a topic of active investigation by NDS and Computer Centre staff.

A first attempt at extracting usage statistics for the NDS Web Server is given in Figs. 1 and 2.

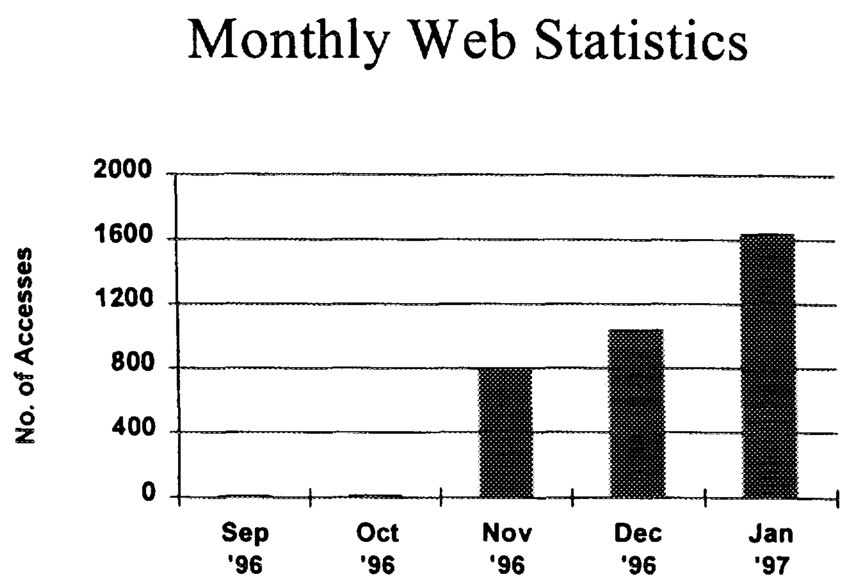


Fig. 1 shows the Web access statistics from the start of the NDS dedicated Webserver. By January 1997, the number of access had grown to 1641.

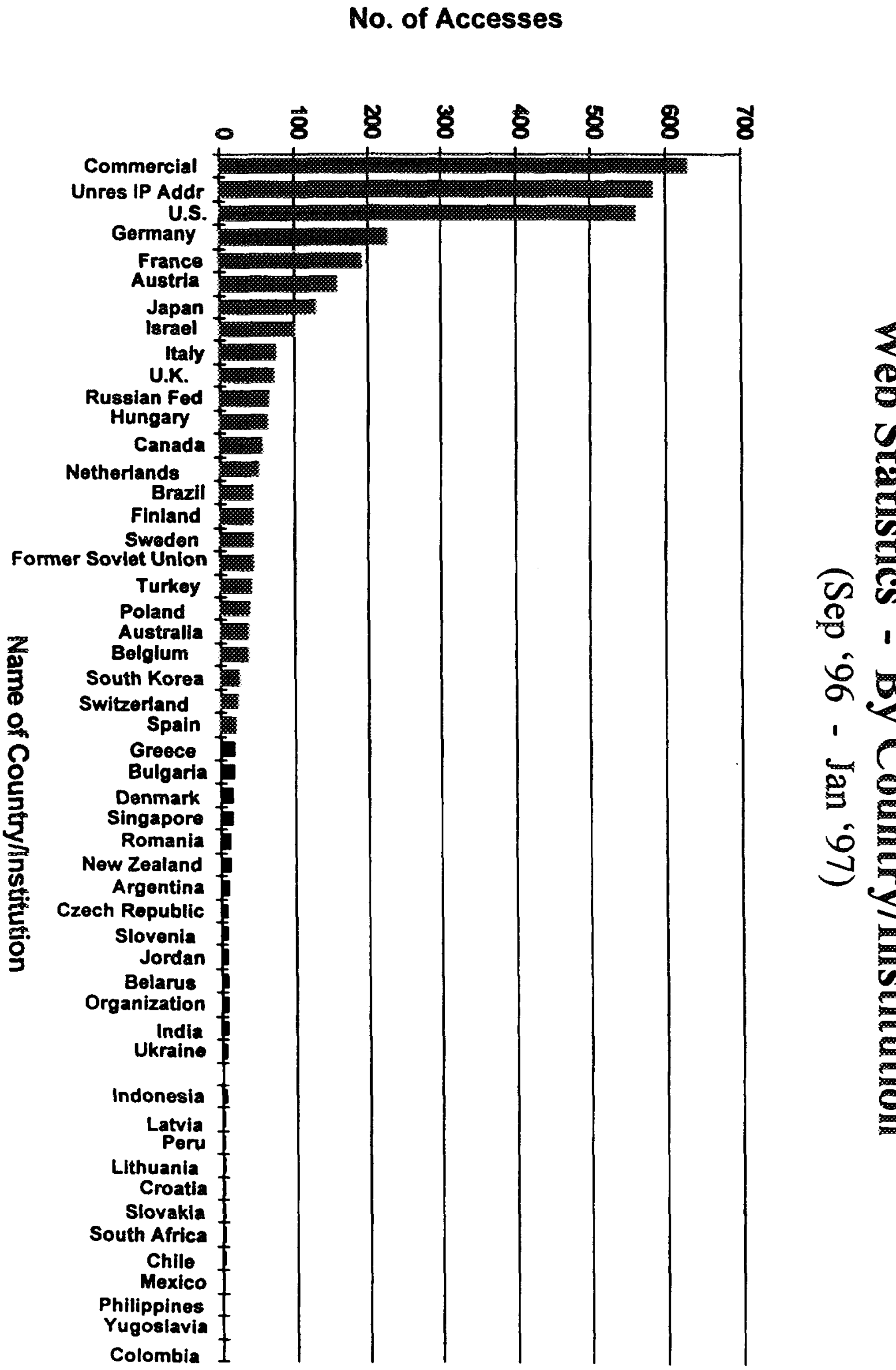


Fig. 2 shows the Web access up to January 1997 by country. Because of the Internet addressing system (unresolved numerical addresses and addresses ending with 'COM' or 'ORG'), not all accesses can be traced back to a particular country

Several files, databases, documents and programs are available (as an alternative to direct WWW access) by FTP (Internet File Transfer Protocol), as is the FENDL library. A statistics program to keep track of the number of retrievals made this way is still being developed.

III. COMPUTER OPERATIONS

Figure 1 shows the current Ethernet LAN configuration. The AlphaServer computer and most of its peripheral devices are now located on the Section's office floor (A23). The retired VAX-4000/200 had been housed in the IAEA's central computing facility, which has naturally tightly-controlled physical access for non-computer-centre staff members.

Furthermore, the following software products were installed on the AlphaServer over the last year or so to enhance its overall functionality and usefulness to the end-users:

a) Web browsers (Netscape and Mosaic) , a Web server and document viewers to allow the Section to build and maintain its own Web site as well as access other Web sites.

b) A MIME-capable messaging system and a powerful document conversion utility to handle the exchange and distribution of data, programs and documents through electronic mail.

c) DOS/Windows Emulator to allow X-Window terminal users who do not have a PC on their desktops to handle applications and documents which specifically require the DOS/Windows environment.

Inter-Centre Cooperation

The Section continued to benefit from having similar computing facilities to that of NNDC, Brookhaven, USA. In September 1996, T. Burrows installed on the AlphaServer Web-related applications software developed at the NNDC, particularly ENSDF and the Wallet Cards. Since then, retrieval of data through the Web site has demonstrated steady growth.

1. Planned Computing Facilities Upgrade

The Section will continue to upgrade its computer facilities when needed to match growth in the demand for service. For the period 1997 to 1998, the following activities are foreseen:

- Another Alpha-based workstation will be purchased for the incoming head of the data centre unit to give him the flexibility to run Windows NT, Digital UNIX or OpenVMS.

- Client/server applications will be developed to replace the outmoded "legacy" systems running on the IBM mainframe. The clients will be X-Windows-based desktops and the database server will be the AlphaServer.

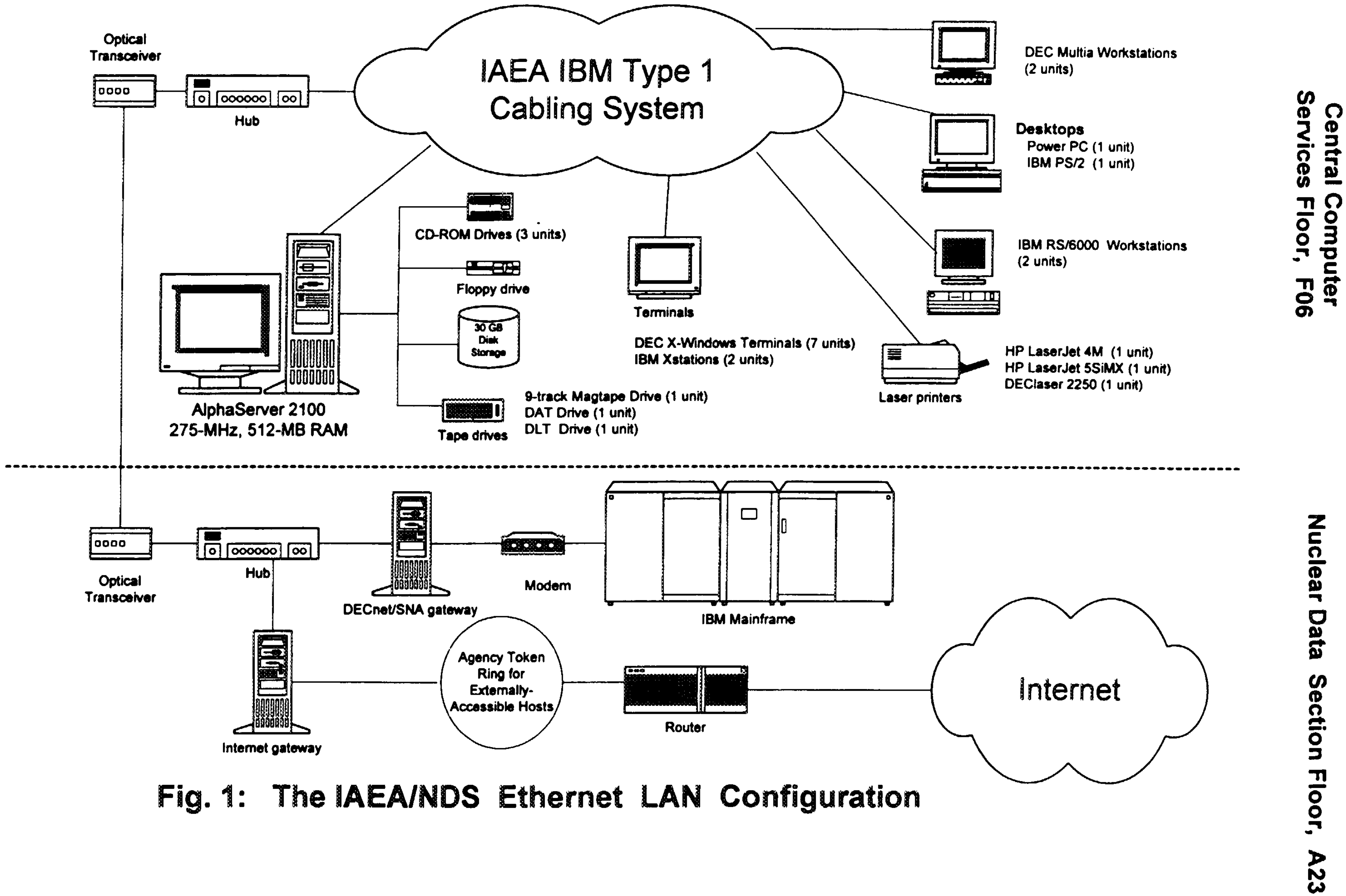


Fig. 1: The IAEA/NDS Ethernet LAN Configuration

- A Compact Disc writer has been purchased and installed in a PC. It will be used in distributing data libraries and processing codes on CD-ROM.

- An IBM E30 UNIX Server was purchased in July 1997 for the Atomic and Molecular Data Unit. This workstation will be the central server for accessing the atomic and molecular databases and has approximately three times the processing speed of the previous server.

IV. NETWORK COORDINATION

The network of eleven Nuclear Reaction Data Centers (see Table 7) continued its smooth cooperation, with four main elements:

- compilation of experimental data in EXFOR and CINDA;
- exchange of evaluated nuclear data files;
- exchange and joint operation of related software; and
- the work-sharing in the Data Center Services to customers worldwide.

In all of these elements there is lack of manpower, leading to delays in data transmission as well as in developing improved processing and checking codes. However, despite the reduced manpower available, significant amounts of valuable new data have been exchanged.

Status of data compilation

1. Neutron reaction data. The four centers, i.e. NNDC, NEA Data Bank, NDS, and CJD continue the compilation of new data in EXFOR and CINDA. The timeliness of the transmissions has improved, as can be seen in Table 8.

Table 8: CINDA/EXFOR data transmission (20 January 1997)

	Last CINDA entries received*)	**Last EXFOR entries received*)**
from NNDC	September 96	December 96
from NEA	August 96	December 96
from NDS	July 96	January 97
	(believed to be up-to-date and complete except for China)	
from CJD	January 97	January 97

*) The date given is that of the center-to-center data transmission

Though the regularity of transmissions between the four neutron centers has improved compared to the 1993/94 period, the delay from publication date to the center-to-center transmission was still between ½ year and 3 to 4 years, which is far from satisfactory (see Table 9).

Table 9: New EXFOR entries (neutron data) transmitted
January 1995 - January 1997

	Publication Year							
	96	**95**	**94**	**93**	**92**	**91**	**90**	**pre-90**
from NNDC	11	6	10	5	1	1	-	-
from NEA-DB	0	3	12	5	17	10	-	1
from NDS	2	6	13	1	4	-	-	15 (Chinese)
from CJD	0	11	19	7	5	7	4	10

In addition to the lack of staff for data compilation, there is still a serious lack of staff for programming, specifically for the programming of new features in EXFOR.

2. Evaluated Data

In 1995 - 1996, the following major evaluated data files have been released to the network:

- ENDF/B-VI updates and ENDF utility codes by NNDC
- CENDL-2.1 by CNDC
- EFF-2.4 by NEA-DB
- the neutron activation library ADL-3 and the intermediate energy data library MENDL-2 by CJD
- new version of PREPRO96 codes by R. Cullen

3. Charged-particle Reaction Data and Photonuclear Data

The charged-particle reaction data file in EXFOR has grown considerably. Between January 1995 and January 1997, 8 transmissions were received from CAJaD (Kurchatov Institute, Moscow), 3 of which contain compilations made in the Sarov center (Arzamas). Through NEA, 3 transmissions containing intermediate energy CPND, compiled at CAJaD under contract with NEA, were received. After an interruption of several years, NNDC transmitted 6 CPND EXFOR tapes in 1996. The first two CPND transmission tapes compiled at ATOMKI/Debrecen (finalized in cooperation with NDS) were also distributed. Contributions were received also from the two Japanese CPND centers and from the Chinese center.

In photonuclear data, the main compilation activity was a major revision of the EXFOR entries originating from the US "Berman file" by V. Varlamov (CDFE, Moscow State University) including not only corrections but many additional data tables, and one transmission of new compilations by CDFE.

RIKEN Nuclear Data Group

IAEA Technical NRDC Meeting
Vienna, 26-28 May 1997

Y. Tendow

EXFOR

The compilation works have been carried out successively. We have transmitted the TRANS R011 and R012. The TRANS R011 contained three entries R0051, R0052 and R0053 with a total of 89 subentries. However, the entry R0051 happened to be a duplicate of an already existing entry and therefore it has been deleted. The TRANS R012 was a re-transmission of the corrected R0052 entry. The compilation work for new entries after the R0052 is now in progress.

ENSDF, NSR

We continue the mass chain evaluation as a member of the Japanese ENSDF working group. After the A = 127 and 129 evaluations were published, the draft of A = 120 evaluation has been back from the review by the NNDC and is now under the author review. Hereafter, partial update works for A = 129 and 127 are expected to follow.

NSR compilation of secondary sources originated in Japan in 1996 has been carried out. A total of 175 works from eight annual reports has been sent to the NNDC to be incorporated into the Recent References.

Computers

The computer system is essentially the same as before. We are using PC's of Windows 95 and Macintosh platforms connected to the network. The processing programs we are using are of rather old version, so it is needed to update with the latest ones.

Staff

Present group members are unchanged since the previous year:

4	"professionals",	Y. Tendow,	EXFOR, ENSDF, NSR,
		A. Hashizume,	EXFOR, ENSDF,
		K. Kitao,	ENSDF, (EXFOR),
		A. Yoshida,	NSR.
1	"general service",	Y. Kidachi,	secretary, data preparation, maintenance.

To maintain the man-power of the group remains a problem to be resolved as well as to improve the quality of compilation.

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Japan Charged-Particle Nuclear Reaction Data Group (JCPRG)

Progress Report to the IAEA Technical Meeting May 26-28, 1997

The Executive Committee of JCPRG

General

In the latest meeting of the NRDF advisory committee, we had conclusions on our responsibilities in the international nuclear data centers' network;

(1) Compiling all CPND produced in Japan with NRDF,

(2) Translating data in NRDF into EXFOR format,

(3) Making a combined index database for the CPND in both of NRDF and EXFOR for the convenience of the customers in Japan,

(4) Distributing CPND and promoting utilization within Japan.

The JCPRG is organized by two committees (advisory committee and executive committee) and secretariat in order to accomplish above four duties. As the members of both committees are listed in Annex, the chairman of the NRDF executive committee was taken by K. Kato from H. Tanaka from April, 1997.

NRDF Data Compiling Activity

In 1996, we newly compiled 52 entries (1,176 tables) based on the data obtained at the accelerators in Japan. We list the institutes provided us with their data:

- Tohoku Univ.(CYRIC) — 1 entry
- Tsukuba Univ.(UTTAC) — 1 entry
- Institute or Nuclear Study, Tokyo Univ. (INS) — 9 entries
- Tandem Accelerator Labo., Kyushu Univ. — 4 entries
- Research Center for Nuclear Physics, Osaka Univ. (RCNP) — 10 entries
- JAERI Tandem, LINAC & V.D.G. — 4 entries
- RIKEN Accelerator — 10 entries

- KEK Accelerator — 9 entries
- Van de Graaff, Tokyo Inst. of Tech. — 3 entries
- Osaka Univ. — 1 entry

By March of 1997, amount of the data compiled have reached 24,319 tables of about 69.33 MB. Our aim is to store all data produced by Japanese accelerators in the NRDF database. The amount of data to be compiled is approximately 1,000 tables and 3 MB in every year.

EXFOR Translation from NRDF

Translation of the NRDF data compiled up to 1993 was done, but the work of translation did not progress for the data from 1994. Recently, we had discussions on the NRDF compilation of data and researched problems to increase amount of translatable data. From April, 1997, translation from NRDF to EXFOR has restarted, and our plan of this year (1997) is to translate the data compiled from 1994 to 1996 and to send them to IAEA.

Customer Services

For the purpose to extend the NRDF data service to more general users,
(1) we made the IntelligentPad system and
(2) we made our WWW homepage and opened to public the NRDF data,
in addition to the usual retrieval services of NRDF and EXFOR data by using computers in the Hokkaido University Computing Center.

Evaluated Data: Nucleosynthesis

New data evaluation activity for charged-particle data has been discussed to make nucleosynthesis database in Japan. Recently, the working group was organized.

ANNEX: Organization and members of JCPRG

Advisory committee:

Yasuhisa ABE (Research Institute for Fundamental Physics, Kyoto Univ.)

Yoshinori AKAISHI (Institute for Nuclear Study, Tokyo Univ.)

Yasuo AOKI (Tsukuba Univ.)

Junsei CHIBA (National Institute for High Energy Physics)

Masayasu ISHIHARA (Tokyo Univ.)

Ichiro KATAYAMA (Institute for Nuclear Study, Tokyo Univ.)

Mituji KAWAI (Kyushu Univ.)

Akira HASEGAWA (Japan Atomic Energy Research Institute)

Tetsuo NORO (Research Center for Nuclear Physics, Osaka Univ.)

Shunpei MORINOBU (Kyushu Univ.)

Hajime OHNUMA (Tokyo Institute of Technology)

Hikonojo ORIHARA (Cyclotron and Radioisotope Center, Tohoku Univ.)

Teijiro SAITOH (Tohoku Univ.)

Hajime TANAKA (Sapporo-Gakuin Univ.)

Yoshihiko TENDO (Institute of Physical and Chemical Research)

Kiyoshi KATO (Hokkaido Univ.)

Executive committee:

Kiyoshi KATO (Chairman, Hokkaido Univ.)

Akira OHNISHI(Hokkaido Univ.)

Shigeto OKABE (Hokkaido Univ.)

Toshiyuki KATAYAMA(Hokusei-Gakuen Univ.)

Yoshuharu HIRABAYASHI (Hokkaido Univ.)

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Shigeyoshi AOYAMA(Hokkaido Univ.)
Naoyuki ITAGAKI(Hokkaido Univ.)
Takakuki MYO(Hokkaido Univ.)
Yuji HIRATA(Hokkaido Univ.)

(2) Data input:

Takako ASHIZAWA
Hitomi YOSHIDA (Hokkaido Univ.)

NRDF System Maintenance:

Akira OHNISHI(Hokkaido Univ.)

Working Staff of Transformation from NRDF to EXFOR:

Masaki CHIBA(Sapporo-Gakuin Univ.)
Toshiyuki KATAYAMA(Hokusei-Gakuen Univ.)

The CAJAD progress report to technical nuclear data centers meeting Vienna, 26-28 May 1997

S. Yu. Babykina

Nuclear Structure and Reaction Data Center,

Kurchatov's Institute,

Moscow.

ACTIVITY of CAJAD

After our last meeting CAJAD EXFOR activity had two main problems:

1. Compilation for 'A' library.
2. Team-work with NEA DATA BANK.

Together with NEA DATA BANK we collect and compile data for medium energy (up to 1 Gev) proton interactions with the most important construction materials. We prepared 275 ENTRIES (end of 1996) and have plans to compile 100 ENTRIES additionally to end 1997. These ENTRIES contain very much differential data for elastic and inelastic scattering and production cross sections radioactive and stable isotopes. This work is problem orientated on removal radioactive waste products and must be finished before deadline time.

Now, I would like to take your attention for the proposal of NNDC. The proposals regarding the division of responsibility (see Memo CP-C/227 and Memo CP-C/229) shall increase the number of duplicated ENTRIES. In the present time we have been compiled 50 ENTRIES (Some old USA and Canada papers have been included too). Some times ago NEA-DB (but no CAJAD) prepared the compilations of some ORNL reports of F.Bertrand and Peele.(See ENTRIES O0288-O0293). Data tables of these reports contain 500 pages of digits approximately. These data tables have printed on paper, its are absent in electronic form. Does NNDC going to repeat this huge work? It will be obligatory if coordination efforts were stopped, as Memo CP-C/229 proposes. Can our cooperation to permit the duplication? All Centers have manpower deficit and any duplication will increase it.

I can not understand the reason for new division of responsibility?

I believe that the question about the division of responsibility for the compilation of charge particle reaction data must be decide on the Head' Centers Meeting 1998.

CONTRADICTIONS.

We would like to take your attention on the contradiction which is observed in our work.

1. The new particle code 'HE2' is not accepted (see Brookhaven Meeting, concl. 56), but 'HE2' is presented in Dic. 29.

2. 'Radioactive decay data should not be compile in EXFOR' (see Technical Meeting 1995, concl. 36) and further (see concl. 45 Technical Meeting 1995)- 'Subentry 40420.002 should be coded...(0,F)MASS,PR,NU '. But this is radioactive data.

3.' Use in Reaction SF7 any combination of codes from dic.33 and dic.27, without updating Dic.36' (see WP17 and Act.6 Technical Meeting 1995). Additionals to dic.36 contain SF7 again (see concl. 48, Brookhaven Meeting, 1996) and MEMO CP-C/224 and 230.

4. Isomer labels in Dictionary 27.

We took the attention of our collegues to specific isomer problem by Memo CP-A/80. I would like to remember this problem. According to ENSDF some nuclides have isomer state, but another sources (for example, last version of Karlsruher Nuclidkarte) do not contain these isomers. This situation forces us to return to old problem: 'What is an isomer?'

We proposed to accept conclusion-

'Isomer state label in Dictionary 27 must be set according to ENSDF'.

About transmission corrected ENTRIES

Change transmission ENTRIES must be simplify. It is enough to show in HISTORY that correction was made. Who are going to read all label in 80 columns of data-section? Users have interest to corrected data only.

SOFTWARE.

Our center improves quality the text-checking EXFOR program constantly. During to the last year some correction were included in this code aimed at better quality of Checking. I have the last version (May 1997) of EXFOR checking code. The remarks of our colleague for this welcomed.

TRANSES.

After Brookhaven meeting we transmitted TRANSES (A035-A039) prepared together ARZAMAS and checked CAJAD. TRANS A040 is ready now and I have it.

Nuclear Data Group RFNC-VNIIEF.

(NDG-VNIIEF)

Status report to the IAEA Technical Meeting, May 26-28, 1997.

S.A.Dunaeva

Russian Federal Nuclear Center - VNIIEF.
Russia, 607190,Sarov, Nizhnij Novgorod region, pr. Mira 37

Last year according to proposal of the Nuclear Data Center Meeting a group for support and development the experimental and estimated data libraries was set up at RFNC-VNIIEF. The tasks of the group are:

- support exchange of nuclear data and software between Nuclear Data Centers and VNIIEF.
- coordinate works on data compilation and estimation, which are performed at the institute to include them in the existing libraries.
- carry out the activities to correct data in graphic and tabular forms of the VNIIEF library on charged particles reactions on light nuclei (project ISTC 145) to match with the International experimental data library.
- coordinate the work being carried out at VNIIEF on creation the experimental and evaluated data libraries on gamma-production (project ISTC 731).
- upgrade and establish software for operation with nuclear data.

Activities of the group are being conducted jointly with Russian Nuclear data Centers (CAJAD and CJD).

Within the last year the following works were:

- software from USA National Nuclear Data Center (NNDC) on execution with experimental and evaluated data was received and installed;
- main international experimental and evaluated nuclear data libraries received.
- 252 entries of the charged particles reactions on helium and 163 entries of the charged particles reactions on lithium were compiled and transmitted in the international experimental nuclear data library. We planned to transmit 1500 entries in EXFOR in 1996. During compiling data into EXFOR we found a lot of errors in our entries. A set of entries has been already compiled in EXFOR by other Centers or was published after 1989, a some conformity with the format EXFOR were found and so on. Now we are need to check carefully all data;
- collaboration on compilation of a number of entries was established with USA National Nuclear Data Center (NNDC).

The following activities are planned to be fulfilled:

- entries of the charged particles reactions on beryllium, boron, hydrogen and fluorine are compiled and transmitted to the international experimental nuclear data library.
- entries of the gamma-production reactions are compiled and transmitted to the international experimental nuclear data library

• the data on charged particles reactions on the light nuclei and as well as total software for support these data on PC are prepared and transmitted to international evaluated nuclear data library.

We have received great support from NNDC and CAJAD, who checks all our data transmitted to the EXFOR.

I appreciate everybody, who gave us corrections and I believe that we shall collaborate fruitfully in the works we have planned.

Staff: Five persons are working on the tasks in part-time. Next year ISTC project 145 will be finish and our main problem now is to continue it.

China Nuclear Data Center
Status Report

Liang Qichang
China Nuclear Data Center
China Institute of Atomic Energy
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P.R.CHINA

1. CENDL

1.1. CENDL-2.1

Since the CENDL-2.1 released in the end of 1995, the following modification and improvement have been made.

(1). For the evaluation data of natural Hg and Tl, the gamma-production data have been added in the data files.

(2). The new evaluation for natural Ga has been completed

1.2. CENDL-3

According to the plan, the CENDL-3 will be completed by the end of 2000, CENDL-3 will contain about 200 nuclides, among them, about 90 fission product nuclides are new evaluations.

In the past year, the experimental data evaluation have been completed, and the theoretical model code SUNF used for fission product nuclides calculation has also basically been developed.

For the special files of fission yield, the important fission yields of Kr-85m,85,87,88, Zr-95, Mo-99, Xe-133,135m,135, Ce-144, Nd-147, Eu-155,156, and Tb-161 for U-235, U-238, and Pu-239 fission induced by thermal, fission spectrum, and around 14 Mev neutron have been completed.

2. EXFOR compilation

Since last consultants' Meeting on technical aspects of NRDC (May 1995), CNDC has compiled and transmitted 13 entries (most are fission yields) to NDS, another 5 entries have been compiled and will be transmitted to NDS after checked further.

3. Customer services

In order to manage the data libraries and to meet the customer services requirements, the utility codes, version 6.10, and the data base storage and retrieval system developed by NNDC were put into operation on micro-VAX-2.

The main libraries for evaluated neutron reaction data including CENDL-2.1, BROND-2.2, ENDF/B-6, JENDL-3.2, and JEF-2.2, the fission yields libraries including CENDL/FPY, BROND-2/FPY, ENDF-B6/FPY, JENDL-3.2/FPY, JEF-2.2/FPY, as well as the updated EXFOR master library have been loaded in micro-AVX-2, and the users can accesse the data on the terminal or PC directly.

4. Computer facilities

It became clear in the past two years that the CNDC micro-AVX-2 computer usage had saturated and can't meet the requirement of the nuclear data development,this was indicated by degraded interactive user response and reduced input-output performance, such a situation was not unanticipated since the computer is relatively slow and outmoded by current computing standards.

Now we have purchased a DEC ALPHA SERVER 4000 5/300 with operation system OPEN VMS 7.x, 512 MB main memories and 3*4 GB hard disk, it will be installed in CNDC befor September 1997, the local network will be created on the base of this computer and micro-AVX-2, SUN workstation, and other auxiliary facility, as well as some PC as shown in Fig.1, the NNDC online system will be adopted on ALPHA computer, all this changed greatly the computer situation in CNDC required some efforts and time to learn new software and gain experience in operation with nuclear data libraries in new computer system, for this purpose, a young staff member of CNDC as IAEA fellow has gone to NNDC in May 1997 for six months.

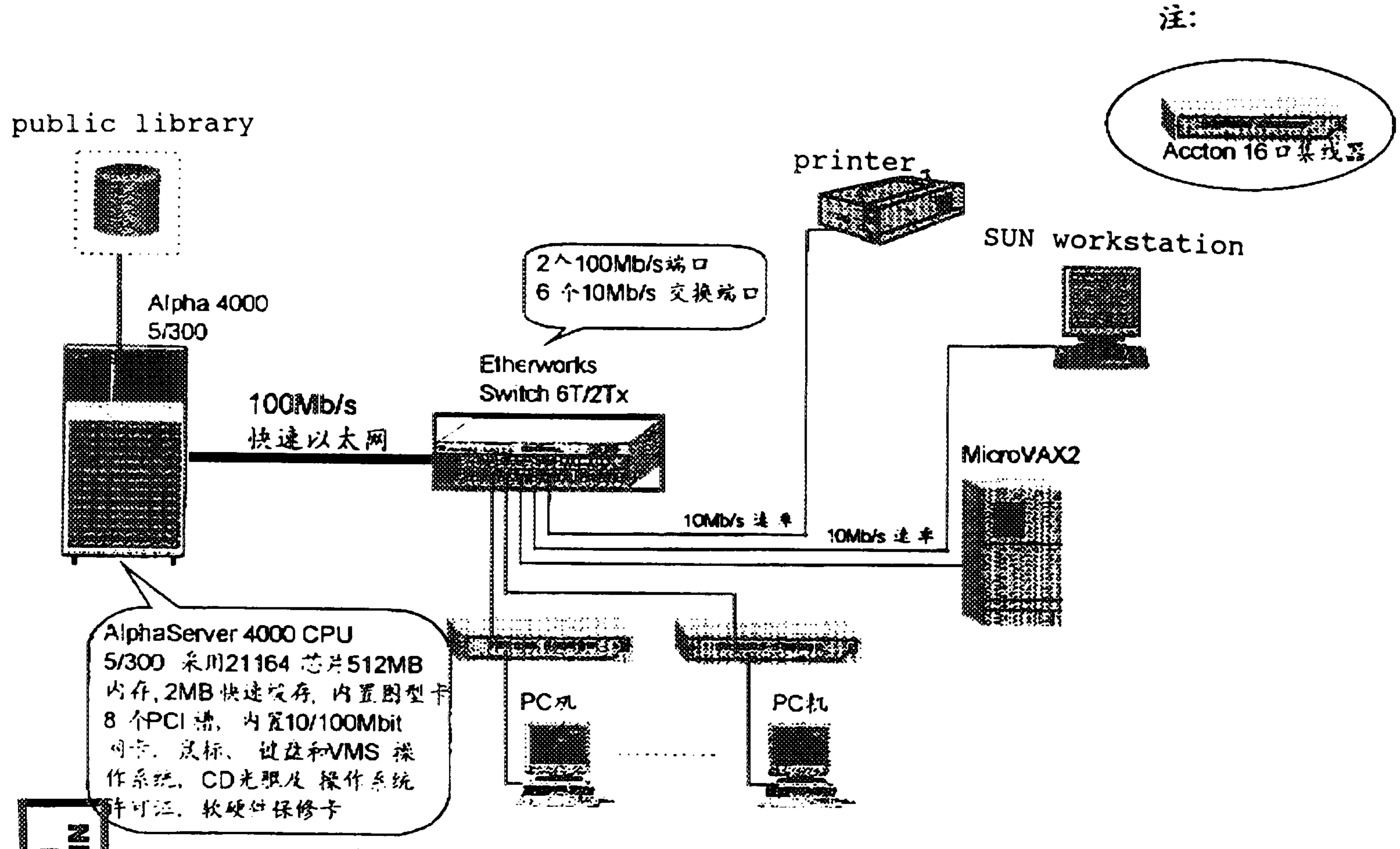


Fig. 1 Computer Network in CNDC

The Russian Nuclear Data Center(CJD)

Progress Report
to the IAEA Technical NRDC Meeting
(Vienna, 24-28 May 1997

V.N.Manokhin.

1. CINDA and EXFOR.

Since May 1996 up to May 1997 the CJD has transmitted 4 CINDA batches (018 - 021) with 1859 entries in exchange format.

During the same period the CJD has compiled data from 48 publications and transmitted TRANS 4101-4104, which contained 88 entries (67 entries are new). The number of subentries is 736 (300 subentries are new). The data from 21 works has been corrected.

Having in mind a lot of new applications for which the nuclear data are needed we consider the completness of EXFOR library as the most important task of CJD activity and the NRDC Network activity as well.

2. COMPUTER MATTERS.

We continue to develop our local computer network. Now 14 personal computers AT 486 DX and AT 486 DX2 are connected with ALPHA 3600S. The work is made to improve the hardware and software of the system. This year the additional RAM with 64 Mb and HDD with 2 Gb were installed. The scheme of the CJD local computer network is shown in Appendix.

The ALPHA computer is used for data processing and for theoretical model calculations of nuclear reactions.

3. EVALUATION ACTIVITY.

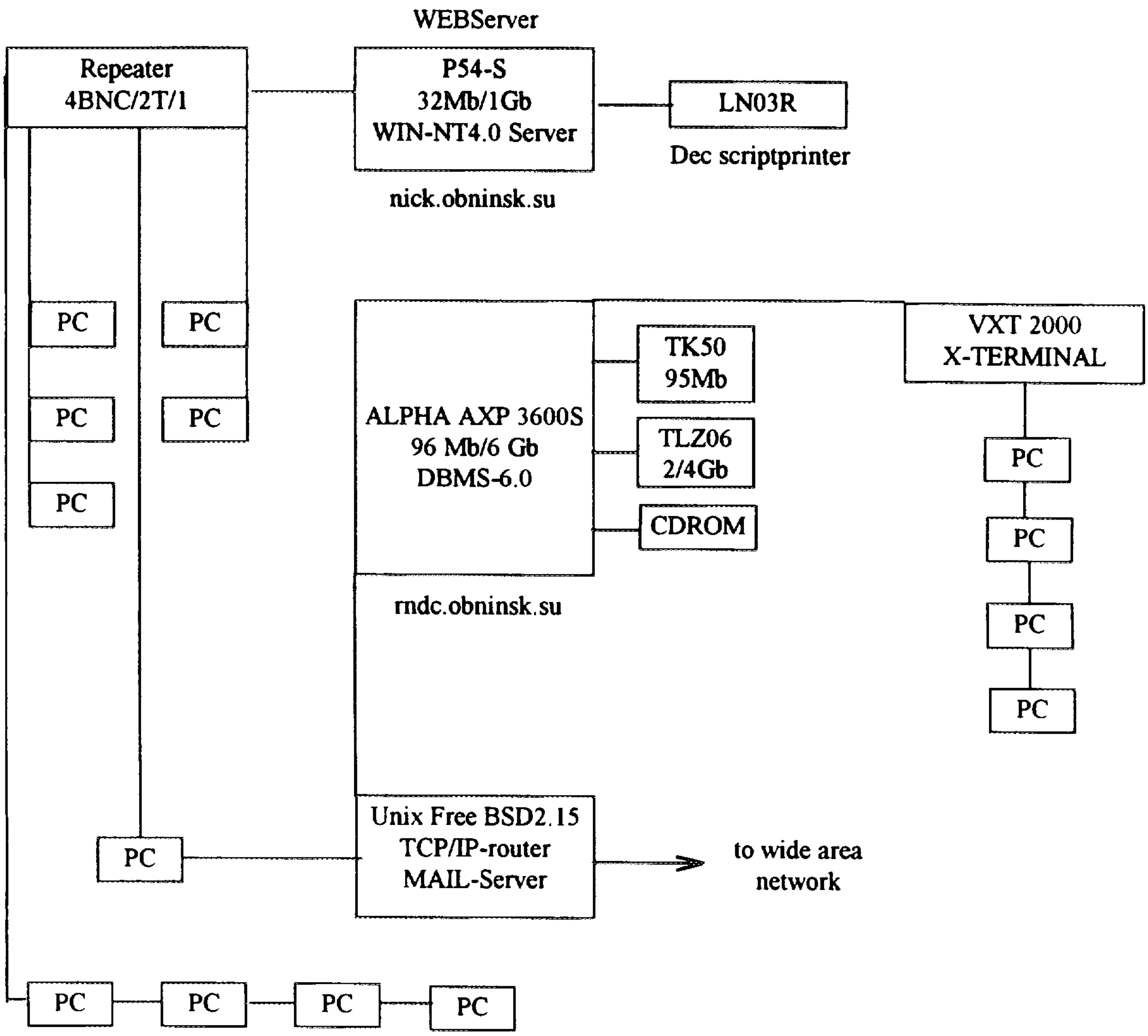
The evaluation activity in the CJD is on high level. It is connected with new requirements in nuclear data and participation of the CJD staff in some international projects. As a result of great work of the CJD in the comparison and analysis of all available experimental and evaluated cross sections of neutron induced threshold reactions the new systematics of excitation functions were developed, which can be effectively used for the selection of more reliable evaluated data and also in the analysis of experimental data.

On the basis of these systematics an expert system of quality analysis and reliable selection of neutron induced threshold reactions can be developed. There is a set of small data processing codes, which enable to do some simple operations with nuclear data curves and calculate excitation functions using systematics relations.

At the present time the systematics of excitation functions for fissile isotopes are under development.

Appendix

The CJD local computer network



NEA DATA BANK

PROGRESS REPORT FOR 1996

NRDC Meeting at IAEA NDS, Vienna

26 - 28 May, 1997

1. INTRODUCTION

Carrying out the Data Bank and Nuclear Science programmes has been made difficult in 1996, and again in 1997, by uncertainties as to the total budget available until well into the year concerned, and by the need to make significant savings. Following a request in 1996 by some members of the NEA Steering Committee to make appreciable savings in the cost of support services, the Secretariat proposed a reduction in this item of 14 percent over the period 1997-98. For the Data Bank as a whole, the reduction in 1997 will be 5 percent.

2. NUCLEAR DATA SERVICES

Experimental (EXFOR) and Bibliographic (CINDA) data compilation

The Data Bank's objective, in the compilation of CINDA and EXFOR entries, is to be continuously up-to-date. This means that all known and relevant publications older than six months should be compiled, entered in the data bases and sent to the other data centres. In the beginning of 1996, it became clear that the Data Bank was getting too far behind in its compilation efforts both for the CINDA and EXFOR data bases. In order to catch up with this backlog, the Data Bank concentrated its efforts in 1996 initially on the compilation of CINDA entries, as these will help identify the publications containing experimental data for the EXFOR data base. This special effort resulted in a compilation of over 1000 new entries to the CINDA bibliographic data base in 1996, compared to the 300 envisaged.

In parallel with the effort on the CINDA data base in 1996, the Data Bank also worked on deficiencies in older EXFOR entries. Following feedback from users and from other data centres, a certain number of existing entries had been identified as having more or less serious errors in them. Seventy-one (71) EXFOR data sets were revised/updated in 1996.

The correction of older EXFOR entries will continue in 1997 and 1998, in parallel with the compilation of new entries identified. In the first three months of 1997, 34 new EXFOR works and 22 corrected works had been compiled.

The international nuclear data conference, held in May 1997 in Trieste, will lead to an increased volume of data needing compilation in CINDA and EXFOR in 1997 and 1998.

The retirement of the computer system manager, who has been replaced by another Data Bank staff member, with subsequent optimisation of the Data Bank's staff resources, have made it possible to allocate a second full time post dedicated to nuclear data activities, commencing October 1997. This new situation will significantly help the Data Bank to remain up-to-date with its data compilation duties, in addition to its responsibility in the JEFF project.

Intermediate Energy Nuclear Data (IEND)

Intermediate energy nuclear data are compiled into EXFOR on the basis of the IEND request list, established in Subgroup 13 of the Working Party for Evaluation Cooperation, and are also available freely from the NEA Data Bank/ECN Petten Partitioning and Transmutation Website. During 1996, 100 data sets were compiled under an arrangement with the Kurchatov Institute, while 15,000 data points from new measurements were contributed by Hannover University. Plans are to compile 180 data sets in 1997.

The JEFF Project

A number of subgroups, each coordinated by an expert in the field, were set up by the JEFF Scientific Co-ordination Group to produce the summary documentation for JEF-2.2. The documentation will contain both information about the content of the JEF-2.2 files and results from the extensive benchmark testing that the file has undergone. Work in the subgroups continued in 1996, and a final report is expected in Autumn 1997.

An initial selection of materials for a JEFF-3 starter file, undertaken in 1995, was followed in 1996 by a more rigorous review of candidate evaluations. Final selections for the most important isotopes, such as the light elements, the structural materials, and the major and minor actinides were taken in mid-1996. The physical assembly of the starter file was started in the latter part of 1996. The largest part of the JEFF-3 general purpose starter file, covering the fission product isotopes, is being selected by a specific subgroup, which will hold its first meeting in mid 1997.

Among the JEFF special purpose files, the most voluminous is the radioactive decay data file, with over 2300 isotopes. A special working group within the JEF project is working on the selection and verification procedures for this part of the library. Another very large file will be the newly adopted activation file, which has been developed mainly by ECN Petten, the Netherlands, and by Culham, UK, within the EFF-EAF project. The work of translating this library into strict ENDF-6 format has been started at ECN Petten. A new fission yield library for the JEFF-3 file is being prepared by BNFL, UK.

Assembly of the JEFF-3 starter file will continue in 1997. A starter file for structural materials should be available by the middle of 1997; work on the rest of the starter file is likely to take at least the remainder of 1997, with compilation of the fission product part of the JEFF-3 starter file being performed in 1998. Concerning the special purpose file, the main workload for the Data Bank will be the assembly and testing of the radioactive decay data file. This work will begin in 1998, but before starting it is difficult to estimate exactly how long it will take.

Quality Assurance Procedures

Following the approval of the JEFF Quality Plan in mid 1996, and completion of the more general Quality Manual, the Data Bank continued to write the more specific Control Procedures, with the help of external experts. The initial idea was to restrict the QA system only to the JEFF project, but this was later considered impractical, since it is necessary to take into account correlations with for example computer system related tasks, such as file back-up, data copying and dispatch procedures, and with the registration and storage of official documents. This extension of the Quality Management System to encompass all activities related to nuclear data led, in 1996, to the writing and completion of five additional generic Control Procedures, while work has been started on three more.

The maintenance of the JEFF Quality Assurance system will continue in 1997 and 1998. Writing additional Control Procedures, covering mainly registration and storage of official documents, will be started in 1997.

Services to Nuclear Data Users and Publications

One hundred and fifty-seven (157) data requests were dealt with manually in 1996. This figure represents not only the largest or most complex requests, but also requests for new users or those without access to the Internet. A total of 1.6 Gbytes of data were retrieved from the on-line data bases in 1996, and an additional 0.4 Gbytes of textual information were downloaded from the Data Bank's nuclear data related Web pages. The volumes of on-line data requests have been steadily growing and it is therefore predicted that about 2.0 Gbytes of data will be retrieved in 1998, with between 8-10 thousand user accesses.

Development of a new extended version of the JEF-PC desktop software for viewing evaluated data continued in 1996. The new package will be distributed with three CD-ROMs containing evaluated data from seven libraries (JEF, ENDF, JENDL, BROND, CENDL, EFF and EAF), as well as all experimental neutron data contained in EXFOR. At the present time the package is undergoing beta testing and is scheduled for completion by summer 1997.

Due to lack of contributions, the 1996 issue of the Nuclear Data Evaluation Newsletter (NNDEN) was suspended. Instead, it is hoped to issue a version in 1997 covering the last two years.

Manpower for Nuclear Data

In 1996, 11 man-months were available for basic nuclear data, and 16 man-months for data evaluation.
For 1997 and 1998, the effort needed for basic nuclear data is estimated at 12 man-months, with 16 man-months for data evaluation.

3. COMPUTER PROGRAM SERVICES

Program Acquisition/Revision of Existing Information

Newly acquired information in 1996 consisted of 114 items, most of them computer codes, but with an increase compared to previous years in general purpose basic data libraries and data sets from integral experiments (integral shielding experiments (11), fuel performance data sets covering more than two hundred fuel rods). Revisions of cross section data verification and processing codes were received as well as new nuclear model codes. A number of new or revised neutronic design, lattice and cell, and radiation transport codes were acquired. 33 of these codes were released by the Radiation Safety Information and Computation Centre (RSICC), and 13 by the Energy Science and Technology Software Centre (ESTSC). 21 of these packages were contributed by countries or organisations not members of the OECD.

A new release of the International Criticality Safety Benchmark Handbook was issued in 1996 in hard copy. The CD-ROM version was released at the beginning of 1997. Further critical systems are being added and a new electronic issue is scheduled for 1998.

Abstracts concerned with data libraries used by codes were improved: lists of nuclides, group structures, weighting, temperatures and other useful parameters are now provided systematically to facilitate computerised search of appropriate libraries by the user. Also an analysis was made of the present validity of some categories of codes, and a major cleanup was carried out by removing obsolescent codes from the library. This cleanup will continue during 1997 so that the new DBAIS management system for computer program services can be brought into service with fully revised program content.

Testing, Validation and Master-filing of Computer Programs

The number of programs tested in 1996 was less (65 programs/data sets) than in previous years. Computer codes tend to be increasingly bigger and more complex, thus requiring an increasing workload to standardise, test and validate. In addition, the changes that were being applied to the program management system have drawn more human resources than expected. The man-months of consultants allocated for helping to improve the situation turned out to be insufficient. Extended testing of the SCALE system was carried out in close cooperation with Oak Ridge.

Distribution of Programs

During 1996 an overall increase in dispatch of computer programs compared to previous years can be noted. In fact a historical high was reached (1837), due to two main factors:

- increasing interest in integral experiments data bases (IFPE for instance)

- large distribution at ICTP Workshop in Trieste in cooperation with the IAEA.

In fact 497 computer codes were sent to the non-OECD area. This should also be compared with 425 computer codes distributed, originating from outside OECD. In addition 255 copies of the international Handbook of Criticality Safety Benchmarks were distributed worldwide, both in hard copy and CD-ROM.

A trend can be observed concerning the distribution method requested by users: as in the previous year about two-thirds of the programs requested were sent out on diskettes, one-fifth on cartridges; however no dispatches were made on tape reels, instead CD-ROMs have been the medium increasingly replacing them. Distribution via network in 1996 was below the 1995 level. The reason is that most codes have documentation in paper form only, and that the retrieval method available to users was not very convenient. A new system has been developed and installed, and experience in the first four months of use in 1997 shows that the percentage of codes distributed via Internet has doubled. For the future we expect CD-ROMs to replace cartridges and to a large extent diskettes. This trend should amplify in 1998.

Computer Program Service Data Base Management

The integrated Data Bank Administration Information System (DBAIS), which takes care of the bookkeeping of all service transactions (acquisition, storage, testing, distribution, information on users, feedback) is a computerised QA enforcing tool still operational on the VAX-4000 in the form in which it has been used in the last decade. This system has been optimised over the years but is now being transformed to a relational data base structure, as an investment for maintaining this system over the next decade. In fact with the increase of computing power and available memory, relational data bases have become the preferred support for their flexibility and advanced user interfaces. Also, development of the data base system currently in use has been stopped by the vendor. Design and implementation of a new DBAIS system on ORACLE has been progressing and at present applications are being programmed. The migration to the new system will take place during 1997 with the old system working in parallel for thorough testing. In fact all functionalities of the present system, plus some new ones, will be maintained. A possible extension to include the bookkeeping for the data services is being investigated. DBAIS will be brought into full service in 1998.

Training courses and workshops

Several training courses, seminars and workshops were held in 1996 with the aim of contributing to an effective utilisation of widely used computer codes, to improve communication between authors and users.

Two introductory training courses for MCNP (Monte Carlo, neutron, photon, electron transport) were held at the University of Stuttgart, Germany. One specifically concentrating on dosimetry applications with MCNP was held at ENEA Bologna in cooperation with the CEC; a SCALE course (criticality, source term, shielding and heat transfer) on spent fuel was held in Stuttgart; finally a training course on the electron and photon transport code EGS4 was held in Montpellier in cooperation with FIRAM.

A seminar on 3D deterministic transport codes was held in December 1996, in which all such new codes were presented and a benchmark proposed. Finally, one workshop of the NJOY user group was held in December and the latest version of the code presented and future developments discussed.

Manpower for computer programs

In 1996, 34 man-months were available for software standards, validation and exchange of computer programs, and 4 man-months for calculation methods for fission reactors.

In 1997, 33 man-months are foreseen for software standards, validation and exchange of computer programs, and 4 man-months on calculation methods for fission reactors. In 1998 these allocations will be 34 man-months and 4 man-months respectively.

4. COMPUTER INFRASTRUCTURE

Introduction

Following preliminary work in 1994, notably a test conversion of the EXFOR data base to ORACLE, the principle of moving to a workstation-based open system with a UNIX and ORACLE software environment was agreed in 1995. In addition to potential flexibility in the choice of hardware, this approach made it possible to envisage "rolling renewal" of equipment from an annual budget, rather than loan financing over the lifetime of a central computer. The Data Bank had built up its use of Internet starting in 1993, and providing access initially to on-line user services under VMS, based on the DEC 6000-510 central computer.

In autumn 1995, when details of the new UNIX/ORACLE configuration were agreed, the Data Bank had three DEC Alpha workstations under UNIX, one under VMS for use in developing the new EVAluated data storage system, and a media workstation to be used for copying computer program packages and data onto a variety of tape cartridge media (DAT, QIC and EXABYTE at different recording densities) for UNIX and VMS.

Hardware and software to constitute the core of the new UNIX configuration was acquired early in 1996:

- Internet and Intranet servers
- The DBAIS server for Computer Program Services tasks
- Workstations for EVAluated data and TDB services
- Two "Gatekeeper" stations for Firewall protection
- Central software for automated file/database backup and for updating systems software on all UNIX stations

At that time, good development versions of EVA, TDB and EXFOR were available, as well as a prototype Webserver. Data base programming for EVA and TDB was carried out largely by software consultants, and included a QA module for control and documentation of file changes, added to EVA for Quality Assurance of the new JEFF-3 evaluation. Many of the necessary QA procedures had been defined and documented in autumn 1995.

Development of the UNIX system in 1996

Although some staff members were familiar with UNIX, the base of knowledge and experience among Data Bank staff was far narrower than for VAX/VMS. Training in UNIX was organised in February-April 1996, and an expert consultant engaged to build up the UNIX system and assist users in bringing the ORACLE/UNIX versions of their data bases into service, and to work with Digital engineers in defining, setting up and tuning the operation of the two Gatekeeper ("firewall") stations.

As will be seen below, most operations are now running on their intended workstations under UNIX and with data bases reprogrammed for ORACLE. Computer program service operations have been transferred from the DEC-6000 central computer to a DEC-4000 server, pending transfer to a UNIX server; the DEC-6000 was disconnected from the network early in 1997. A systems programming assistant is being recruited, specialised in ORACLE and UNIX.

Development on the Internet server in 1996

This work was carried out in-house to a very large extent, using software tools developed specifically for the Web (WWW or World-Wide Web). As of April 1997, nearly all the problems experienced during development have been resolved, and the focus of interest in-house has transferred from the functioning of the NEA Webserver and file transfer mechanisms to the content which should be made available to users, and how it should be presented.

Work on the UNIX system and ORACLE data bases

The system configuration as of May 1997 comprises the following stations now running fully in their intended role as data base carriers, user stations and security guardians:

- The external Internet server providing Web facilities for the Data Bank (data, program information and text information) and for the Agency as a whole, with the address NEA.FR.

- The Intranet server carries a copy of all the information intended for presentation on the external Internet server (whose contents are compared daily with the Intranet server, in case of loss or corruption of data) as well as the NEA's internal Web.

- The two UNIX Firewall stations, which filter all traffic between the Internet and the Data Bank workstations, and between these workstations and the OECD and NEA office automation network.

- The EVA workstation carrying the EVA data base and its JEFF/QA section with detailed recording of all modifications, used for compilation of the JEFF-3.T starter file for the new JEFF-3 evaluation.

- The UNIX/ORACLE development station, also carrying the EXFOR data base of nuclear reaction cross-section data.

- The Media workstation which carries copies of both VMS and UNIX systems, and can run (with the same peripherals) under either one, used for making copies of programs or data onto VMS or UNIX media.

- Two further stations for program testing under UNIX

- An external VMS server used as a platform for the NNDC Brookhaven data bases ENSDF, NSR and NUDAT.

Stations/databases where significant programming work needs to be completed in 1997 are:

- The TDB (Thermochemical Data Base) station, used for customer service, but loaded with a static copy of the data base, which is still updated in its VMS/DBMS form. Highest priority has been given in 1997 to publishing two volumes in the Chemical Thermodynamics series; this has in turn delayed completion and testing of the complex updating and checking programs in their ORACLE/UNIX version. It is hoped to complete the transfer in autumn 1997.

- The Computer Program Services station (UNIX/ORACLE). The new version of the DBAIS management system is advancing well, and it is hoped to make the transfer from the present VMS/DBMS system at the end of 1997 or early in 1998. The main immediate tasks are: transformation of the applications accessing the central data base (language upgrade); completion of semi-automatic procedures for preparing program packages in a standard form for dispatch via Internet, on CD-ROM or diskettes; utilities for correspondence indexing and media storage indexing. Later tasks will be transferring the program Master Files to the UNIX server, and documentation.

- The ADDress data base should be common to all Data Bank users, and at least compatible with an NEA-wide system. A prototype is running; it needs to be assessed, modified and brought into service rapidly as an essential Data Bank tool. This work should be completed in 1997.

- Migration of the CINDA data base, currently maintained on a VAX-VMS workstation, to a simplified management system on the Web. While there is little public access to CINDA, it contains the information needed to identify nuclear data which should be compiled into EXFOR, and as such is essential. This work will be done in 1998.

Manpower for computer infrastructure and development

The main manpower for this work is supplied by the Systems Manager, with help as necessary from the groups concerned. In addition an expert consultant was employed for eight months in 1996 to install and test the UNIX and ORACLE systems. In 1997 his work will be supplemented by consultant help.

SCIENTIFIC MANPOWER USE IN THE DATA BANK (man-months)

Project area	*1996*	*1997*	*1998*
Co-ordination, Computing infrastructure and development	38	30	30
Computer program services			
Software standards, validation and exchange	34	33	34
Calculation methods for fission reactors	4	4	4
Nuclear Data Services			
Basic Nuclear Data	11	12	12
Evaluated Nuclear Data	16	16	16
Scientific Support Services			
Support for Nuclear Science	6	10	10
Support to other NEA divisions	28	20	19
TOTAL DATA BANK MANPOWER	137	125	125

CHARGED PARTICLE NUCLEAR DATA GROUP, DEBRECEN

Status Report
to the
Consultants' Meeting
on Technical Aspects of Co-operation
of the Nuclear Reaction Data Centres
26 - 28 May 1997

(Sándor Takács)

General

The Debrecen Nuclear Data Group is working within the Cyclotron Application Department of the Institute of Nuclear Research of the Hungarian Academy of Sciences (ATOMKI).

We have continued the compilation and the critical comparison of several selected reactions used for production of medically important radioisotopes, for monitoring charged particle beams and for thin layer activation measurements. New experimental cross section determination were made as the part of a systematic investigation of the above mentioned type of reactions.

Recent Progress

In the second half 1996 we have compiled 18 new CPND entries (155 sub-entries) in EXFOR format. The entries were checked and corrected by the NDS. In 1997 till May 15 new entries were compiled and transferred to NDS for checking.

Staff

The staff consist of five "professional" members working only in part-time.

In December 1996 one person participated at a two week training course of the NDS to study the practical aspects of the compilation of Charged Particle Nuclear Data in EXFOR format.

Because of he limited manpower and because the Debrecen Group is involved in another CRP project of the IAEA and because one person was away for a quarter of the year in 1997 the EXFOR compilation work slowed down for that period of the year.

Computer Facilities

For data handling and storage we use Personal Computers (PC) and their environments (large hard disk 1 GByte, 5 GByte EXABYTE tape unit, scanner for graphical data input). Since the last meeting we have installed a new PC (Pentium 100 MHz) which is used to handle EXFOR data.

For data input and editing the DOS Editor is used, for checking the new entries the Chukreev's checking codes are applied. In the lack of proper retrieve software for PC we use the Microsoft Winword 6.0 to search on index files or on EXFOR data files. Doing that it is necessary to divide the entire Charged Particle Data file into smaller sections and retrieve the desired entry manually. The PCs can communicate with each other trough local network and can have access to other centres trough international network.

We have checked the on-line service of the IAEA as well as the file transfer protocol (FTP) to fill down data from the server of the Agency, but we found it almost useless because of the very low speed of the connecting line. To use the FTP to transfer large files (> 1 Mb) is very difficult because of the frequent break down of the connection.

Compilation, evaluation and measurements of selected reactions

Beside the compilation of CPND in EXFOR format the Debrecen Group is participating in a Co-ordinated Research Program on "Development of Reference Charged Particle Cross Section Data Base for Medical Radioisotope Production" co-ordinated by IAEA. The CRP focuses on beam monitor reactions and production reactions for most important gamma- and positron emitter isotopes induced by light charged particles with an incident energy up to 100 MeV. The work programme contains compilation and evaluation of the existing data and some new experimental measurements.

We have continued the compilation and the critical comparison of several selected reactions used for production of medically important radioisotopes, for monitoring charged particle beams and for wear measurements. The reactions included in the scope of the CRP are given in tables 1 - 3. The results of compilation and evaluation of cross sections for production of ^{67}Ga and ^{111}In and p, d, alpha and ^{3}He induced monitor reactions on Cu, Ti, Ni and Fe are already published or accepted for publication in a referred journals.

All the old published data which we encounter during the CRP work and are not included in the EXFOR library will be compiled in EXFOR format by the Debrecen Group.

The new experimental data published from the Jülich and the Debrecen Institutes will be also entered into the EXFOR library by the Debrecen Group.

Table 1. Monitor reactions evaluated in the CRP

Particle	Reaction	Product half life	Phase	Additional experiment
p	$^{27}Al(p,3p3n)^{22}Na$	2.6 y	I	
	$^{nat}Ti(p,x)^{48}V$	16.0 d	I	σ
	$^{nat}Ni(p,x)^{57}Ni$	1.5 d	I	σ, n eff.
	$^{nat}Cu(p,x)^{56}Co$	77.7 d	I	
	$^{nat}Cu(p,x)^{62}Zn$	9.3 h	I	
	$^{nat}Cu(p,x)^{63}Zn$	38.1 min	I	
	$^{nat}Cu(p,x)^{65}Zn$	244.1 d	I	
d	$^{nat}Al(d,x)^{22}Na$	2.6 y	II	
	$^{nat}Ti(d,x)^{48}V$	16.0 d	II	σ
	$^{nat}Fe(d,x)^{56}Co$	77.7 d	II	σ
	$^{nat}Ni(d,x)^{61}Cu$	3.4 h	II	σ
^{3}He	$^{nat}Al(^{3}He,x)^{22}Na$	2.6 y	II	
	$^{nat}Ti(^{3}He,x)^{48}V$	16.0 d	II	σ
	$^{nat}Cu(^{3}He,x)^{66}Ga$	9.5 h	II	σ
	$^{nat}Cu(^{3}He,x)^{67}Ga$	3.3 d	II	σ
	$^{nat}Cu(^{3}He,x)^{65}Zn$	244.1 d	II	σ
α	$^{nat}Al(\alpha,x)^{24}Na$	14.7 h	II	
	$^{nat}Ti(\alpha,x)^{51}Cr$	27.7 d	II	σ
	$^{nat}Cu(\alpha,x)^{66}Ga$	9.5 h	II	σ
	$^{nat}Cu(\alpha,x)^{67}Ga$	3.3 d	II	σ
	$^{nat}Cu(\alpha,x)^{65}Zn$	244.1 d	II	σ

Table 2 Reactions for medical radioisotope production. Single photon emitters

Nuclei	Half life	Nuclear reaction	Phase	Additional measurement
^{67}Ga	3.3 d	$^{67}Zn(p,n)^{67}Ga$	II	yield
		$^{68}Zn(p,2n)^{67}Ga$	II	σ, yield
$^{81}Rb(^{81}Kr)$	4.6 h(13s)	$^{82}Kr(p,2n)^{81}Rb$	II	
		$^{nat}Kr(p,2n)^{81}Rb$	II	
^{111}In	2.8 d	$^{111}Cd(p,n)^{111}In$	I	yield
		$^{112}Cd(p,2n)^{111}In$	I	σ
		$^{nat}Cd(p,xn)^{111}In$	I	
^{123}I	13.2 h	$^{123}Te(p,n)^{123}I$	I	yield
		$^{124}Te(p,2n)^{123}I$	I	yield
		$^{127}I(p,5n)^{123}I$	I	yield
^{201}Tl	3.0 d	$^{203}Tl(p,3n)^{201}Tl$	I	
		$^{nat}Tl(p,xn)^{201}Tl$	I	
^{211}At	7.2 h	$^{209}Bi(\alpha,2n)^{211}At$	II	

Table 3 Reactions for medical isotope production. Positron emitters.

Nuclei	Half life	Nuclear reaction	Phase	Additional measurement
^{11}C	20 min	$^{14}N(p,\alpha)^{11}C$	II	
^{13}N	10 min	$^{16}O(p,\alpha)^{13}N$	II	
^{15}O	2 min	$^{14}N(d,n)^{15}O$	II	σ
^{18}F	110 min	$^{18}O(p,n)^{18}F$	II	σ
		$^{20}Ne(d,\alpha)^{18}F$	II	σ
$^{62}Zn(^{62}Cu)$	9.3 h(9.7 min)	$^{63}Cu(p,2n)^{62}Zn$	II	
$^{68}Ge(^{68}Ga)$	288 d	$^{69}Ga(p,2n)^{68}Ge$	II	
$^{68}Ge(^{68}Ga$	288d	$^{nat}Ga(p,x)^{68}Ge$	II	
$^{82}Sr(^{82m}Rb)$	25.5 d	$^{85}Rb(p,4n)^{82}Sr$	II	
		$^{nat}Rb((p,x)^{82}Sr$	II	yield

The last column of the tables indicates the new experiments required to perform on different reactions and quantities.

Services

The group supply charged particle reaction data for Hungarian users.

Addresses:

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S. Takács: takacs-s@atomki.hu

Recent References

1. B. Scholten, Z. Kovács, F. Tárkányi and S.M. Qaim:
Excitation Functions of Deuteron Induced Reactions on ^{123}Te:
Relevance to the Production of ^{123}I and ^{124}I at Low and Medium Sized Cyclotrons.
Applied Radiation and Isotopes **48**, 267 (1997)

2. S. Takács S, A.A. Azzam, M. Sonck, F. Szelecsényi, Z. Kovács, A. Hermanne and F. Tárkányi:
Excitation Function of $^{122}Te(d,n)^{123}I$ Nuclear Reaction: Production of ^{123}I at Low Energy Cyclotron.
Applied Radiation and Isotopes (submitted)

3. A. Fenyvesi, S. Merchel, S. Takács, F. Szelecsényi, F. Tárkányi and S.M. Qaim:
Excitation Functions of $^{nat}Ne(^{3}He,x)^{22,24}Na$ and $^{nat}Ne(a,x)^{22,24}Na$ Processes:
Investigation of Production of ^{22}Na and ^{24}Na at a Medium Sized Cyclotron.
Radiochimica Acta (in press)

4. F. Szelecsényi, S. Takács, A. Fenyvesi, Z. Szücs, F. Tárkányi, S-J. Heselius, J. Bergman and T.E. Boothe:
Study of the $^{197}Au(p,pn)^{196m1,m2,g}Au$ and $^{197}Au(p,n)^{197m}Hg$ Reactions and their Application for Proton Beam Monitoring in Radioisotope Production.
International Conference on Nuclear Data for Science and Technology, Trieste, 1997.

5. M. Sonck, S. Takács, F. Szelecsényi, A. Hermanne and F. Tárkányi:
Excitation Functions of Deuteron Induced Reactions on ^{nat}Mo from Threshold to 21 MeV an Alternative Route for the Production of $^{94m,99m}Tc$ and ^{99}Mo.
International Conference on Nuclear Data for Science and Technology, Trieste, 1997.

6. A. Fenyvesi, S. Takács, F. Szelecsényi, G. Petõ, F. Tárkányi, T. Molnár, S. Merchel and S.M. Qaim:
Excitation Functions of Charged Particle Induced Reactions on Neon: Relevance to the Production of ^{22},^{24}Na and ^{18}F
International Conference on Nuclear Data for Science and Technology, Trieste, 1997.

7. F. Tárkányi, Z. Kovács, L. Andó, F. Szelecsényi and S. Takács:
Production of ^{123}I at Small Cyclotrons.
2nd School and Workshop on Cyclotrons and Applications.
March, 1997, Cairo, Egypt.

8. S.M. Qaim, A. Hohn, B. Scholten, F. Tárkányi, Z. Kovács, S. Takács and H.H. Coenen:
New Nuclear Data Relevant to the Production of the Positron Emitting Radioisotopes ^{124}I and ^{120g}I.
XIIth Symposium on Radiopharmaceutical Chemistry, Uppsala, Sweden, 1997.

1. M. Sonck, A. Hermanne, F. Szelecsényi, S. Takács and F. Tárkányi:
Study of the $^{nat}Ni(p,x)^{57}Ni$ Process up to 44 MeV for Monitor Purposes.
Applied Radiation and Isotopes (accepted).

2. S. Takács, F. Tárkányi, M. Sonck, A. Hermanne and S. Sudár:
Study of Deuteron Induced Reactions on Natural Iron and Copper and their Use for Monitoring Beam Parameters and for Thin Layer Activation Technique.
Proc. XIV International ,Conference on the Application of Accelerator in Research and Industry. Denton, TX, USA, 6-9 Nov., 1996 (accepted).

3. S. Takács, M. Sonck, B. Scholten, A. Hermanne and F. Tárkányi:
Excitation Functions of Deuteron Induced Nuclear Reactions on ^{nat}Ti Up to 20 MeV for Monitoring Deuteron Beams.
Applied Radiation and Isotopes (in print).

4. F. Szelecsényi, T. E. Boothe, S. Takács, F. Tárkányi and E. Tavano:
Evaluated Cross Section and Thick Target Yield Data Bases of Zn+p Process for Practical Applications.
Applied Radiation and Isotopes (accepted).

5. S. Takács, M. Sonck, A. Azzam, A. Hermanne and F. Tárkányi:
Activation Cross Section Measurements of Deuteron Induced Reactions on ^{nat}Ni with special Reference to Beam Monitoring and Production of ^{61}Cu for Medical Purpose.
Radiochimica Acta 76(1997)15.

6. F. Tárkányi and P. Oblozinsky:
Development of Reference Charged Particle Cross Section Data Base for Medical Radioisotope Production.
International Conference on Nuclear Data for Science and Technology, Trieste, 1997.

7. F. Ditrói and I. Mahunka:
Investigation of the He-3 Induced Reactions on Natural Ti for the Purpose of Activation Analysis and Nuclear Implantation.
International Conference on Nuclear Data for Science and Technology, Trieste, 1997.

9. A. Hermanne, M. Sonck, S. Takács, F. Szelecsényi, J. Van hoyweghen and F. Tárkányi:
Influence of Secondary Neutrons on Cross Section Determination of Proton and Deuteron Induced Reactions on ^{nat}Ti targets.
International Conference on Nuclear Data for Science and Technology, Trieste, 1997.

NATIONAL NUCLEAR DATA CENTER

Status Report
to the
Consultants' Meeting
on Technical Aspects of Co-operation of the Nuclear Reaction Data Centers
26 - 28 May 1997

General

Since the last meeting of the Nuclear Reaction Data Centers in June 1996, our staff has remained constant (there are currently 8 full-time equivalent scientific/professional and 4 support staff). We have one consultant who is responsible for the coding of Nuclear Structure Reference entries. We are now looking for a permanent staff member to fill this position. We also have 3 adjunct positions. During this period we have also had a consultant from the Sarov Research Center to work on charged-particle data compilation. We are also working with students from San Jose State University on an electronic "Barn Book".

Computer Facilities

We have purchased a Pentium Pro Windows NT server in order to investigate various windows NT server capabilities. Wincenter software has been installed on a Pentium PC which then works as an intranet application server and allows xterminal users to run PC applications.

Bibliographies

The NSR activity has continued. One supplement of ***Recent References*** has been published.

The CINDA compilation activity has continued at a reduced level. Those references associated with the experimental data compiled at the Center have been entered. In the period from June 1996 through May 1997, 3 CINDA transmissions have been sent (BNL146-148).

Data Libraries

In the period from June 1996 through May 1997, 7 neutron data (TRANS 1261-1267) and 8 charged particle data (C016-C023) transmission files were sent containing new and corrected entries. The statistics for the current CSISRS library are attached.

Evaluated Nuclear Reaction Data

NNDC continues to coordinate the work of the Cross Section Evaluation Working Group.

Release 4 of ENDF/B-VI has been prepared and transmitted. The ENDF-102 Formats and Procedures Manual Revision 2/97 and the ENDF-201 Summary Documentation were issued and are availalbe online.

Nuclear Structure Data

NNDC continues to publish the ***Nuclear Data Sheets***. As of May 1997, issues through Volume 81, #1, have been sent to Academic Press.

Customer Services

In 1996, there were 488 requests processed in-house. Of these, 332 were for documents, 100 for CD ROM's, 25 for ENDF, 14 for CSISRS(EXFOR), 14 for ENSDF, and 9 for bibliographic information.

The NNDC WorldWideWeb page has been moved to the Alpha; retrievals from ENSDF, Relativistic Heavy-Ion Data, and NUDAT have been added, and NSR is under development. The use of the Online Data Service seems to have stabilized, probably because of the addition of the WWW services. There are now about 1300 customer accounts with about 1700 users. Last year there were about 6,600 retrievals per month from the Online Service, and about 10,000 retrievals per month total for all online services.

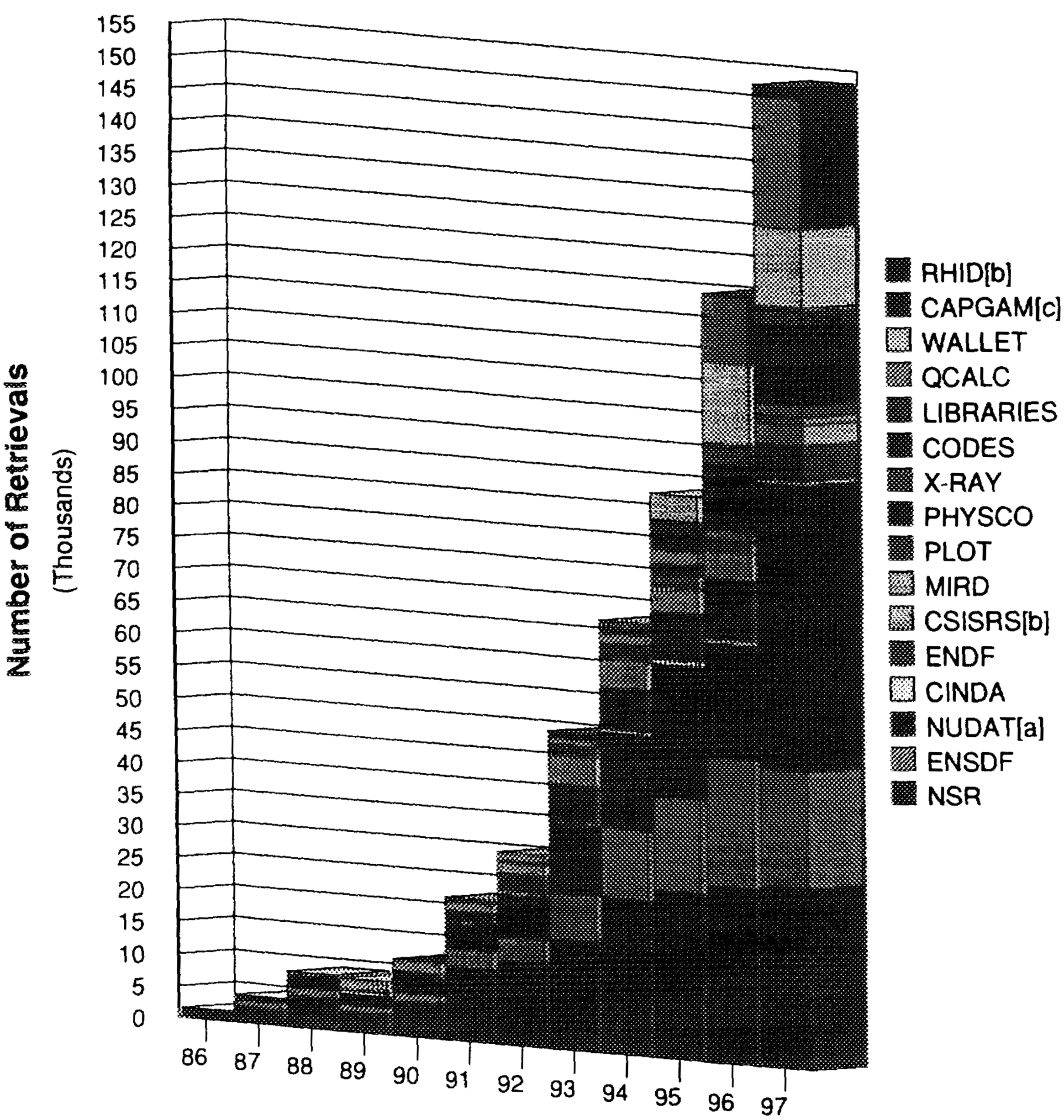
A chart of Online Retrieval Statistics is attached.

Publications

The following publications were issued from June, 1996 through May, 1997.

- S. Ramavataram, C. L. Dunford, Nuclear Science References Coding Manual, BNL-NCS-51800 (1996)
- V. McLane, EXFOR Basics, BNL-NCS-63330 (1996)
- V. McLane, Citation Guidelines for Nuclear Data Retrieved from Databases Resident at the Nuclear Data Centers Network, BNL-NCS-63381 (1996)
- P. Ekström, R. R. Kinsey, E. Browne, Nuclear Data and References, CD ROM (1996)
- V. McLane and Members of CSEWG, ENDF-201 ENDF/B-VI Summary Documentation Suppl. 1; ENDF/HE-VI Summary Documentation, BNL-NCS-17541, Suppl. 1 (1996)
- CSEWG, ENDF-102 Data Formats and Procedures for the Evaluated Nuclear Data File ENDF-6, V. McLane, C. L. Dunford, P. F. Rose, eds., BNL-NCS-44945, Rev. 2/97 (1997)

*NNDC On-Line Data Service, World Wide Web (W^3), and FTP Retrievals 1986-1997**



* Extrapolated as of April 30, 1997.

[a] Added to Web March 12, 1997.

[b] Added to Web November 25, 1996. CSISRS includes RHID retrievals since November 25, 1996.

[c] Thermal Neutron Capture γ's added to Web March 4, 1996.

CSISRS Library Statistics

May 14, 1997

Area	# entries	# subentries	# data points	Last tape
Neutron				
1	3 530	17 639	2 030 806	1267
2	2 216	15 024	1 534 390	2141
3	1 052	5 418	58 780	3101
4	1 177	7 695	187 943	4104
Total neutron	7 975	45 776	3 811 919	
Charged particle				
A	788	5 116	124 609	A039
B	178	1 538	16 828	B011
C	317	1 850	63 728	C023
D	101	681	13 928	D020
E	124	1 923	31 948	E015
O	269	5 027	151 604	O004
P	706	11 552	11 552	P001
R	428	5 925	5 925	R011
S	342	4 954	4 954	S009
Total charged particle	3 253	38 566	424 536	
Photonuclear				
G	13	29	455	G007
L	59	726	39 619	L005
M	494	2856	83 641	M019
Q				
Total photonuclear	566	3 611	123 715	
Evaluation V	41	618	36 380	V025
Grand total	11 835	88 571	4 396 550	

Selected Working Papers

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DISTRIBUTION OF TRANS TAPES

The distribution pattern of EXFOR TRANS tapes is the following:

- Each of the four centres producing neutron EXFOR TRANS tapes (NNDC, NEA-DB, NDS, CJD) will continue to send their tapes to each of the other three centres.

- All centres will send their "non-neutron" TRANS tapes only to NDS.

- NDS will, after checking them, send these "non-neutron" tapes to all centres needing the particular data type:

NNDC:	all data types
NEA-DB:	all data types
CJD:	all data types
CAJaD:	CPND only
CDFE:	PhotoND only
CNDC:	receives from NDS all data types (including neutron data) in CSISRS backup format
RIKEN:	none
Sapporo:	CPND only
Debrecen:	CPND only
NDG-RFNC:	all data types

Media for data exchange between Centres

Please indicate which centre will accept what media for the various types of data. If more than one medium is acceptable, the preferred one is in **bold**.

I	=	e-mail (Internet)	D5	=	PC diskette 5½ inch
F	=	FTP (Internet File Transfer)	D3	=	PC diskette 3½ inch
T	=	conventional magnetic tape	H	=	hardcopy or fax

	NNDC	NEA-DB	NDS	CJD	CAJaD	CDFE	CNDC	RIKEN	JCPRG	ATOMKI	NDG-RFNC
Cinda batch	I,F	I,F,D3	**I** (F,D3,D5)	(D3,D5) **I,F**	-	-	I,T,(D3,D5)	-	-	-	-
EXFOR TRANS	I,**F**	I,F,D3	T,F,D3,D5	(D3,D5) **I,F**	**D3,D5**	F,D3	**D3**,I,T,D5	**F**,D3	**F**	I,**D3**,D5,F	F
CP-Memos and 4C-Memos	**I**,H	H,I	H,I	(H),**I,F**	**I**,(H)	I,F	H,D5,I,D3	H,I	**I**,H	H,I	I,H

Notes:

1) If data are sent in zipped (compressed) mode on diskette, the unzipping code should be included on the diskette.

2) **For memos, H (hardcopy) should be acceptable at least as a secondary choice (for receiving).**
Centres are free to send their own memos always electronically.

List of TRANS tapes exchanged since the 1996 NRDC meeting

NEUTRON DATA

Center	TRANS	Dated	
NNDC	1262	96-09-26	
	1263	96-11-04	
	1264	96-12-04	
	1265	97-03-13	
	1266	97-04-17	
	1267	97-04-23	*)
NEA-DB	2136	96-11-12	
	2137	96-12-08	
	2138	96-12-20	
	2139	97-02-06	*)
	2140	97-01-30	*)
	2141	97-02-14	*)
NDS+CNDC	3100	96-11-12	
	3101	97-04-25	
CJD	4101	96-05-30	
	4102	96-10-08	
	4103	96-12-19	
	4104	97-04-22	
NDS	(V025	92-07-29)	

CPND

Center	TRANS	Dated	
CAJaD	A034	96-05-24	
	A035	96-05-24	
	A036	96-12-05	
	A037	96-12-05	
	A038	97-01-17	
	A039	97-03-03	
NNDC	C017	96-07-11	
	C018	96-10-01	
	C019	96-12-26	
	C020	97-02-25	
	C021	97-04-01	
	C022	97-05-05	*)
	C023	97-05-08	*)
NDS+ATOMKI	D020	97-01-17	
JCPRG	(E015	95-04-28)	
NEA+CAJaD	O004	97-01-21	*)
	O005	97-02-14	*)
RIKEN	R011	97-01-15	
CNDC	(S009	95-11-17)	

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*) Not yet processed at NDS (TRANS received in May 1997)

Photonuclear Data

NDS	(G007	92-02-14)
NNDC+CDFE	L006	97-02-10
CDFE	M019	96-03-12

Pending EXFOR items

	For details see:
1. Angular distributions as a function of momentum transfer	CP-C/226,232, CP-A/79 *)
2. New names for elements 104 -109	e-mail McLane 97-03-11
3. New formalism for incident source code MPH=	CP-C/225
4. New coding for thick-target yields	CP-C/224,233 e-mail Chukreev 97-03-26 e-mail McLane 97-04-02
5. Polarization	CP-C/228,230
6. Proposal on INC-SPECT	CP-A/77 e-mail McLane 97-05-07
7. Units B*KEV = MB*MEV	CP-A/76, CP-C/223

*) Copies of the respective memos are available from the IAEA Nuclear Data Section

EXFOR Corrections

1.Pending retransmissions

It is important that all centers submit corrections to their Exfor entries where retransmission was requested by another center.

In view of the many TRANS tapes distributed shortly before this meeting, the review of retransmissions requested earlier, which are still pending, is postponed until this TRANS tapes are processed. A summary of this review will be distributed.

2.Special problems

2.1 Neutron data in TRANS A039

```
               From                Memo CP-D/283

To: Distribution                                     11 April 1997

From: O.Schwerer

Subject: TRANS A039

.........

 Subentries A1125.003 and A1403.002,3 contain neutron data which were
compiled earlier as subentries 10866.002 and entry 20534, respectively.
In case of A1125 / 10866 the data are identical; in the case of A1403 /
20534 the area 2 entry has data received from authors by private
communication which A1403 has not. We propose to delete the concerned A
subentries (they were not removed from TRANS A039 by NDS).
```

....

Proposal: a) Action on CAJaD to delete the concerned subentries
(retransmit with NOSUBENT)
b) Conclusion/Reminder on how to treat mixed CPND / Neutron works

2.2 Requested deletion of entry R0010

In April 1996 it was agreed between NDS, RIKEN and ATOMKI that entry R0010 should be deleted because it duplicates an ATOMKI entry which contains more information.

Proposal: Action on RIKEN (procedure for deletion of a whole entry)

2.3 Use of FLAG in TRANS A038 to distinguish different quantities

From Memo CP-D/281

To: Distribution 19 February 1997

From: O.Schwerer

. . . .

Entries A0502, A0512, A0513, A0514, A0515, A0557: Distinction between independent, cumulative and "unclear" cross sections by FLAG is probably not the best solution. What about using different REACTION codes

```
IND,SIG
CUM,SIG
(CUM),SIG  (with free text explanation of "unclearness")
IND/M+,SIG
```

with either multiple reaction formalism or splitting into several subentries?
We understand however that the compactness of the tables, which may be more user-friendly but has less accurate data definitions, would be lost. We request either retransmission or discussion at the forthcoming data centres meeting.

. . . .

```
FLAG       (1.) This is Independent Cross Section.                 A0502001    65
           (2.) This is Cumulative Cross Section.                  A0502001    66
           (3.) The Kind of Cross Section is Unclear.              A0502001    67
           (4.) This is Independent Cross-Section + Isomer.        A0502001    68
HISTORY    (930603C)                                               A0502001    69
           (961024A) Flags are Added in All Subentries. Method andA0502001    70
           Monitor are Corrected.                                  A0502001    71
           (961216U) Last checking has been done.                  A0502001    72
ENDBIB              70                                             A0502001    73
COMMON               3          3                                  A0502001    74
EN         ASSUM       ERR-1                                       A0502001    75
MEV        MB          PER-CENT                                    A0502001    76
       660.       10.5        2.5                                  A0502001    77
ENDCOMMON            3          3                                  A0502001    78
ENDSUBENT            3                                             A050200199999
SUBENT        A0502002      961216                                 A0502002     1
BIB                  2          3                                  A0502002     2
REACTION   (27-CO-59(P,X)ELEM/MASS,,SIG,,,EXP)                     A0502002     3
SAMPLE     Co(3)O(4) Was Used. The Thicknesses of Used Targets     A0502002     4
           Were 0.356 and 0.453 G/Cm**2.                           A0502002     5
ENDBIB               3                                             A0502002     6
NOCOMMON             0          0                                  A0502002     7
DATA                 7         22                                  A0502002     8
ELEMENT    MASS       DATA       ERR-T      ISOMER     DECAY-FLAG A0502002     9
FLAG                                                               A0502002    10
NO-DIM     NO-DIM     MB         MB         NO-DIM     NO-DIM      A0502002    11
NO-DIM                                                             A0502002    12
        28.        57.      0.206      0.009                   10.A0502002    13
         1.                                                       A0502002    14
        27.        58.       54.1        3.0         0.        13.A0502002    15
         4.                                                       A0502002    16
        27.        57.       30.4        0.9                   14.A0502002    17
         1.                                                       A0502002    18
        27.        56.       8.04       0.28                   15.A0502002    19
         2.                                                       A0502002    20
        27.        55.       1.33       0.05                   16.A0502002    21
         2.                                                       A0502002    22
```

....

```
From: IN%"chukreev@cajad.kiae.su"  "Chukreev F.E." 28-FEB-1997 13:29:00.03
To:   IN%"Schwerer@IAEAND"
CC:   IN%"NNDCVM@BNL.GOV"
Subj: item 2 of MEMO CP-D/281
```

To: Dr. O. Schwerer
From: F.E. Chukreev
Copy: V. McLane
Subject: MEMO CP-D/281 (item 2)

Your remark regarding to A0502 and similar Entries is suitable. **CAJAD would like to refuse from ELEM/MASS formalism. I had information that NNDC has special code to transform ELEM/MASS for separate SUBENTRIES.** Therefore I sent (03-Dec-96) a letter to V. Mclane, but a reply is absent. My information was incorrect, probably. I have not a time to do needed code now, but it must do some later.

Sincerely yours F.E. Chukreev

Proposal: a) Action on CAJaD to retransmit the concerned entries
b) Conclusion clarifying keeping of ELEM/MASS formalism

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Memo CP-C/229

DATE: April 24, 1997
TO: Distribution
FROM: C. L. Dunford, V.McLane vm
SUBJECT: Charged-particle data compilation responsibility
Re: CP-C/227, CP-A/79

As we said in our previous memo, CP-C/~~226~~ 227, the NNDC feels that we should aim toward a higher level of completeness in the compilation of the data. The NNDC would now like to modify the current agreement on charged-particle data compilation responsibility. We propose to take responsibility for all data from the US and Canada.

Regarding the comments to this proposal in Memo CP-A/79 concerning timeliness of the data compilation: we think that by eliminating the need to get approval from CAJaD before compiling the data from our area, we will be able to compile the data sooner. We have also made good contacts with many of the experimental groups in our area, and are able to obtain the data electrically in many cases.

A center is always free (as has been done at the neutron data centers) to compile data for their own use at any time.

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V. Varlamov, CDFE
Zhang Zingshang, CNDC

cc: Arcilla
Lammer
Muir
Oblozinsky
Schwerer
Wienke

MEMO CP-A/79

22 April 1997

To: Distribution
From: F.E. Chukreev
Subject: 1. MEMO CP-C/226
2. MEMO CP-C/227

1. MEMO CP-C/226

1.1 I would like to take your attention to old CAJAD proposal to include TRMOM code for transferred linear momentum. (See WP7 in INDC(NDS)-360). Brookhaven's meeting (June 1996) did not agree our proposal.(See CONCLUSION, item 59, p.25 of INDC(NDS)-360).

NNDC proposal is similar old CAJAD proposal. If this proposal will be accepted we will have two data heading for transferred linear momentum (WVE-NM, which was accepted by Brookhaven's Meeting and MOM-TR from CP-C-226).

Do we have need for two equal data heading?

1.2 Regarding to LEXFOR entry on ANGLE.

Data unit 1/Fermi is data unit for wave number of residual nuclei, but not one for transferred momentum.

Wave number is (Transferred momentum)/(Plank's constant).

Besides, transferred momentum is equal in CM and LAB-systems.

2. MEMO CP-C/227

This MEMO proposed to change "Agreement on Charged-Particle Data Compilation Responsibility" (See Appendix 1 in INDC(NDS)-360) and quoted this "Agreement...." with a little misprint regarding to CAJAD area.

My opinion, that new return to this subject is not needed. All problems could be decided by current coordination.

But, if NNDC wishes to secure the responsibility on CPND compilation, then NNDC and another Centers must promise to compile data which are needed for another Centers during to FINITE time!

For example, needed data must be transmitted within 3 months.

Is it possible?

CAJAD proposal: to conserve Brookhaven's agreement on CPND compilation responsibility.

F.E. Chukreev

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Memo CP-C/227

DATE: April 9, 1997
TO: Distribution
FROM: C. L. Dunford, V.McLane
SUBJECT: Charged-particle data compilation responsibility

We propose that it is time to rethink the division of responsibility for the compilation of charged-particle reaction data. Since the NNDC has begun compiling charged-particle data, and has made contact with the experimentalists measuring charged-particle data in the U.S.A. and in Canada, we have been receiving many data sets published before 1990. We feel that now we should aim toward a higher level of completeness in the compilation of all data.

A start was made at the last NRDC meeting at Brookhaven with the agreement on data from 1990 onward. We would now like to extend this agreement to all data, meaning that a regional center can be responsible for the compilation of all data from their area.

The current agreement (for 1990 onward) is that the following centers will compile **all** experimental data for light charged-particle reactions within their geographically-assigned area: NNDC (US and Canada), CAJaD (Former Soviet Union), JCPRG (Japan), CNDC (China), ATOMKI (Jülich and Hungary). CAJaD is responsible for coordinating compilation for data from all other areas, but not for completeness in those areas.

We propose to take responsibility for **all** data from the US and Canada. Are other centers willing to take responsibility for completeness in their areas, and are any other centers interested in taking responsibility for any of the remaining geographical areas?

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Zhang Zingshang, CNDC

cc: Arcilla
Lammer
Muir
Oblozinsky
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(1996) Agreement on Charged-Particle Data Compilation Responsibility

Compilation Centers

NNDC	NEADB
Sapporo	RIKEN
CAJaD	CNDC
Atomki	

Area of Responsibility

New Data (1989→)

NNDC will be responsible for data from the U.S. and Canada.
ATOMKI will be responsible for data from Hungary and Jülich.
CAJaD will be responsible for the rest of the world.

Old Data (→1988)

Sapporo will be responsible for data from Japan.
CAJaD will be responsible for all other data.

Data Compilation

New Data (1989→)

A center wishing to compile data (C1) will contact the center in whose area of responsibility the data were produced (c2) with a list of the data sets to be compiled. C2 will inform C1, as quickly as possible, whether the data either have been compiled or are in the process of being compiled by another center.

If the data are not compiled or being compiled, C2 will either agree to compile them with priority, or ask that C1 compile the data and send them to C2 to be included in the next regular C2 transmission file.

Old Data (→1988)

A center wishing to compile data (C1) will contact all other centers with a list of the data sets to be compiled. The center responsible for the data (Sapporo or CAJaD) will inform C1, as quickly as possible, whether the data either have been compiled or are in the process of being compiled by another center.

If the data are not compiled or being compiled, C1 will compile the data and include in the next regular C1 transmission file.

NACRE: an European network for the compilation of nuclear reaction rates

This document is a brief presentation of the NACRE network: Nuclear Astrophysics Compilation of REaction Rates.
NACRE is supported until 31 May 1997 by the Directorate General for Science, Research and Development of the European Commission in the frame of the Human Capital and Mobility Program.

- **Administrative coordination of the network:**

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- **Scientific coordinators of the network:**

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- **Laboratories in the network**

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2. Service de Physique Nucléaire Théorique et Physique Mathematique, Université Libre de Bruxelles, Brussels, BELGIUM.
3. Centre de Spectrometrie Nucléaire et Spectrometrie de Masse, Orsay - FRANCE.
4. Institut für Physik mit Ionenstrahlen, Ruhr-Universität Bochum - GERMANY
5. Institut für Strahlenphysik, Universität Stuttgart - GERMANY.
6. National Centre for Scientific Research 'Demokritos', Athens - GREECE.
7. Istituto Nazionali di Fisica Nucleare, Laboratori Nazionali del Gran Sasso - ITALY
8. Centro de Fisica Nuclear, Universidade de Lisboa - PORTUGAL
9. Department of Physics, University of Edinburgh - UK

- **Associated Laboratories:**

1. Universidade Catolica Portuguesa, Figueira da Foz - PORTUGAL
2. Institut d'Astrophysique de Paris - FRANCE
3. Institute of Physics and Nuclear Engineering, Bucharest - ROMANIA
4. Observatoire de Géneve - SWITZERLAND

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Objectives of the NACRE network

Charged-particle induced reactions play a key role in the understanding of the generation of energy in stars and of the synthesis of the nuclides. For astrophysical purposes, the rates of these reactions have to be known from near the Coulomb barrier down to far below that energy. The objective of this project is the build-up of an updated and well documented compilation. More specifically:
(i) updating the experimental and theoretical data,
(ii) distinctly referencing the sources of data (resonance properties, cross sections, ...),
(iii) evaluating the uncertainties,
(iv) providing a clear distinction between theoretical results and experimental data and,
(v) providing numerically integrated reaction rates, widely used analytical formulae being sometimes inadequate.

Nuclear reactions under study in NACRE

The nuclear reactions under study in NACRE are listed in Table 1. In December 1996, the number of compiled reactions is about 70. We expect to have about 100 compiled nuclear reactions by the end of May 97.

Table 1 : Nuclear reactions considered in NACRE.
(Nomenclature from Table I in G.R. Caughlan and W.A. Fowler, Atomic Data Nucl. Data Tables 40, 283 (1988)).

H1PENU	LI7PG	C12PG	O17PGI	NA23PN
H2PG	LI7PA	C12AG	O17PAI	NA23PAI
H2DG	LI7PAG	C12AN	O17AN	NA23ANT
H2DN	LI7DN	C13PG	O18PG	NA23ANM
H2DP	LI7T2N	C13PN	O18PA	MG24PG
H3PG	LI7HE3NP	C13AN	O18AGI	MG24AGI
H3PN	LI7AG	C14PG	O18AN	MG25PGT
H3PN	LI7AN	C14PN	F19PG	MG25PGM
H3AG	BE7PG	C14AG	F19PN	MG25PGG
H3T2N	BE7AG	N13PG	F19PA	MG25AN
HE3DP	BE9PG	N14PG	F19AP	MG26PG
HE3TD	BE9PN	N14PN	NE20PG	MG26AN
HE3TNP	BE9PD	N14PA	NE20PA	AL26TPG
HE3HE32P	BE9PA	N14AG	NE20AGI	AL26MPG
HE4DG	BE9AN	N14AN	NE21PGI	AL26GPG
HE4TG	B10PG	N15PG	NE21AN	AL27PGI
HE4HE3G	B10PA	N15PN	NE22PGI	AL27PAI
HE4ABE8	B10AN	N15PAI	NE22AG	AL27AN
HE42AGI	B11PG	N15AG	NE22AN	SI28PG
LI6PG	B11PN	N15AN	NA22NP	SI29PG
LI6PHE3	B11PA	O16PG	NA22NA	SI30PG
LI6AG	B11AN	O16PA	NA22PG	
LI7PN	B11AP	O16AG	NA23PG	

A summary of the results of the compilation work (pp-chain, CNO-cycle, NeNa-cycle, MgAl-cycle, n-production reactions) will be published in *Atomic Data and Nuclear Data Tables.*

The more extensive information provided by the internal reports, as well as full tables of reaction rates will be available on the WWW site of the collaboration:

http://pntpm.ulb.ac.be/cee.htm

What is expected from IAEA?

Provide manpower and/or financial support in order to extend the evaluation/compilation to more charged-particle induced reactions of astrophysical interest.

The minimum requirement is to re-evaluate/recompile the rates of all the 159 reactions included in the latest Caltech compilation (G.R. Caughlan and W.A. Fowler, Atomic Data Nucl. Data Tables 40, 283 (1988)).

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Memo CP-C/234

DATE: May 8, 1997
TO: Distribution
FROM: V.McLane vm
SUBJECT: New "CINDA2000" index

At the NRDC meeting last June, I volunteered to design a "CINDA2000", which would solve two problems: 1) dates as of the year 2000, and 2) the entry of charged-particle and photo-nuclear reaction data into the bibliogaphic file. The ***first-order*** exchange file format is as follows:

1st record of block

Columns		
	1-5:	block (A5: EXFOR accession number or Zyynn)
	6-24:	reaction (A23:ZZZSSAAAM(xxxxx,yyyyy))
	25-33:	quantity (A9)
	39-43:	institute (2A3: country, lab)
	44:	data type(A2)

Following record(s) Multiple records will be used for the same reaction coded in different subentries or for variable product nucleus.

Columns		
	1-5:	*blank*
	6:	reference hierarchy (I1)
	7-38:	reference,date (A24, I6: yyyymm)
	39-48:	author
	49-88:	comment (A40) or residual nucleus string for hierarchy = R
	89-106:	energy range (2(+x.x+nn))

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Example of an exchange record

```
A0517 6C 12 (A,X)          TTT GERKLN E
      3 R,INDC(GER)-37/LN       1969   Krasnov+ Grphs.        2.7+07 4.1+07
      6  A0517.002              199311 .3 pts. prod.yld.      2.7+07 4.1+07
      R                                Be9,B10,B11
```

I have written codes to convert both CPBIB (NNDC Charged-particle bibliography) and EXFOR references into this format. Examples of the output listings are attached.

Example of Reaction Bibliography for alpha on 12C 12-Jul-1996

Reaction	Quantity	Ty	Lab	Block	Energy range		H	Reference	Date	Comment
C 12(A,EL)	DA	EX	JPNTOK	E1191	6.5+07	6.5+07	3	J,NP/A,394,29	1983	Yasue+
					6.5+07	6.5+07	6	4,EXFOR E1191.002	1990Oct	.8 pts. dA.
C 12(A,EL)	DA	EX	USAOSU	Z8501	3.5+06	3.6+06	3	J,PR/C,31,1065	1985	Kovash+ +MIT. Grphs.
C 12(A,G)	DA	EX	CANQU	Z9201	1.4+04	3.0+06	3	J,PRL,69,1896	1992	Ouellet+ Grphs.
C 12(A,G)	DA	EX	GERMUN	Z8501	9.4+05	2.8+06	3	J,NP/A,462,385	1987	Redder+ +oth. Grphs,tbl,E1/E2.
					1.7+06	2.8+06	3	J,PRL,55,1262	1985	Redder+ Grphs.
C 12(A,G)	DA	EX	UK OXF	Z7001	7.7+06	8.1+06	3	J,PL/B,33,291	1970	Von Wimmersperg+ NDG. T-inv holds.
C 12(A,G)	DA	EX	UK OXF	Z7101	7.6+06	8.1+06	3	J,NP/A,167,352	1971	Kernel+ Rel,tbl,grph,Leg pol fit.
C 12(A,G)	DA	EX	USABNL	Z8101	3.4+07	4.2+07	3	J,PRL,46,884	1981Mar	Sandorfi+
					NDG		5	J,BAPS,26,536(AG6)	1981	Sandorfi+
C 12(A,G)	DA	EX	USAKTY	Z8801	NDG		5	J,BAPS,33,1023(GI14)	1988	Trice+ 16O quadr capt ampl.
C 12(A,G)	DA	EX	USAWAU	Z7401	7.0+06	2.8+07	3	J,PRL,32,1061	1974	Snover+ Grphs.
					1.0+07	2.8+07	3	C,73MUNICH,1,683	1973Aug	Snover+ +UBC. 52degr, rel grph.
C 12(A,G)	DA/DE	EX	AULAMU	Z6401	6.9+06	8.2+06	3	J,NP,58,529	1964	Mitchell+ Rel grphs.
C 12(A,G)	DA/DE	EX	USACIT	Z6401	2.8+06	8.3+06	3	J,NP,56,497	1964	Larson+ Rel grphs.
C 12(A,G)	DE	EX	AULAMU	Z7601	6.5+06	8.5+06	3	J,NP/A,273,397	1976	Ophel+ Rel yld, grph, tbl.
C 12(A,G)	SIG	EX	FR CSN	Z9601	1.4+06		5	C,96NOTRED,(NAE2-5)	1996Jun	Kiener+ Inv react,from 16O breakup.
C 12(A,G)	SIG	EX	GERBOC	Z9601	1.0+06	3.4+06	3	C,96NOTRED,(NEA2-4)	1996Jun	Trautvetter+ E1/E2 determ.
C 12(A,G)	SIG	EX	GERKLN	Z7301	+06		5	P,BMFT-FBK-73-02	1973Mar	Ewen+ Grphs.
C 12(A,G)	SIG	EX	GERMUN	Z8501	1.7+06	2.8+06	3	J,PRL,55,1262	1985	Redder+ Partl sig, tbl, E1/E2.
C 12(A,G)	SIG	EX	USACIT	Z7401	1.4+06	2.9+06	3	J,NP/A,233,495	1974	Dyer+ Grphs. E1 sig, tbl.
					1.7+06	2.9+06	5	J,DA/B,34,808	1973	Dyer. lvls,lvl wid.
C 12(A,G)	SIG	EX	USACIT	Z8801	1.3+06	3.0+06	3	J,PRL,60,1475	1988	Kremer+ Grphs.
					1.3+06	3.3+06	5	J,DA/B,48,1725	1987	Kremer. SIG=42.6nb at 2.4MeV.
C 12(A,G)	SIG	EX	USAKTY	Z8801	NDG		5	J,BAPS,33,1023(GI14)	1988	Trice+ 16O quadr capt ampl.
C 12(A,G)	SIG	TH	USALAS	Z9601	+06		3	C,96NOTRED,(NAE2-8)	1996Jun	Hale. R-mat anal, fit to meas.
C 12(A,G)	SIG	EX	USAORL	Z7001	1.6+06	3.1+06	3	J,PR/C,2,63	1970	Jaszczak+ Grph, data in text.
C 12(A,G)	SIG	EX	USAORL	Z7002	3.1+06	4.1+06	3	J,PR/C,2,2452	1970	Jaszczak+ Grph.
C 12(A,G)	SIG	EX	USAOSU	Z8501	3.5+06	3.6+06	3	J,PR/C,31,1065	1985	Kovash+ +MIT. Rel sig,G-G coinc.
					NDG		5	J,BAPS,28,967(AC3)	1983Oct	Kovash. +MIT. NDG.
C 12(A,G)	SIG	EX	USAWAU	Z7801	NDG		5	J,DA/B,39,2374	1978	Ebisawa. DSD mdm.
C 12(A,G)	SIG/SFC	EX	CANQU	Z9201	1.4+04	3.0+06	3	J,PRL,69,1896	1992	Ouellet+ Tbl.
C 12(A,G)	SIG/SFC	EX	GERMUN	Z8701	9.4+05	2.8+06	3	J,NP/A,462,385	1987	Redder+ +oth. Tbl.
C 12(A,G)	SIG/SFC	EX	USACIT	Z7401	1.4+06	2.9+06	3	J,NP/A,233,495	1974	Dyer+ E1 contr, grphs.
C 12(A,G)	SIG/SFC	EX	USACIT	Z8801	1.3+06	3.0+06	3	J,PRL,60,1475	1988	Kremer+ Grphs.

						1.3+06	3.3+06	5	J,DA/B,48,1725	1987	Kremer. S=40 keV-b at 300 keV.
C	12(A,G)	SPC	EX	GERMUN	Z8501	1.7+06	2.8+06	3	J,PRL,55,1262	1985	Redder+ +oth. nonneg E2 contr RR
C	12(A,G)	SPC	EX	GERMUN	Z8701	2.7+04	2.9+05	3	J,NIM/A,260,33	1987	Seuthe+ Thk targ. Grph.
C	12(A,G)	SPC	EX	UK BIR	Z7501	4.1+06	4.4+06	3	J,NP/A,252,8	1975	Chew+ G-G coinc, grph.
C	12(A,INL)	DA	EX	JPNTOK	E1191	6.5+07	6.5+07	3	J,NP/A,394,29	1983	Yasue+
						6.5+07	6.5+07	6	4,EXFOR E1191.003	1990Oct	.8 pts. partl d/dA.
						6.5+07	6.5+07	6	4,EXFOR E1191.004	1990Oct	.8 pts. partl d/dA.
C	12(A,INL)	DA/DE	EX	AULAMU	Z6401	6.9+06	8.2+06	3	J,NP,58,529	1964	Mitchell+ Gam em, rel grphs, anisot
C	12(A,INL)	DA/DE	EX	USACIT	Z6401	2.8+06	8.3+06	3	J,NP,56,497	1964	Larson+ Gam em, el grphs.
C	12(A,INL)	SIG	EX	USAWAS	C0313	2.7+07	2.7+07	3	J,PR/C,32,1873	1985Dec	Dyer+ Prod 4.439 MeV gamma, tbl.
						2.7+07	2.7+07	6	4,EXFOR C0313.002	1996Jul	.17 pts. partl sigma.
C	12(A,N)	DA	EX	USAMHG	R0028	4.1+07	4.1+07	3	J,NP/A,363,93	1981	Overway+
						4.1+07	4.1+07	6	4,EXFOR R0028.002	1989Apr	.1 pts. partl d/dA.
						4.1+07	4.1+07	6	4,EXFOR R0028.003	1987Oct	.5 pts. partl d/dA.
						4.1+07	4.1+07	6	4,EXFOR R0028.004	1987Oct	.3 pts. partl d/dA.
						4.1+07	4.1+07	6	4,EXFOR R0028.005	1987Oct	.1 pts. partl d/dA.
						4.1+07	4.1+07	6	4,EXFOR R0028.006	1987Oct	.2 pts. partl d/dA.
						4.1+07	4.1+07	6	4,EXFOR R0028.007	1987Oct	.1 pts. partl d/dA.
						4.1+07	4.1+07	6	4,EXFOR R0028.008	1987Oct	.2 pts. partl d/dA.
						4.1+07	4.1+07	6	4,EXFOR R0028.009	1987Oct	.2 pts. partl d/dA.
C	12(A,N)	TTY	EX	UK HAR	D0047	3.6+06	1.0+07	3	R,AERE-R-10502	1982Jun	West+
						3.6+06	1.0+07	6	4,EXFOR D0047.005	1984Jan	.4 pts. TT yld.
C	12(A,N)	TTY	DE	UK HAR	D0048	3.7+06	9.9+06	3	R,AERE-R-10502	1982Jun	West+
						3.7+06	9.9+06	6	4,EXFOR D0048.005	1984Jan	.2 pts. TT yld.
C	12(A,N+A)	SIG	EX	USABRK	B0101	3.8+08	3.8+08	3	J,PR,101,329	1956	Crandall+
						3.8+08	3.8+08	6	4,EXFOR B0101.004	1979Nov	.20 pts. sigma.
C	12(A,N+A)	SIG	EX	ZZZDUB	A0242	1.5+10	1.5+10	5	P,JINR-16-85-35	1985	Bamblevskij.
						1.5+10	1.5+10	6	4,EXFOR A0242.002	1987Apr	.10 pts. sigma.
C	12(A,N+A)	TTY	EX	CCPFEI	A0260	3.0+07	4.3+07	3	J,AE,27,125	1969	Krasnov+
						3.0+07	4.3+07	6	4,EXFOR A0260.008	1986Sep	.4 pts. TT yld.
C	12(A,X)	SIG	EX	FR CSN	Z7101	1.0+08	1.4+08	3	J,NP/A,165,405	1971	Fontes+ Prod 6,7Li,7,9Be,10Be,tbl.
C	12(A,X)	SIG	EX	FR PAR	B0092	1.0+08	1.6+08	3	J,PR/C,15,2159	1977	Fontes. Boron prod.
						1.0+08	1.6+08	6	4,EXFOR B0092.003	1979Jun	.25 pts. Ratio 11B/10B prod.
C	12(A,X)	SIG	EX	GERUH	A0529	7.7+07	1.6+08	3	C,91JUELIC,,745	1991	Lange+
						7.7+07	1.7+08	6	4,EXFOR A0529.003	1995Apr	.5 pts. 10Be prod sigma.
						7.7+07	1.6+08	6	4,EXFOR A0529.002	1995Apr	.8 pts. 7Be prod sigma.
C	12(A,X)	SIG	EX	GERKLN	A0517	7.9+07	1.7+08	3	R,INDC(GER)-36/LN,55	1991	Dittrich+
						7.9+07	1.7+08	6	4,EXFOR A0517.002	1993Nov	.3 pts. 7Be prod sigma.
						7.9+07	1.7+08	6	4,EXFOR A0517.003	1993Nov	.3 pts. 10Be prod sigma.
C	12(A,X)	TTY	EX	CCPFEI	A0260	2.7+07	4.1+07	3	J,AE,27,125	1969	Krasnov+
						2.7+07	4.1+07	6	4,EXFOR A0260.009	1986Sep	.4 pts. 13N prod TT yield.
C	12(A,RES)		EX	AULAMU	Z6501	7.7+06	8.4+06	3	J,NP,66,553	1965	Mitchell+ gam-0 em. J,pi,lvl-wid.
C	12(A,RES)		EX	AULAMU	Z6401	6.9+06	8.2+06	3	J,NP,58,529	1964	Mitchell+ Gam em, lvl J,pi.
C	12(A,RES)		EX	AULAMU	Z7601	7.1+06	7.9+06	3	J,NP/A,273,397	1976	Ophel+ Res.

C	12(A,RES)	EX	CANQU	Z9201	1.4+04	3.0+06	3	J,PRL,69,1896	1992	Ouellet+ E1,E2 contr,cluster mdl
C	12(A,RES)	EX	FR STR	Z7001	3.6+06	5.8+6	3	J,JPR,31,255	1970Apr	Brochard+ partl wid.
C	12(A,RES)	EX	ITYMIL	Z7401	5.1+06	5.4+6	3	J,NCL,9,251	1974Feb	Bellotti+ partl wid.
C	12(A,RES)	EX	UK BIR	Z7501	4.2+06		3	J,NP/A,252,8	1975	Chew+ Res G-wid.
C	12(A,RES)	EX	USABNL	Z8101	3.4+07	4.2+07	3	J,PRL,46,884	1981Apr	Sandorfi+ Giant E2 trns,mdl calc
					NDG	0	5	J,BAPS,26,536(AG6)	1981	Sandorfi+ Giant E2 trns,mdl calc
C	12(A,RES)	EX	USACIT	Z6401	3.2+06	8.1+06	3	J,NP,56,497	1964	Larson+ Gam em, lvls,J,pi,RP.
C	12(A,RES)	EX	USAWAU	Z7401	1.3+06	2.7+07	3	J,PRL,32,1061	1974	Snover+ Giant E2 res.
					1.7+07	2.6+07	3	C,73MUNICH,1,683	1973Aug	Snover+ +UBC. E res, tot wid.
					1.3+06	2.7+07	5	P,RLO-1388-21,111	1973Jun	Adelberger+

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Memo X4-97/1

DATE: May 15, 1997
TO: Distribution
FROM: V.McLane
SUBJECT: EXFOR Manual Updates

Enclosed are updates to the following pages. The changes are marked by a change bar in the outside margin, and the date is given as May 1997.

Page	Update
2.2	Added resposibility for B and P entries
3.2	Record ID on ENDTRANS record
3.4	Removal of special use of field 3 on SUBENT record
4.3	Addition of text explaining placement of free text
7.8	Addition of Dictionary 19 delimiter field [1]
8.3	(Editorial change - correction of error in tab setting)
8.I.1	Explanation of use of MPH [1]
P.9-P.10	Update of addresses, addition of Sarov

---

[1] Pending acceptance of proposal in Memo CP-C/225.

Distribution:
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Zhang Zingshang, CNDC

Chapter 2

RECORD IDENTIFICATION

Columns 67-80 are used to identify uniquely each record and to flag altered records. These columns are divided into five fields as follows:

67-71	Center-assigned accession number
72-74	Subaccession number
75-79	Sequence number
80	Alter flag

Each of these fields is described in detail in this chapter.

File identification character

The first position of accession numbers, and the first position of an exchange file identification contain a character indicating the center at which the information originated and the type of data compiled[1]. The following file identification characters have assigned:

0	Preliminary	For internal center use (*i.e.*, not included on exchange files).
1	NNDC (Brookhaven)	Neutron nuclear data
2	NEA-DB (Paris)	Neutron nuclear data
3	NDS (Vienna)	Neutron nuclear data
4	CJD (Obninsk)	Neutron nuclear data
6	data from area 2	Data entered by NNDC; not part of the normal neutron nuclear
8	data from area 4	2, 3, 4 series.
9	NDS (Vienna)	Dictionary transmission (see page 7.1)
A	CaJaD (Moscow)	Charged-particle nuclear data
B	KaChaPaG (Karlsruhe)	Charged-particle nuclear data [2]
C	NNDC (Brookhaven)	Charged-particle nuclear data
D	NDS (Vienna)	Charged-particle nuclear data
E	"Study Group" (Sapporo)	Charged-particle nuclear data
G	NDS (Vienna)	Photonuclear data
H	NNDC (Brookhaven)	Special internal use for relativistic particle reaction data
L	NNDC (Brookhaven)	Photonuclear data
M	CDFE (Moscow)	Photonuclear data
N	NEA-DB (Paris)	Special use for memos only
O	NEA-DB (Paris)	Charged-particle nuclear data
P	NNDC (Brookhaven)	Charged-particle nuclear data from MacGowen file[3]
Q	CJD (Obninsk)	Photonuclear data
R	RIKEN	Charged-particle nuclear data
S	CNDC	Charged-particle nuclear data
V	NDS (Vienna)	Special use for selected evaluated neutron data 'VIEN' file.

[1] Neutron, charged-particle, and photonuclear reaction data must be compiled in separate entries with appropriate identification, even if they are reported in the same publication. See Appendix P, Protocol, page P.3.

[2] Updates to these entries are the responsibility of CAJaD.

[3] Updates to these entries are the responsibility of NNDC. Originally corrected and coded by KaChaPaG.

Chapter 3

SYSTEM IDENTIFIERS

Each of these basic system identifiers refers to one of the hierarchy of units contained on a transmission file. These units and their corresponding basic system identifiers are:

TRANS	- A transmission in the unit
ENTRY	- A work (entry) is the unit
SUBENT	- A sub-work (subentry) is the unit
BIB	- The BIB section of a complete work or sub-work is the unit
COMMON	- The common data section of a complete work or sub-work is the unit
DATA	- The data table section of a sub-work is the unit

These basic system identifiers are combined with the modifiers

NO
END

To indicate three conditions:

- The beginning of a unit (basic system identifier only)
- The end of unit (modifier END preceding the basic system identifier)
- A positive indication that a unit is intentionally omitted (modifier NO preceding the basic system identifier)

However, only those combinations of basic system identifiers and modifiers which are defined on the following pages, and are included in Dictionary 1, are used.

System identifier records

The general format of a system identifier record is:

```
1                 11|          22|          33|                          66|
SYSTEM IDENTIFIER   |          N1|          N2| Free text                  |
```

SYSTEM IDENTIFIER may be any of the permitted system identifiers, left adjusted to begin in column 1. N1 and N2 are integers, right adjusted to columns 22 and 33, respectively. The significance of N1 and N2 depends on the system identifier used.

Columns 34-68, with the exception of the special uses listed under the system identifiers, may contain any free text that a center wishes to use or may be used internally by the centers for additional coded information.

The following pages describe all permitted system identifier records in detail. The detailed description is followed by a brief summary of the characteristics of the system-identifier records.

TRANS. The **first record** of the exchange file.

N1 - The exchange file identification, consisting of:
column 19: the file-identification character[1],
column 20-22: a three-digit number (padded with zeros), sequentially assigned to allow other centers a simple means of determining whether or not they have received all exchange files.

N2 - A six-digit integer containing the data (year, month, and day) on which the exchange file was generated. The format is: yymmdd.

The record identification contains the file-identification character in column 67 and zero's in columns 68-79[1].

ENDTRANS. The **last record** of the transmission file.

N1 - The number of entries (accession numbers) on the file.

N2 - Presently unused (may be blank or zero).

The record identification contains a character, whose value is ≥ the file identification number of the previous record, in column 67 and 9's in columns 68-79[2].

---

[1] On files which contain entries with different file-identification characters (*i.e.*, other than exchange files), column 67 is assigned such that the record sorts at the beginning of the file (*e.g.*, equal to, or less than, the file-identification character of the first entry included on the file).

[2] On files which contain entries with different file-identification characters (*i.e.*, other than exchange files), column 67 is assigned such that the record sorts at the end of the file (*e.g.*, equal to, or greater than, the file-identification character of the last entry included on the file).

DICTION
ENDICTION
NODICTION

(not part of an exchange file)[3]

ENTRY. The **first record** of each work.

N1 - 5-character accession number
N2 - Date of last update (or date of entry if never updated) (yymmdd)

The record identification contains the accession number (columns 67-71), the subentry number zero (000) (columns 72-74), and the sequence number one (00001) (columns 75-79).

The following special uses are made of the free text field in the ENTRY record:

NDS: For entries containing evaluated or recommended data, a "V" is inserted in column 44.

Columns 45-55 contain the initials of the physicist who complied the entry or made the last revision.

NNDC: Columns 43, 44 contain a compiler-identification code.

ENDENTRY. The **last record** of each work.

N1 - The number of subentries in the work[4].
N2 - Presently unused (may be blank or zero).

The record identification contains the accession number (columns 67-71), the subentry number 999 (columns 72-74), and the sequence number (99999) (columns 75-79).

[3] When dictionaries are transmitted, they must be in a separate file apart from the EXFOR data entries. See Chapter 7.

[4] When NOSUBENT records are included in an entry, they are counted as subentries when computing N1.

SUBENT. The **first record** of each subentry.

N1 - 8-character subaccession number (accession number and subentry number).
N2 - Date of last update (or date of entry if never updated) (yymmdd).

The record identification contains the subentry number (columns 67-74) and sequence number one (00001) (columns 75-79).

ENDSUBENT. The **last record** of each subentry.

N1 - The number of records within the subentry.
N2 - Presently unused (my be blank or zero).

The record identification contains the subaccession number (columns 67-74) and sequence number 99999 (columns 75-79).

NOSUBENT. This record indicates that a subentry number has been assigned by the center but that either the information associated with it was not ready at the time the file was transmitted by the center, or that the subentry has been deleted or combined with another subentry.

N1 - 8-character subaccession number (accession number and subentry number).
N2 - Date of last alter or blank (if merely assigned and not yet used).

The record identification is the same as on a SUBENT record.

Free text

Free text may be entered in columns 12-66 under each of the information-identifier keywords in the BIB section and may be continued onto any number of records. It may include parentheses, if necessary, although, a left parenthesis in the text ***will not*** be used in column 12 (as this implies the opening parenthesis of machine-retrievable information).

The language of the free text is English, and clear English phrasing should be used; no codes are to be used within the free text[2].

See also **LEXFOR Free Text.**

Codes and free text

If both coded information and free test are given under an information-identifier keyword, the free text may appear either on records given before the coded information, on the same record as code (always after the code), or on records following the code, as appropriate.

In general, coded information given with an information-identifier keyword is for the purpose of machine processing and the free text is self-explanatory. That is, coded information is expanded into clear English and amplified as necessary in the free text. However, for some keywords, such an expansion of the codes is not given, on the assumption that such expansion will be done by an editing program. For other keywords, an indication may be given that the coded information is not expanded in the free text.

An indication that the code is not expanded is given by:

either a decimal point/full stop immediately following the closing parenthesis,
or a completely blank field between the closing parenthesis and column 66.

If both coded information and free text are given, it is legal to start with free text and include the code(s) on following lines.

Example:
```
ERR-ANALYS    Total uncertainties are not given.
              (DATA-ERR) Statistical uncertainty.
```

See page 8.4 for details on specific information-identifier keywords.

[2] Expansions of these codes may be used, at the compiler's discretion, embedded in free text.

An example of several BIB information entries is given below:

```
1        11|12        22|
ENTRY      |      00001 |
SUBENT     |   00001001 |
BIB        |            |
AUTHOR     |(J.W.DOW,M.P.JONES)  This space may contain any free text.
           |              The beginning of a new BIB entry is indicated by
           |              a non-blank in the keyword field (columns 1-10).
INSTITUTE  |(3AAABBB)     Since the keyword field is non-blank, this is
           |              considered a new BIB entry.
INC-SOURCE |(ABC,WXYZ)    This is an example of a BIB entry with more than
           |              one piece of machine-retrievable information in
           |              one set of parenthesis.  The absence of a pointer
           |              in column 11 shows that this information refers
           |              to all data.
COMMENT    |This is an example of a BIB entry without machine-retrievable
           |information.
          1|The pointer in column 11 indicates that this record, and the
           |following records until a new pointer is encountered, refer to
           |all data with the same pointer in all following subentries.
ENDBIB     |            |
NOCOMMON   |            |
ENDSUBENT  |            |
SUBENT     |   00001002 |
BIB        |            |
REACTION  1|(92-U-235(N,EL),,WID)       This is an example of multiple
          2|(92-U-235(N,F),,WID)        reactions with pointers
ANALYSIS  1|(CDEFG).     This is an example of a BIB entry with more than
           |             one piece of machine-retrievable information, each
           |             coded in its own
          2|(HIJ).       set of parenthesis.  Each part of the BIB entry is
           |             linked by a pointer in column 11 to other
           |             information in this subentry and in subentry 1 with
           |             the same pointer.  The point after the closing
           |             parenthesis indicates that the contents of the code
           |             in parenthesis is not expanded in free text, as
           |             would be required if the point were absent.
ENDBIB     |            |           |           |
NOCOMMON   |            |           |           |
DATA       |            |           |           |
EN         |DATA       1|DATA-ERR  1|DATA      2|
EV         |MILLI-EV    |MILLI-EV   |MILLI-EV   |
           |            |           |           |
ENDDATA    |            |           |           |
ENDSUBENT  |            |           |           |
ENDENTRY   |            |           |           |
```

Dictionary 5. Journals. The actual journal code is restricted to 4 characters or less. Where journals are subdivided into parts, the part is included in the dictionary with the journal code, and separated from it by a slash; the complete code is restricted to 6 characters, as for example:

ND/A = Nuclear Data, Part A.

The area code and country code (country of publication) are in columns 63 to 66.

The ***expanded form*** follows the commonly adopted style for journal titles, in particular, INIS [2]. However, some abbreviations have been expanded for clarity.

Obsolete codes are marked by an O in column 80; extinct codes are marked by an X in column 80 (see page 1).

The dictionary is sorted by codes.

Dictionary 6. Reports. Each code in the dictionary consists of the alphanumeric character string which precedes the actual report number. The final character of the codes given in the dictionary is always a hyphen (-), except in a few cases where the report codes are 11 character and the 12th character a hyphen. In such cases the hyphen is dropped in the dictionary.

Annual progress reports which do not have a report number given are assigned an EXFOR report code A-, followed by the 3-digit institute code; when coded, the code is followed by the year for which the report is given.

Example: A-ARK-84

The 7-character institute code (as in Dictionary 3) of the institute at which the report was issued is given in columns 60 to 66.

Obsolete codes are marked by an O in column 80; extinct codes are marked by an X in column 80 (see page 1).

The dictionary is sorted on the institute code and, within the institute code, by report code.

[2] Authority List for Journal Titles, IAEA-INIS-11

Dictionary 7. Conferences and Books. Codes are up to 8 characters[3].

Conference codes are composed of the ***year of the conference*** given in the first 2 digits of the code, followed by the place of the conference, which may have up to 6 characters.

Examples: 66PARIS
82ANTWER

Book codes give a concise short title of the book, or the family name of the first author.

Examples: ABAGJAN - *Group Constants for Nuclear Reactor Calculations,* Abagjan, et al., 1964

NEJTRONFIZ - *Neytronnaya Fizika,* P.Krupcicke, 1961

In the dictionary, books, sorted alphabetically by code, precede conferences, which are sorted alphabetically by code, within year.

Dictionary 9. Chemical Compounds[4]. The general compound code CMP can be combined with any element in the form (Z-S-CMP) without entry in this dictionary, which only lists special cases. The actual compound codes (*e.g.* OXI for oxide) are restricted to three characters. The codes are sorted by atomic number.

Dictionary 15. Status. This dictionary is in the standard format except that column 66 of the explanation field is reserved for a flag which indicates which codes may be followed by an accession number field:

S indicates the code may be followed by an accession number field;

R indicates that the code is always followed by an accession number field.

Dictionary 19. Incident Source. This dictionary is in the standard format except that column 66 of the explanation field is reserved for a field delimiter which indicates that another code is expected following the code given, and separated from it by the delimiter given.

[3] Some older codes may have a total length of 10 characters. The codes in this dictionary are also used by CINDA, which is restricted to 8-character codes.

[4] Codes are also used in CINDA.

<u>**Coding of nuclides and compounds**</u>. Nuclides appear in the coding of many keywords. The general code format is Z-S-A-X, where:

Z	is the mass number; up to 3 digits, no leading zeros
S	is the element symbol; 1 or 2 characters (Dictionary 8)
A	is the atomic weight; up to 3 digits, no leading zeroes. A single zero denotes natural isotopic composition (limited to special cases as given under the specific keyword).
X	is an isomer code denoting the isomeric state (this subfield may be omitted) X may have the following values: G for ground state (of a nucleus which has a metastable state) M if only one metastable state is regarded M1 for the first metastable state M2 for the second, *etc.* T for sum of all isomers (limited to use within an isomeric ratio in SF4 of the reaction string)

Exceptions to this coding are noted on the pages for each keyword. (See also **LEXFOR Elements**). Valid nuclide codes are given in Dictionary 27 (see page 7.10).

Compounds may in some cases replace the nuclide code. The general format for coding compounds is either the specific compound code, taken from Dictionary 9, or the general code for a compound of the form Z-S-CMP. (*e.g.*, 26-FE-CMP). (See also **LEXFOR Compounds**).

<u>**Information identifier categories**</u>. Detailed coding rules for each information identifier are given on the following pages. The keywords can be grouped in certain categories, which are shown in the following table.

The second and third columns of the table show that some of the keywords are:

- obligatory: these must be present in either subentry 001 or in ***all*** other subentries.
- obligatory, except when not relevant: these must usually be present, however, occasionally they are not relevant and may be absent; see the detailed coding rules.
- obligatory for specific data headings: these must be present when certain data headings are present in the COMMON or DATA section (see the detailed coding rules), otherwise, they are optional.

all other keywords are optional.

The fourth and fifth columns of the table indicate whether coded information and/or free text is obligatory. For certain keywords coded information is obligatory, for others optional.

It should be noted that the table serves only as an aide-memoire, and does not replace the detailed coding rules given on the subsequent pages.

Keyword	The presence of the keyword is		when keyword present, coded information is	coded information repeated in free text
	O = obligatory X = obligatory when relevant	obligatory with the data heading		
Bibliography				
TITLE	X		(free text only)	-
AUTHOR	O		obligatory	no
INSTITUTE	O		obligatory	no
EXP-YEAR			obligatory	no
REFERENCE	O		obligatory	no
REL-REF			obligatory	no
MONIT-REF			obligatory	no
Data Specification				
REACTION	O		obligatory	no
RESULT	X		obligatory	no
Related Data				no
MONITOR	X	MONIT, *etc.*	obligatory	no
ASSUMED		ASSUM, *etc.*	optional	
DECAY-DATA		DECAY-FLAG	optional	no
DECAY-MON			obligatory	no
PART-DET			obligatory	optional
RAD-DET			obligatory	no
HALF-LIFE		HL1, *etc.*	optional	no
EN-SEC		E1, *etc.*	optional	no
EMS-SEC		EMS1, *etc.*	optional	no
MOM-SEC		M1, *etc.*	optional	no
MISC-COL		MISC, *etc.*	optional	no
FLAG		FLAG	obligatory	no
Physics				
INC-SOURCE		optional	optional	
INC-SPECT		EN-DUMMY,EN-MEAN,KT	(free text only)	-
SAMPLE			(free text only)	-
METHOD			optional	optional
FACILITY	one of these is obligatory		optional	optional
ANALYSIS			optional	optional
DETECTOR			optional	optional
CORRECTION			(free text only)	-
COVARIANCE	X		optional	no
ERR-ANALYS		ERR-, or -ERR1, *etc.*	optional	no
Other				
ADD-RES			optional	optional
COMMENT			(free text only)	-
CRITIQUE			(free text only)	-
Bookkeeping				
STATUS	X		optional	no
HISTORY	O		obligatory	no

INC-SOURCE

1. Gives information on the source of the incident particle beam used in the experiment. See also **LEXFOR Measurement Techniques and Incident-Particle Energy**.

2. Presence is optional. May contain either free text, or coded information and free text.

3. Coded information, if given, may be in either of the general forms, see page 8.2, with code(s) from Dictionary 19, but see exception below.

4. If the code POLNS is used, the code for the polarized source, if given, must follow within the same set of parenthesis.

   Example:

   ```
   INC-SOURCE    (POLNS,D-T)
   ```

   If the code MPH, followed by the separator = is present, the next filed contains a reaction string coded as under the keyword REACTION.

   In both these cases, other sources are coded on a separate record, starting in column 12.

INC-SPECT

1. Provides information on the characteristics and resolution of the incident-projectile beam. See also **LEXFOR Incident-Projectile Energy**.

2. Required when a spectrum average modifier (*e.g.*, MXW, SPA, or FIS) is present in REACTION SF8 (see page 6.8); otherwise, optional. See also **LEXFOR Spectrum Average**. No coded information.

INSTITUTE

1. Designates the laboratory, institute, or university at which the experiment was performed, or with which the authors are affiliated. See also **LEXFOR Institute**.

2. Presence is obligatory with coded information.

3. The code information is given in either of the general forms, see page 8.2, with code(s) from Dictionary 3.

   Where the institute code is less than 7 characters, trailing blanks may be omitted, however, embedded blanks must be included, as they are considered part of the code.

   Examples:

   ```
   INSTITUTE    (1USAGA, 1USALAS)
   INSTITUTE    (2FR SAC)
   ```

Cooperating Centers and Groups

NNDC	National Nuclear Data Center, Bldg. 197D Brookhaven National Laboratory Upton, NY, U.S.A. 11973-5000 Email: NNDC@BNL.GOV or NNDC*nn*@BNL.GOV[1]
NEA-DB	NEA Data Bank 12, boulevard des Iles 92130 Issy-les-Moulineaux, FRANCE Email: NEA@NEA.FR or *name*@NEA.FR
NDS	IAEA Nuclear Data Section Wagramerstr. 5, P.O.Box 100 A-1400 Vienna, Austria Email: *name*@iaeand.iaea.or.at
CJD	Federal Research Center IPPE Centr Yadernykh Dannykh Ploschad Bondarenko 249 020 Obninsk, Kaluga Region, RUSSIA Email: manokhin@cjd.obninsk.su
CAJaD	National Scientific Research Center Kurchatov Institute Russia Nuclear Center 46 Ulitsa Kurchatova 123 182 Moscow, RUSSIA Email: CHUKREEV@CAJAD.KIAE.SU
CDFE	Institute of Nuclear Physics Moskovskiy Gos. Universitet Vorob'evy Gory 119 899 Moscow, RUSSIA Email: VARLAMOV@CDFE.NPI.MSU.SU

[1] *nn* = first and last initial of person to be contacted, *e.g.*, NNDCCD@BNL.GOV.

CNDC	China Nuclear Data Center China Institute of Atomic Energy P.O. BOX 275 (41) Beijing 102413, China Email: cndc@mipsa.ciae.ac.cn
RIKEN	The Institute of Physical & Chemical Research (RIKEN) 2-1 Hirosawa, Wako-Shi Saitama-ken 351-01, JAPAN Email: TENDOW@postman.RIKEN.GO.JP
Japan Charged Particle Reaction Group	Dept. of Physics Hokkaido University Kita-10 Nisha-8, Kita-ku Sapporo 060, JAPAN Email: kato@nucl.phys.hokaido.ac.jp
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The following center has contributed in the past, but is no longer compiling data.

KaChaPaG	Charged Particle Nuclear Data Group Institute for Radiochemie Kernforschungszentrum Karlsruhe Postfach 3640 D-75 Karlsruhe, Fed. Repub. of Germany

CSISRS LIBRARY STATISTICS FOR AREA 1 LISTED BY REFERENCE

Year	# entries	# Subentries	# Data points	Last Transmission 1267
1992	14	44	66 026	
1993	16	65	33 623	
1994	17	69	61 929	
1995	8	25	8 304	
1996	16	69	12 654	
1997	2	6	1 787	
Total	73	278	184 323	

CSISRS LIBRARY STATISTICS FOR AREA 2 LISTED BY REFERENCE

Year	# entries	# Subentries	# Data points	Last Transmission 2138
1992	24	99	8 311	
1993	12	34	7 256	
1994	32	130	144 604	
1995	11	33	168 358	
1996	1	5	16	
1997				
Total	80	301	328 545	

CSISRS LIBRARY STATISTICS FOR AREA 3 LISTED BY REFERENCE

Year	# entries	# Subentries	# Data points	Last Transmission 3101
1992	24	111	834	
1993	13	63	1 649	
1994	16	56	333	
1995	8	21	115	
1996	4	62	242	
1997				
Total	65	313	3 173	

CSISRS LIBRARY STATISTICS FOR AREA 4 LISTED BY REFERENCE

Year	# entries	# Subentries	# Data points	Last Transmission 4104
1992	23	123	3 199	
1993	15	64	1 654	
1994	20	109	3 644	
1995	14	46	702	
1996	4	33	1 484	
1997				
Total	76	375	10 683	

CSISRS LIBRARY STATISTICS FOR AREA A LISTED BY REFERENCE

Year	# entries	# Subentries	# Data points	Last Transmissionn A038
1991	17	681	11 330	
1992	10	118	917	
1993	19	130	2 497	
1994	5	52	541	
1995	7	60	692	
1996				
1997				
Total	58	1,041	15 977	

CSISRS LIBRARY STATISTICS FOR AREA C LISTED BY REFERENCE

Year	# entries	# Subentries	# Data points	Last Transmissionn C023
1991	12	65	10 292	
1992	4	33	4 139	
1993	8	39	3 713	
1994	6	133	8 991	
1995	7	27	685	
1996	17	39	4 867	
1997				
Total	54	336	32 687	

CSISRS LIBRARY STATISTICS FOR AREA D LISTED BY REFERENCE

Year	# entries	# Subentries	# Data points	Last Transmissionn D020
1991	6	32	354	
1992	3	17	75	
1993	8	35	652	
1994	10	42	887	
1995	5	29	500	
1996	7	25	802	
1997				
Total	39	180	3 270	

CSISRS LIBRARY STATISTICS FOR AREA E LISTED BY REFERENCE

Year	# entries	# Subentries	# Data points	Last Transmissionn E015
1991	1	2	17	
1992	2	33	808	
1993				
1994				
1995				
1996				
1997				
Total	3	35	825	

CSISRS LIBRARY STATISTICS FOR AREA O LISTED BY REFERENCE

Year	# entries	# Subentries	# Data points	Last Transmissionn O003
1991	7	135	6 037	
1992	3	116	4 380	
1993	3	52	2 034	
1994	1	4	63	
1995	3	78	748	
1996				
1997				
Total	17	385	13 262	

CSISRS LIBRARY STATISTICS FOR AREA R LISTED BY REFERENCE

Year	# entries	# Subentries	# Data points	Last Transmission R011
1991				
1992				
1993				
1994				
1995				
1996				
1997				
Total	0	0	0	

CSISRS LIBRARY STATISTICS FOR AREA S LISTED BY REFERENCE

Year	# entries	# Subentries	# Data points	Last Transmission R011
1991				
1992	3	7	162	
1993	1	4	61	
1994	1	1	22	
1995				
1996				
1997				
Total	5	12	245	

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An IntelligentPad System for the Reuse of Nuclear Reaction Data

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1 Introduction

A new retrieval system for NRDF[1,2] is redesigned and developed as an application of IntelligentPad architecture[3]. NRDF is a database originally designed and developed for compiling charged-particle nuclear reaction data. IntelligentPad is now actively studied as a meme media system at Hokkaido University in Japan[4,5,6]. I will first give a brief explanation of the IntelligentPad, and then show several Pads that are specially designed for the NRDF database.

You will see that the exploitation of the IntelligentPad architecture in developing any systems for the international nuclear community might enhance the usability and reusability of the tools that the community needs.

2 IntelligentPad architecture

IntelligentPad is a synthetic media object. This system provides computers so as to work as meta-media that provides us with an overall integrated environment for our intellectual activities. This system provides a unified framework for modeling, presentation, synthesis and management of multimedia documents, system-provided functions and application programs.

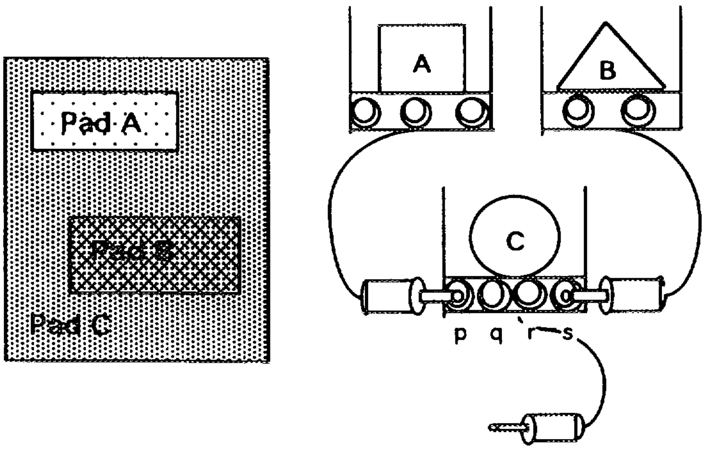

Fig. 1 Function linking of IntelligentPad

In the system, every component is represented by reactive media object called Pad. Any Pad can be copied, pasted on one another to construct some new feature. Pad can display its values which are stored in its slots on itself, and can define functions corresponding to the values in the slots and the events triggered by key or mouse operations. This unified frame work of IntelligentPad is modeled just like as AV components. The intellectual resource are wrapped in the connection mechanism standardized, which provides several connection jacks and only one pin plug connecting to slots (Fig. 1).

There also provided a mechanism for any Pad to be embedded in WWW Pages Any users at remote sites can view these pages, and may obtain any tools and data in the form of Pads through Internet.

3 Pad tools developed for NRDF

Fig. 2 shows a composite Pad for the access of NRDF database and the distribution of records retrieved in the form of Pads in one or two dimensional. The tool Pad is composed of one DatabaseProxyPad, Input/OutputPads, ButtonPad, SqlQueryMakerPad and RecordDistributionPad on the ProxyPad.

First, you can specify one or two attributes that describe information in the NRDF database such as "ATH" and "D#" in Fig. 2. If SearchButton is clicked, the NRDF database is retrieved according to the SQL query made up from the specification. When database search has finished, the records found are distributed in plane geometry as DatasetIDPads on the RecordDistributionPad. Each of the X- and Y-coordinate of the RecordDistributionPad corresponds to value varieties of the specified attributes. In this case, you can see a name of the author and a dataset number in the DatasetIdPad clicked.

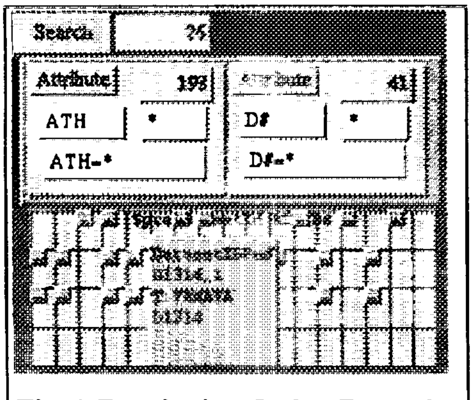

Fig. 2 Retrieving Index Records

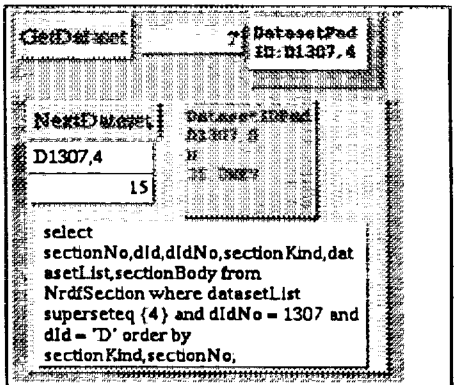

Fig. 3 Making DatasetPad

A DataSetIdPad has not full information of the dataset in its slots. If full information of the dataset is needed, it has to be filtered out from the database and set it in the slots of a DatasetPad. DatasetFilteringPad do this function as shown in Fig. 3. Paste any DatasetIdPad on DatasetFilteringPad and click the GetDataset button then a DatasetPad will appear such as "D1307,4"

If you have got a DatasetPad, you can see any details of the dataset through appropriate viewer Pads for different purposes. For examples, we provide two graphical viewing Pads and a text viewing Pad(Fig. 4). GraphPad shows a numerical data table as a data point graph. GraphBasePad is used to compare two or more graphs. This Pad makes the background color transparent and adjust the scale of coordinates of all the GraphPads pasted on itself. TextViewerPad displays the information from DatasetPad as text on itself

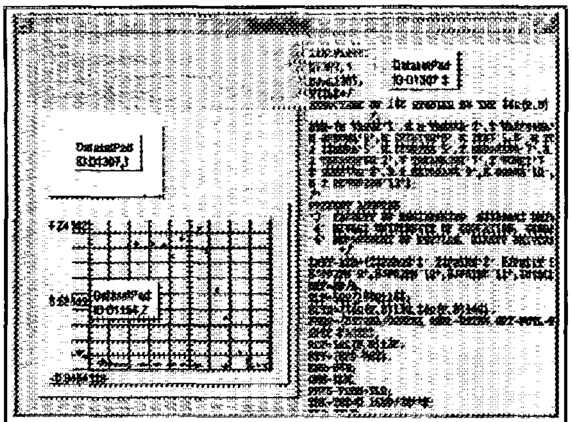
Fig. 4 Viewing Values in DatasetPad

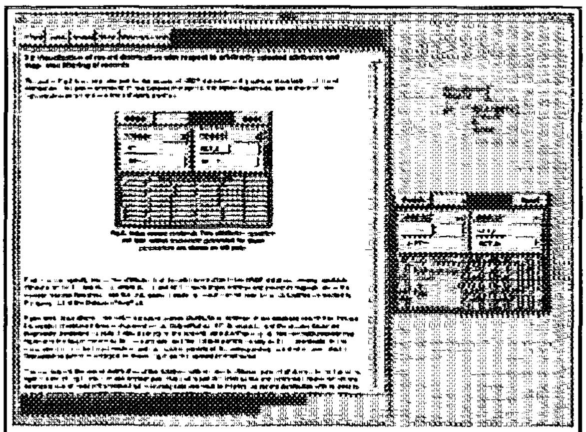
Fig. 5 Distributing Pads in WWW pages

4. Distribution of Pads being embedded in WWW Pages

All the Pads mentioned above are embedded in Web pages[3] so as to distribute them through Internet. Fig. 5 shows that a WWW browser in the IntelligentPad platform is viewing the page containing a Pad and the same Pad is copied to the platform. This WWW browser itself is a composite Pad.

5 Concluding Remarks

We have shown several Pads specially designed for the NRDF database, together with the examples of how to use them. A Pad in the IntelligentPad system is a reusable media object. Once a new Pad is developed, it can be registered in a common pool of Pads as a shared resource. it can be exchanged or reused in different contexts by different people in the community You can also easily distribute any composite Pads through the Internet. In IntelligentPad architecture, any Pads may be put on any places of the document that is to be submitted to WWW.

We could be convinced that the IntelligentPad architecture might be effective in developing application systems shared in some such nuclear data community as shown the example of the NRDF case.

References

[1] Togashi, M. and Tanaka, H. : "An information system for charged particle nuclear reaction data", Journal of Information Science, Vol. 4, No 5, 1982.

[2] NRDF home page: http://nucl.phys hokudai.ac.jp/~nrdf/

[3] Chiba, M.: "IntelligentPad for Exchanging and Reusing Nuclear Reaction Data Information as Shared Resources", http://ca meme.hokudai.ac.jp/people/chiba/Chiba.html

[4] Tanaka, Y. and Imataki, T. : "IntelligentPad: A Hypermedia System allowing Functional Composition of Active Media Objects through Direct Manipulations", IFIP'89, San Francisco, pp. 541-546, 1989.

[5] Tanaka, Y.: "From Augmentation to Meme Media", Proc. of ED-Media 94, Vancouver, pp. 58-63, 1994.

[6] Tanaka, Y.: "A Synthetic Media Architecture and its Prospects", http://ca meme.hokudai.ac.jp/

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STATUS REPORT ON THE EUROPEAN NUCLEAR ASTROPHYSICS COMPILATION OF REACTION RATES (NACRE)

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Abstract

We report on the program and results of the NACRE collaboration (European Nuclear Astrophysics Compilation of REaction rates): a network for the evaluation and compilation of astrophysical nuclear reaction rates. As approved by the Human Capital and Mobility Programme of the European Union, nine European laboratories from seven European countries collaborate to NACRE. A total of about 100 nuclear reactions of astrophysical interest are included in this compilation.

1 Introduction

Charged-particle induced reactions play a key role in the generation of energy and in the nucleosynthesis in stars. For calculating the rates $N_{\rm A}\langle\sigma v\rangle$ of the nuclear reactions occuring in stellar plasmas, the cross sections $\sigma(E)$ of these reactions have to be known from near the Coulomb barrier down to far below that energy. Existing reaction rate compilations [1] need to be improved: more complete, precise and up-to-date evaluated rates are required for the modelling of diverse astrophysical phenomena. An effort has been initiated at the European level in order to build up an updated and well documented compilation. The main goal of the NACRE network is the transparency in the procedure of calculating the rates. More specifically, this compilation aims at (i) updating the experimental and theoretical data, (ii) distinctly identifying the sources of the data used to calculate the rates, (iii) evaluating the uncertainties and errors, and (iv) providing numerically integrated reaction rates, widely used analytical formulae being sometimes inadequate (see below).

This compilation is concerned only with reaction rates that are large enough for the target lifetime to be shorter than the age of the Universe, taken equal to 15×10^9 y. Assuming a typical density of 10^4 gcm^{-3}, and taking into account stellar screening effects, this leads to an approximate lower limit $N_A\langle\sigma v\rangle = 10^{-25}$ mole^{-1}s^{-1}cm^3. The reaction rates are provided from the temperature corresponding to this lower limit up to a temperature $T = 10^{10}$ K.

In its present status, NACRE is limited to the compilation of the reactions of the p-p chain, CNO-cycle, NeNa-cycle, MgAl-chain, several α-induced reactions, and other astrophysically important capture reactions by nuclei up to silicon. This leads to a total of about 100 reactions. Additional reactions will be considered in a further stage.

In parallel with the rate compilation, a cross section data bank has been created. The center-of-mass energies, cross sections and S-factors, with errors, are tabulated for each reference. These cross section data can be found on a WWW site that also contains more extended evaluation and compilation reports for each reaction. This WWW site (http://pntpm.ulb.ac.be/cee.htm) will be public in a near future.

2 Compilation procedure

An extensive collection and evaluation of existing data is performed. When cross section data are available, the nuclear reaction rates $N_A\langle\sigma v\rangle$ are calculated numerically (in contrast to the analytical approximations adopted in the existing compilations), and presented in a tabular way. The values of $N_A\langle\sigma v\rangle$ are computed from [2]

$$N_A\langle\sigma v\rangle = N_A \frac{(8/\pi)^{1/2}}{\mu^{1/2}(k_B T)^{3/2}} \int_0^\infty \sigma(E) E \exp(-E/k_B T)\, dE, \tag{1}$$

where N_A is the Avogadro number, μ is the reduced mass of the system, and k_B is the Boltzmann constant. When only resonance parameters are available, the cross section is assumed to be approximated by a Breit-Wigner expresion. When inserting the Breit-Wigner cross section in Eq. (1), one gets

$$N_A\langle\sigma v\rangle \approx N_A\langle\sigma v\rangle_r + N_A\langle\sigma v\rangle_t \tag{2}$$

where $N_A\langle\sigma v\rangle_r$ is the "usual" resonant rate and $N_A\langle\sigma v\rangle_t$ is the low energy "tail" contribution [3].

The adopted values of the rates are complemented with lower and upper limits, which allows an evaluation of the uncertainties. In cases where the lack of experimental data does not allow the rates to be evaluated for temperatures as high as $T_9 = 10$, a theoretical estimate is based on the Hauser-Feschbach model (HF). A linear interpolation between the evaluated rate at the last temperature available and the HF rate at $T_9 = 10$ is performed.

In some cases, it is found that the widely used analytical formulae do not approximate properly the reaction rates calculated by numerical integration, even if the S-factor curve is well approximated by a polynomial. This can happen when the S-factor varies rapidly with the energy. For example, the S-factor of the reaction d(d,γ)^{4}He can be well represented by the polynomial $S(E) = S(0) + S'(0)\,E + \frac{1}{2}\,S''(0)\,E^2$, with $S(0) = 6.2 \times 10^{-9}$ MeV-b, $S'(0)/S(0) = -1.7$ MeV^{-1} and $S''(0)/S(0) = 14.2$ MeV^{-2}. Even so, Fig. 1 shows that the numerical reaction rates may differ by more than a factor of 2 from the analytical rates [1].

An analytical fit for the adopted rates is provided as a guide for the physics of the reaction, and for comparison with the existing compilations. For the non-resonant contribution, a fitting polynomial in T_9, instead of $T_9^{1/3}$, is provided. It has been found indeed that the polynomial in $T_9^{1/3}$ leads to several mathematical problems in fitting procedures. The effect of thermal excitation of the target nuclei is evaluated in the frame of the HF model, and a fit to the ratio of the thermalized rates $N_{\rm A}\langle\sigma v\rangle_{\rm tt}$ to the ground state rates $N_{\rm A}\langle\sigma v\rangle_{\rm gs}$ is also available.

3 Examples of rate calculations

For illustrative purposes, we present in a schematic way the general format of the evaluated ^{3}He(^{3}He,2p)^{4}He and ^{23}Na(p,γ)^{24}Mg rates, to appear in Atomic Data and Nuclear Data Tables. The first reaction is an example of a non-resonant case while resonances dominate the rate of the second reaction.

^{3}He(^{3}He,2p)^{4}He:
Experimental data from several authors at $E_{\rm cm} \leq 2.9$ MeV ($T_9 \leq 24$) have been used for the calculation of the present rates. In order to avoid the possible effect of laboratory electron screening, data at $E_{\rm cm} < 44$ keV have been discarded. Up to $E_{\rm cm} = 2.9$ MeV, the S-factor data are well approximated by a polynomial of degree 2. At $T_9 \leq 1$, the present rates are slightly ($\leq 10\%$) smaller than the rates recommended in [1] as a consequence of the different adopted $S(0)$. For $T_9 > 1$, the present rates are significantly lower than in [1]. In this temperature region the expression proposed in [1] is based purely on an extrapolation of the experimental data from [4]. Table 1 shows an example of calculated rates for the reaction ^{3}He(^{3}He,2p)^{4}He for some temperatures up to T_9=10. Fig. 2 shows the ratio of the present rates to the rates from [1].

For comparison with the compilation [1], an analytical approximation is given. The following expression is a fit of the numerical adopted rates, and not the results of an analytical formulation. It reproduces the adopted rates within 2%.

$$
\begin{aligned}
N_{\rm A}\langle\sigma v\rangle_{\rm gs} &= 5.59\times10^{10}\,T_9^{-2/3}\exp(-12.277\,T_9^{-1/3})\times(1-0.135\,T_9+0.0254\,T_9^2-0.0013\,T_9^3)\\
N_{\rm A}\langle\sigma v\rangle_{\rm tt} &= N_{\rm A}\langle\sigma v\rangle_{\rm gs}
\end{aligned}
$$

Table 1: Numerical reaction rates for ^{3}He(^{3}He,2p)^{4}He. The columns labelled *low, adopt, high* correspond to the lower limit, the adopted rates and the upper limit, respectively, in units of mole^{-1} s^{-1} cm^3. The column labelled *exp* corresponds to the exponent n of the factor 10^n that should multiply the 3 previous columns. The last column, labelled *ratio*, is the ratio of the present adopted rates to the rates proposed in [1].

T_9	low	adopt	high	exp	ratio	T_9	low	adopt	high	exp	ratio
0.003	2.62	2.79	2.96	-25	0.9	0.25	4.30	4.59	4.87	2	1.0
0.005	1.15	1.22	1.29	-19	0.9	0.5	1.48	1.58	1.68	4	1.0
0.01	1.96	2.08	2.21	-13	0.9	1	2.18	2.34	2.49	5	0.9
0.025	3.46	3.68	3.90	-7	0.9	2.5	2.75	2.95	3.16	6	0.4
0.05	1.26	1.34	1.42	-3	1.0	5	1.00	1.09	1.17	7	0.1
0.1	7.62	8.11	8.61	-1	1.0	10	2.49	2.72	2.94	7	0.04

^{23}Na(p,γ)^{24}Mg:

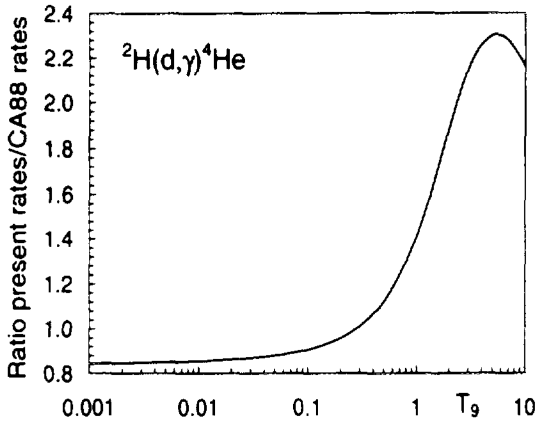
At $T_9 \leq 5$, the rates have been computed with the $\omega\gamma$ values of [5], where more than 80 resonances up to $E_r = 3.7$ MeV are reported. Two subthreshold states with $J^\pi = 2^+$ ($\ell = 0$) have been included with a reduced width $\gamma_p^2 = 305$ keV, (10% of the Wigner limit at $a = 4.6$ fm). These subthreshold states dominate the rate up to $T_9 \approx 0.07$. The lower and upper limits on γ_p^2 have been taken as 0 and 3.05 MeV (the Wigner limit). Since interference effects cannot be evaluated, and are therefore neglected, a factor of 2 has been included in the uncertainty on the contribution of subthreshold and low-energy states. At $T_9 > 5$, the rates are the result of the linear interpolation between the rate obtained from experimental data at $T_9 = 5$ and the HF rate at $T_9 = 10$. The analytical expression in [1] is unchanged with respect to [6]. Therefore, the data published after 1975 have not been taken into account. Moreover, the direct-capture term in [1] is obtained with $S_0' > 0$, which means that subthreshold states have been disregarded. Table 2 shows an example of calculated reaction rates for this reaction. The labels of the columns have the same meaning as in Table 1. The accuracy of the analytical fit is better than 7%.

Table 2: Numerical reaction rates for ^{23}Na(p,γ)^{24}Mg

T_9	low	adopt	high	exp	ratio	T_9	low	adopt	high	exp	ratio
0.02	0.03	6.16	122	-25	0.2	0.2	2.67	6.66	16.0	-3	0.8
0.03	0.04	6.71	132	-21	0.2	0.5	2.06	4.97	11.7	1	0.8
0.05	0.01	1.42	27.7	-16	0.2	1	3.93	7.25	15.2	2	0.9
0.08	0.77	2.57	11.9	-12	0.4	2	3.40	4.25	6.76	3	1.0
0.1	0.78	2.24	5.93	-9	0.7	5	1.76	2.10	3.24	4	1.3
0.15	1.53	3.94	9.62	-5	0.8	10	3.31	7.75	15.5	4	3.1

$$
\begin{aligned}
T_9 \leq 5 \quad N_A\langle\sigma v\rangle_{gs} = \;& 9.55\times10^7\,T_9^{-2/3}\exp(-20.77/T_9^{1/3}-(T_9/0.3)^2)\times(1-10.80\,T_9+61.08\,T_9^2)\\
&+85.2\,T_9^{-3/2}\exp(-2.808/T_9)+1.70\times10^4\,T_9^{-3/2}\exp(-3.458/T_9)\\
&+5.94\times10^4\exp(-5.734/T_9)\\
T_9 > 5 \quad N_A\langle\sigma v\rangle_{gs} = \;& 1.13\times10^4\,T_9-3.55\times10^4\\
N_A\langle\sigma v\rangle_{tt} = \;& N_A\langle\sigma v\rangle_{gs}\times(1-0.560\exp(-5.119/T_9-0.050\,T_9))
\end{aligned}
$$

4 Figures



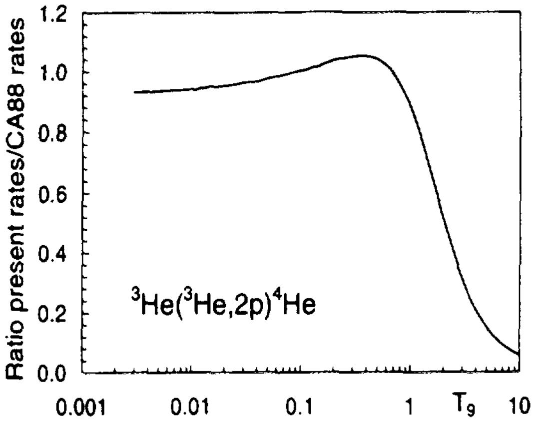


Figure 1: Ratio of the present numerical rates to the analytical rates of [1] for the reaction d(d,γ)^{4}He.

Figure 2: Same as in Fig. 1, but for ^{3}He(^{3}He,2p)^{4}He.

References

[1] C.R.Caughlan and W.A.Fowler, At. Data Nucl. Data Tables 40(1988)283.

[2] W.A.Fowler,G.R.Caughlan,B.A.Zimmerman, Ann.Rev.Astron.Astrophys.5(1967)525.

[3] C.E.Rolfs,W.A.Rodney,Cauldrons in the Cosmos,University of Chicago Press (1988).

[4] A.Krauss,H.W.Becker,H.P.Trautvetter,C.Rolfs, Nucl.Phys.A467(1987)273.

[5] P.M.Endt, Nucl.Phys.A521(1990)1.

[6] W.A.Fowler,G.R.Caughlan,B.A.Zimmerman, Ann.Rev.Astron.Astrophys.13(1975)69.

bnl aui

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National Nuclear Data Center
Bldg. 197D

(516) 282 } 2901, 2902
FTS 666

CP-C/183

DATE: April 6, 1989

TO: Distribution

FROM: V. McLane VM

SUBJECT: Redundant information in EXFOR

I would like to ask the other data centers to try and eliminate redundant lines of information from their EXFOR entries. These now take up many thousands of records in our already very large data bases. Since they contribute no useful information, they are an unnecessary waste of space, time and money.

Some examples of frequently-entered redundant lines are:

1. PART-DET. When the particle detected is evident from the reaction code or is coded under DECAY-DATA this keyword need not be used.

2. EN-SEC. When the particle to which the secondary energy refers is evident from the REACTION code, this keyword need not be coded (similarly, EMS-SEC, MOM-SEC).

3. RAD-DET. If the information about the radiation detected is given under DECAY-DATA, this keyword need not be coded. (also see memo CP-D/180).

4. HISTORY. As with all other keywords, the information coded in subentry 1 need not be repeated in the other subentries.

Charles L. Dunford

Charles L. Dunford

Distribution:

F. E. Chukreev	J. J. Schmidt
V. Vlarmov	A. Hashizume
V. Manokhin	N. Tubbs
S. Pearlstein	NNDC (5)

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HOW TO MAKE THE COMPILATION OF NRDF(NUCLEAR REACTION DATA FILE) MORE EFFICIENT — AUXILIARY DICTIONARIES AND CODING EDITOR ON THE WINDOWS ENVIRONMENT —

HIROSHI NOTO[1] *

[1] Hokusei Gakuen University, Sapporo, Japan,
* visiting professor of Institute of Physics and Astronomy
University of Aarhus, Aarhus, Denmark

The basic aim of the Japan Charged Particle Nuclear Reaction Data Group(JCPRG) is to construct and to disseminate an academic-oriented database(called NRDF(Nuclear Reaction Data File)[1]) according to its original and unique format by compiling and storing all charged-particle nuclear reaction data produced with Japanese accelerators. One of the characteristics of the NRDF is to compile physical quantities obtained from the nuclear reaction data through the published journals. The physical quantities dealt with in the journals are diverse and being newly set forth and accepted according as the progress both in the experimental devices and techniques and in the theoretical knowledge in nuclear physics. The concept and specifications of NRDF are able to incorporate those various and new physical quantities in its data file.

In this report we present our recent methodological developments in how to compile the NRDF more efficiently through the published journals.

In the compilation we are, based on the NRDF Dictionaries, coding not only the physical quantities and their relevant deduced parameters but also the experimental conditions, the models and the approximations exploited in the analysis in the experiment. Therefore it is particularly vital for the compilation to maintain the updated NRDF dictionaries without conflict which predefine all the codes that are used in all the stages of compilation, retrieval and maintenance of the NRDF database. We usually use two dictionaries: one covering Field Name Codes, the other covering Field Value Codes. Recently we have prepared two auxiliary dictionaries[2] that help the persons easily get proper codes who are engaged in the coding process: one "Name-Codes to Value-Codes Correspondence Dictionary" which can specify the Field Values acceptable as the candidates to be assigned to each Field Name, the other "Hierarchical Indexes Classified by Terms of NRDF Dictionary" which can identify the NRDF codes corresponding to ordinary terms that are used in the nuclear physics studies. Figure 1 and

Figure 2 display the portions of these two auxiliary dictionaries.

```
retrieval class = Models and approximations used in the analysis
                  Field Name [ANL]
   1. adiabatic model                                   : ADB-MODEL
   2. method of coupled channels                        : CC
   3. coupled channels born approximation               : CCBA
   4. coupled channels impulse approximation            : CCIA
   5. cluster model                                     : CLUST-MODEL
   6. collective model                                  : COLL-MODEL
   7. direct process                                    : DIRECT-PROC
   8. doppler shift attenuation method                  : DSA
   9. dwba(distorted wave born approximation)           : DWBA
  10. dwia(distorted wave impulse approximation)        : DWIA
  11. exciton model                                     : EXCITON
  12. exciton model                                     : EXCITON-MODEL
  13. faddeev method                                    : FADDEEV
  14. glauber approximation                             : GLAUBER
  15. interacting boson model                           : IBM
  16. impulse approximation                             : IMPULSE-APPROX
   ------------------- the rest omitted -------------------
```

Figure 1: "Name-Codes to Value-Codes Correspondence Dictionary". The Field Value (on the right with their definitions on the left) are listed alphabetically which are the candidates for the Field Name 'ANL'(Models and approximations used in the analysis).

```
string = cross section, sigma (hit counts of codes[34])
cross section                                       : XSECTN
   error in cross section                             : DELTA-XSECTN
   total cross section                                : SIGMA, TOT-XSECTN
      1. error in total cross section                   : DELTA-SIGMA
      2. error in total reaction cross section          : DELTA-TOT-RCT-XSECTN
      3. total reaction cross section                   : TOT-RCT-XSECTN
   sigma for                                          : XSECTN-
      1. sigma for individual final products            : XSECTN-LEVEL
   reaction cross section                             : RCT-XSECTN
      1. error in reaction cross section                : DELTA-RCT-XSECTN
      2. error in total reaction cross section          : DELTA-TOT-RCT-XSECTN
      3. total reaction cross section                   : TOT-RCT-XSECTN
   cross section ratio                              : XSECTN-RATIO
      1. error in cross section ratio                   : DELTA-XSECTN-RATIO
   differential cross section                         : DSIGMA/DOMEGA
      1. ratio of differential cross section            : DSIGMA/DOMEGA-RATIO
      2. error in ratio of differential cross           : DELTA-DSIGMA/DOMEGA-RATIO
         section (error in dsigma/domega-ratio)
  ------------------- the rest omitted -------------------

string = density (hit counts of codes[4])
density                                             : DNSTY
   charge density                                     : CHARGE-DNSTY
   matter density
      1. density distribution                           : DNSTY-DSTRB
      error                                             : DELTA-
         1. error in density                              : DELTA-DNSTY
   error                                              : DELTA-
      1. error in density                               : DELTA-DNSTY
```

Figure 2: Two examples for key words 'cross section' or 'sigma', and 'density'. "Hierarchical Indexes Classified by Terms of NRDF Dictionary" arranges all the Value Codes(literals with the upper cases on the right) hierarchically whose defining sentences(with the lower cases on the left) contain their respective key words.

We have recently developed "NRDF Coding Editor"[3] by using Visual Basic processor on the WINDOWS3.1/WINDOWS95 environment which could be installed on the UNIX workstation as well. The basic functions of the editor which has the Windows interface meet the six requirements below. In the following description four windows are opened at a time if necessary:

1)In the "1st window" the coding sheets are displayed. One clicks each Field Name whose Field Value one wants to specify.

2)In the "2nd window" the Field Values are listed which are acceptable as the candidates for the present Field Name. Those Field Values are retrieved from the

"Name-Codes to Value-Codes Correspondence Dictionary".

3)One selects the preferred Field Value by clicking one of the list displayed in "window 2". The selected Field Value is automatically transferred to the value field corresponding to the Field Name displayed in "window 1".

4)If one cannot find out a desirable Field Value in the previous process, one may have another way to display candidates list in the "4th window", by placing some key word(s) in the "3rd window". The key word here means a literal which is relevant to find out the present Field Value Code and which is included in the defining sentences of this code that is stored in the "Hierarchical Indexes Classified by Terms of NRDF Dictionary".

5)One selects the preferred Field Value by clicking one of the list displayed in "window 4". The selected Field Value is automatically transferred to the value field corresponding to the Field Name displayed in "window 1".

6)In "window 3" one enters key word(s) directly at a keyboard to search a desirable Field Value. In "window 1" one may of course directly place the preferred Field Value. In those situations the editor should support the completion function which enables one to type only the first few characters to complete the key word(s) or the Field Value if those strings or literals are stored in the above-mentioned two auxiliary dictionaries.

Figure 3 shows the example of the four windows of the NRDF Coding Editor.

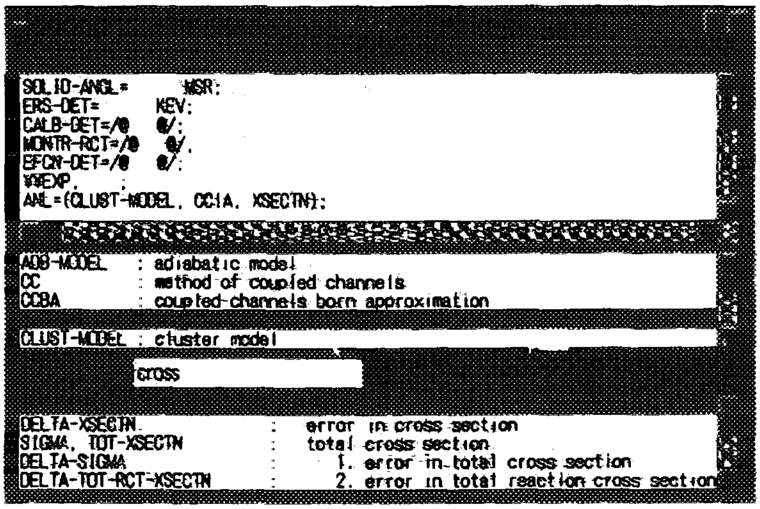

Figure 3: The Field Value 'CCIA'(window 2) and the 'XSCTN'(window 4) which is the retrieved Field Value for the keyword 'cross'(window 3) are automatically transferred to the field value column corresponding to the Field Name'ANL'(window 1).

In conclusion the two auxiliary dictionaries and the NRDF Coding Editor are expected to make the coding work considerably easier and more efficient.

References

[1] M.Togashi,H.Tanaka,Journal of Information Science,Vol.4(1982)No.5.

[2] H.Noto,NRDF ANNUAL REPORT 94,No.8(1995)2.

[3] H.Noto,NRDF ANNUAL REPORT 95,No.9(1996)57.

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