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INDC

INTERNATIONAL NUCLEAR DATA COMMITTEE

Report of the IAEA Nuclear Data Section to the

International Nuclear Data Committee for the Period 1997-1998

Edited by P. Obložinský

April 1999

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

Report of the IAEA Nuclear Data Section to the International Nuclear Data Committee for the Period 1997-1998

Abstract

This progress report describes the activities of the IAEA Nuclear Data Section in the years 1997 and 1998. The report provides information on the staff and budget, activities of the Nuclear Data Centre, co-ordination of the Nuclear Data Centre Networks, nuclear data development projects, technology transfer, computer support, and atomic and molecular data activities. This is complemented by additional information, including meetings, publications and new products that illustrate activities in the reported period.

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Glossary of Abbreviations

A+M	Atomic and Molecular
AGM	Advisory Group Meeting of the IAEA
AMDIS	A+M Data Information System (compare NDIS)
CD-ROM	Compact disk with read-only memory
CIAMDA	Computerized Index on A+M Data (compare CINDA)
CINDA	Computer Index on Neutron Data
CJD	Centre of Nuclear Data, Obninsk, Russia
CM	Consultants' Meeting of the IAEA
CRP	Co-ordinated Research Project of the IAEA (compare RCM)
ENDF	Evaluated Nuclear Data File
ENSDF	Evaluated Nuclear Structure Data File
EXFOR	Computer-based system for the compilation and international exchange of experimental nuclear reaction data (EXchange FORmat)
FENDL	Fusion Evaluated Nuclear Data Library
IAEA	International Atomic Energy Agency, Vienna, Austria
ICTP	International Centre for Theoretical Physics, Trieste, Italy
INDC	International Nuclear Data Committee
IT	Information Technology
LAN	Local Area Network
NA	Department of Nuclear Sciences and Applications of the IAEA
NAPC	Division of Physical and Chemical Sciences of the IAEA
NDIS	Nuclear Data Information System
NDS	IAEA Nuclear Data Section, Vienna, Austria
NDS	IAEA Nuclear Data Service
NEA	Nuclear Energy Agency of the OECD, Paris, France
NEA DB	NEA Data Bank, Paris, France
NESI	Division of Scientific Information of the IAEA
NNDC	National Nuclear Data Centre, Brookhaven National Laboratory, USA
NRDC	Nuclear Reaction Data Centres
NSDD	Nuclear Structure and Decay Data
NSR	Nuclear Science References, a bibliographic file related to ENSDF
NT	New Technology (operating system Windows NT)
OECD	Organization for Economic Co-operation and Development, Paris, France
PPAS	Programme Performance Assessment
RCM	Research Co-ordination Meeting (compare CRP)
RIPL	Reference Input Parameter Library
TC	Technical Co-operation
TECDOC	Technical document published by the IAEA
VMS	Operating systems of the Compaq Alpha Server

Nuclear Data Section

Organization Chart
(31 March 1999)

Section Head: **D.W. Muir**
Nuclear Data Physicist
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(21709/21710)

Deputy Section Head: **P. Oblozinsky**
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INDC Secretariat

Section Head
Deputy Section Head
E. Baumgartner

Nuclear Data Centre Unit	Nuclear Data Development Unit	Computer Operations Unit	Atomic & Molecular Data Unit
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*) New staff in 1997-1998

Preface

The IAEA Nuclear Data Section is one of 4 sections of the Division of Physical and Chemical Sciences which in turn is one of 5 divisions of the Department of Nuclear Sciences and Applications.

The present report serves the function of the progress report on the IAEA Nuclear Data Program, aiming to provide background information to the International Nuclear Data Committee on the activities of the Nuclear Data Section during the biennium 1997-1998. The report focuses on the nuclear data aspect of activities, constituting about 75% of both the staff and the budget of the Section. Only a brief summary of atomic and molecular data activities is given, since these are regularly reviewed by another committee.

The Section is internally organized into 4 units, and the present report attempts to reflect this structure. Except for Chapter 1 on the Nuclear Data Section Overview prepared by Doug Muir (Section Head), the contributions to the report have been written by the senior staff in their capacity as Unit Heads. In particular, Vladimir Pronyaev (Nuclear Data Centre Unit) contributed Chapter 2 on Data Centre Activities and Chapter 3 on Network Co-ordination. This is followed by Chapter 4 on Nuclear Data Improvement and Chapter 5 on Technology Transfer prepared by P. Obložinský (Nuclear Data Development Unit). Then, Doug Muir (Computer Operations Unit) contributed Chapter 6 on Computer Support and Ratko Janev (Atomic and Molecular Data Unit) prepared Chapter 7 on Atomic and Molecular Data.

The main text of the report is complemented by 3 Appendices that provide additional information on the activities of the Section in the reported period. Appendix 1 gives a list of meetings and workshops organized by the Section, Appendix 2 summarizes its publications, and Appendix 3 lists new products prepared by the Section.

Vienna, 31 March 1999   P. Obložinský

1. NUCLEAR DATA SECTION OVERVIEW

The budget and staffing level of the Nuclear Data Section has been relatively stable during the current reporting period, with the exception that the Section lost one G-4 secretarial position when Sofie Aung retired without replacement in late 1998. The authorized staff level for 1999-2000 is 18, consisting of 10 professionals (P-staff) and 8 support staff (G-staff). Of these 18 staff members, 3 (2 P-staff and 1 G-staff) are assigned to the Atomic and Molecular Data Unit.

As shown in Table 1, the budget approved for the 1999-2000 biennium is nearly constant in dollars, in comparison with 1997-1998. There has been some shift of emphasis in the programme of the Section, with more resources devoted to workshops and other user training initiatives than in the past, increased staff activity in the development of technical co-operation projects, and the 15-month appointment of a Web programmer, Scott Miller of the University of Texas. There have been declines in the hard copy printing budget, and in both staff and non-staff travel. Further pressure on printing and travel budgets can be expected in the future.

Table 1. Budget and staff summary 1997-2000

	1997	1998	1999	2000
Authorized Staff Level	19	18	18	18
Actual Staff Level	17.8	19	18.1	18
Staff Cost Budget	1,600,000	1,600,000	1,600,000	1,550,000
Programmatic Budget	645,000	602,000	570,000[*]	636,000
Total Budget US$	**2,245,000**	**2,202,000**	**2,170,000**	**2,186,000**

*) Already includes recent cut by 47,000 US$ in staff and non-staff travel

In spite of substantial staff turnover during the period, the Section has operated at full staff strength since November 1997, when Vladimir Pronyaev was appointed as successor to Hans Lemmel as Head of the Nuclear Data Centre Unit. Vladimir comes to us from the Nuclear Data Centre at IPPE Obninsk, Russia. In addition to numerous responsibilities connected with the design and delivery of nuclear data services to users, Vladimir also serves as the Scientific Secretary of the Nuclear Structure and Decay Data Evaluators Network.

The Section's long time Data Centre Systems Manager, Ramon Arcilla, completed 7 years of outstanding service in early 1998. Despite good arguments to the contrary, the post was deemed subject to staff rotation, and Mr. Arcilla left the Agency at the end of May. A vigorous recruiting effort (which included upgrading this post to the P-3 level by utilizing a previously frozen P-4 position) resulted in the hiring of William (Liam) Costello as our new Data Centre Systems Manager in May 1998. Liam comes to the Section with 13 years of previous experience managing VMS systems in university science and engineering research centres in Ireland and Kuwait. In other staff movements, Harm (Harry) Wienke left the Section at the end of 1998 and was replaced by Victor Zerkin, who formerly managed the Ukraine Nuclear Data Centre. With Mr. Zerkin's appointment, this position has been redirected somewhat to focus more on the development of computer software for improved nuclear data services.

Mr. M. O'Connell's post in the NDS Computer Operations Unit was upgraded from G-4 to G-5. Mr. O'Connell continues to serve as Information Technology Co-ordinator (ITC) for the Division of Physical and Chemical Sciences along with his work as a programmer in the Nuclear Data Section.

The position of Head of the Atomic and Molecular Data Unit will be vacated this year with the retirement of Ratko Janev after 11-plus years of outstanding service. Mr. Janev's unique accomplishments were recognized formally by the Agency through the granting in 1998 of a Merit Promotion to the P-5 level. Merit promotions are awarded to fewer than one-half of one percent of Agency employees each year. It is anticipated that his successor will arrive in July 1999.

In September 1997 the IAEA General Conference approved the appointment of Dr. Mohamed ElBaradei as Director General of the IAEA, replacing Dr. Hans Blix. The new Director General has initiated an ambitious program of programme reviews, beginning with an in-house Senior Management Conference in early 1998. One of the outcomes of that conference is a new process which "will assist in implementing the staff rotation policy by identifying posts which require continuity, as opposed to those that need the periodic input of fresh talent". This increased attention to the need for continuity in core staff positions is a welcome development, and the Section is participating in the formulation of the new process. Another significant event was the convening of an Agency-wide review by the external Senior Expert Group (SEG), which completed its work in October 1998. Among the recommendations of the SEG was the initiation of Department-level Programmatic Performance Assessments (PPAS) of several Agency Departments, including our own, the Department of Nuclear Sciences and Applications.

In support of the PPAS of the Department of Nuclear Sciences and Applications, the Nuclear Data Section has produced briefing materials on several topics of interest to the review panel, including (a) the special role of the Department of Nuclear Sciences and Applications in developing scientific databases which support the development of nuclear technology in Member States, (b) the close working relationship between the nuclear data programs of the IAEA and the OECD Nuclear Energy Agency, (c) an explanation of the important role of the International Nuclear Data Committee in providing programmatic guidance to Agency activities, and (d) the creation of a unified web site for our parent Division, the Division of Physical and Chemical Sciences (NAPC), on the Agency's central web server; see http://www.iaea.org/programmes/napc/nd/. (The NDS portion of this site provides a useful supplement to the Section's nuclear and atomic data dissemination sites, which continue to be developed separately). The PPAS panel has met twice already and is expected to complete its work in May 1999. The recommendations of the panel can be expected to have an impact on the future directions of the programme and budget of the Section, Division and Department, as well as the standing advisory groups that advise the Director General on these activities.

2.   DATA CENTER ACTIVITIES

The main objectives of the NDS Nuclear Data Centre activity in 1997-1998 can be formulated as follows:

- to collect, assess, recommend and disseminate nuclear data required in the application of nuclear technology,

- to promote the exchange of nuclear data needed for applications,

- to co-ordinate world wide networks of national and regional nuclear reaction and nuclear structure and decay data centres,

- to maintain manuals and software for internationally agreed database formats and exchange procedures, and

- to improve the means by which the data centre provides information to its users.

2.1.   *Nuclear Data Compilation*

Nuclear reaction data compilation includes the collection of bibliographic information and numerical data mainly from the NDS Nuclear Data Centre's area of responsibility, and their compilation in the computerized formats CINDA and EXFOR. This concerns first mainly experimental data.

General purpose evaluated nuclear reaction data libraries are created under national or regional programs and after distribution they are included in the common network's ENDF database by the NNDC, Brookhaven. Special purpose oriented nuclear data libraries and files are prepared in the framework of the IAEA Co-ordinated Research Projects or national and regional programs. They are documented by the IAEA NDS and, after checking and testing, disseminated via online access or off-line upon requests.

CINDA

The co-operation between the four major Nuclear Data Centres (NNDC Brookhaven, CJD Obninsk, NEA DB Paris and NDS Vienna) worked smoothly, and changes in the system and dictionaries were introduced in joint co-ordinated efforts. The top priority among these efforts is the preparation of 'CINDA 2000' (responsibility of NNDC, with input from other centres). This includes the necessary modifications for the coding and storage of data from year 2000 onwards, and an extension of the CINDA system to allow its use for non-neutron reaction data. At the same time, there is an action on NDS to prepare proposals for the coding of theoretical model parameters used in calculations and evaluations.

During 1997-1998, the NDS has prepared and transmitted 3677 CINDA entries either as direct input to the CINDA file (work in laboratories belonging to the responsibility of NDS) or for further processing by the responsible data centres.

CINDA 97 was published as a cumulative issue (1988-1997) and CINDA 98 was published as a supplement to CINDA 97. The introductory pages were revised and some parts omitted that were difficult to keep up to date. The change in programming staff (R. Arcilla replaced by W. Costello) was smooth and caused no delay in the book production.

In 1998, the NEA Data Bank produced a trial version of CINDA on CD-ROM, for which NDS provided some input. The distribution of this CD-ROM will be cost free.

The online use of the CINDA file is increasing steadily. The Web interface is increasingly preferred by users over the Telnet interface.

EXFOR

In the years 1997-1998, 5 neutron-EXFOR transmissions were distributed by NDS to the other centres containing:

- 28 new entries with 315 new data tables (subentries),
- 69 revised or recompiled entries with 209 revised data tables.

The new entries contain data from Albania (1 entry), Bangladesh (2), Brazil (2), China (9), Hungary (4), India (1), Mexico (2), Poland (1), Romania (1), Slovakia (3), and Sudan (2).

In addition, NDS distributed two EXFOR transmissions containing new charged-particle nuclear data compiled at ATOMKI, Debrecen (Hungary) which were checked and finalized at NDS. These transmissions contained 17 new entries with 147 new data tables (subentries) and several revisions.

Evaluated Data Libraries, Files and Programs

The following Evaluated Data Libraries, Files and Programs have been updated or added to the IAEA NDS collection (listed in chronological order of their inclusion):

- CENDL-2.1R. 7 revised materials (^{nat}Fe, ^{54,56,57,58}Fe, ^{nat}Hg, ^{nat}Tl) were replaced in the previous version of the Chinese Evaluated Nuclear Data Library for neutron reaction data (CENDL-2.1). Available online and on CD-ROM.

- "Maslov" updates 97/2 and 98/01. Evaluated neutron reaction data for ^{238}Pu, ^{242}Pu and ^{238}Np were added to this file containing now evaluations for several Np, Pu, Am and Cm isotopes. Available on diskette.

- MENDL-2P. Proton reaction data library for nuclear activation which includes calculated proton cross sections in ENDF-6 format for 505 nuclei (Z=13-84) for energies up 200 MeV. The total number of reactions is 87196. Available on CD-ROM.

- SGNucDat Version 2. Safeguards Nuclear Data for Windows, update 1997, which includes: a) actinide nuclear data (decay data, selected neutron cross section data, fission-neutron data); b) fission-product nuclear data (decay data and selected neutron cross section data); c) fission-product yield data. Available on diskette.

- XMuDat. Photon attenuation data on PC. XMuDat is a package of computer code and data library to be used with Windows 95 or Windows NT for the calculation and presentation of mass attenuation-, mass energy transfer-, and mass energy absorption coefficients in a photon energy range of 1 keV to 50 MeV for materials, their mixture and compounds. Available online and on diskette.

- FENDL-2.0. A comprehensive and extensively tested nuclear data library developed for fusion (thermonuclear) applications and actually used for the ITER design. Evaluations contained in the library are judged to be the best available, as of February 1997. Their use can also be recommended for other (non-fusion) applications. FENDL-2.0 version 14 January 1999 is available online and on CD-ROM and consists of the following sublibraries:

    ACTIVATION (FENDL/A-2.0) - neutron activation cross sections for 13006 reactions on 739 targets ranging from ^{1}H up to ^{248}Cm at incident energies up to 20 MeV. Pointwise and processed data in different formats are included.

    DECAY (FENDL/D-2.0) - decay properties (decay type, decay energy, and half-life) for 1867 nuclides and isomers. FENDL/D-2.0 sublibrary is complementary to the activation sublibrary. Pointwise and processed data are included.

    DOSIMETRY (FENDL/DS-2.0) - neutron cross sections to be used for reactor neutron dosimetry by foil activation, radiation damage cross sections, and benchmark neutron spectra. This sublibrary is identical to the International Reactor Dosimetry File (IRDF-90). Pointwise and processed data are included.

    FUSION (FENDL/C-2.0) - charged-particle cross sections for the following fusion reactions: ^{2}H(d,n)^{3}He, ^{2}H(d,p)^{3}H, ^{3}He(d,p)^{4}He, ^{3}H(t,2n)^{4}He, and ^{3}H(d,n)^{4}He. Pointwise and processed data are included.

    TRANSPORT - validated basic nuclear data (neutron-nucleus interaction including photon production, and photon-atom interaction cross sections) for 57 nuclides relevant for fusion. In addition to the pointwise data (FENDL/E-2.0), the sublibrary also contains processed data FENDL/MG-2.0 and FENDL/MC-2.0 to be used in the discrete-ordinates and Monte Carlo transport calculations respectively.

    BENCHMARKS - collection of benchmarks for FENDL-2.0 validation.

• NGATLAS. The files of this library contain neutron capture cross sections in the range 10^{-5} eV - 20 MeV as evaluated and compiled in recent activation libraries. Numerical values of (n, γ) cross sections are available for a total of 739 targets for the elements H (Z=1, A=1) to Cm (Z=96, A=248), totaling 972 reactions. Available online.

• RIPL. Reference Input Parameter Library for theoretical calculations of nuclear reactions. The library contains input parameters for theoretical calculations of nuclear reaction cross sections. Incident and outgoing particles can be n, p, d, t, ^{3}He, ^{4}He, and gamma with energies up to about 100 MeV. The information is given for Atomic Masses and Deformations, Discrete Level Schemes, Average Neutron Resonance Parameters, Optical Model Parameters, Level Densities (Total, Fission, Partial), Gamma-ray Strength Functions and Continuum Angular Distributions. Available online and on CD-ROM.

• EPDL97. The Evaluated Photon Data Library, 1997 Version. It supersedes the earlier 1989 version of EPDL. The library includes photon interaction data for all elements with atomic numbers between 1 and 100 over energy range 1 eV to 100 GeV. The Evaluated Atomic Data Library (EADL), Evaluated Electronic Data Library (EEDL) and Evaluated Excitation Data Library (EXDL) are included to allow consistent coupled photon-electron calculations. Available on CD-ROM.

• EPICSHOW (Electron Photon Interactive Code - Show Data), 1998 Update. This is interactive graphics code that allows users to view and interact with neutron, photon, electron and light charged particle data. The code is implemented on UNIX, IBM-PC, Power MAC and Windows platform. Available on CD-ROM.

• ENDF/B-VI Library, Release 5. It includes revisions up to October 1998. Available online and on CD-ROM.

• ENDF/B-VI Charged-Particle Sublibraries, Version 1998. It contains interaction data between hydrogen and helium isotopes/nuclei. Available online and on CD-ROM.

• RRDF-98. Russian Reactor Dosimetry File. File contains cross sections (including plots with intercomparisons) and covariance matrices of uncertainties for 22 reactions used for neutron flux dosimetry by foil activation. Available online and on diskettes.

All these files, libraries and codes are documented either in the IAEA-NDS Report series (available online) or in INDC Report (NGATLAS) and IAEA-TECDOC Report (RIPL).

2.2. Nuclear Data Services: Improvement and Statistics

Due to the variety of requirements from users, different media are used for user services. These services include answering requests using ordinary mail with enclosure of hard copies of documents, PC diskettes and CD-ROMs for local use, and online transfer of data retrieved by users through Telnet/NDIS or via Web access to the databases, files and documents. The main innovations and improvements in the user's services in the last two years can be summarized in the following way:

- Platform independent and user-friendly Web access was opened to all major nuclear databases: CINDA, EXFOR and ENDF in 1997-1998.

- CD-ROM versions of important databases, libraries and files (CINDA, EXFOR, ENDF) with retrieval programs were prepared in co-operation with other data centres or by NDS (FENDL-2.0, RIPL). This service is primarily focused on users with limited access to the Internet (new for CD-ROMs with databases and retrieval programs).

- Twenty-two recent reports with descriptions of data and computer codes available from Nuclear Data Section (reports of the IAEA-NDS series) were ported to the NDS Web site. Six of the latest INDC reports which had electronic version were placed at the NDS Web site. Six of the latest Nuclear Data Newsletters announcing new NDS services and products were made available online (new for IAEA-NDS and INDC Reports).

Table 2. NDS nuclear data retrieval statistics by year

Type of Medium	Year			
	1995	1996	1997	1998
Ordinary mail [a]	1556	786	1846	1775
Including:				
Documents (hard copies)	1155	554	1547	1430
Data (diskettes and CD-ROMs)	373	219	286	320
Online retrievals (Telnet and Web)	4462	5688	7350	9300
Web sessions [b]	-	840	13517	28601
Including access to:				
ENDF	-	-	67	1833
EXFOR	-	-	219	1063
CINDA	-	-	33	680
ENSDF	-	67	592	827
FENDL	-	-	512	1044
RIPL	-	-	102	1574
Newsletters and Reports	-	15	182	1224
Volume of information downloaded from the Web server (Mbytes)	-	35	2551	8556

[a] Retrievals prepared upon requests.

[b] A Web session is defined as being any, non-IAEA domain, client connection to the NDS Web server. Such sessions can be of any duration provided that they are not interrupted for a period of more than 30 minutes.

The general statistics of user services in 1997-1998 is shown in Table 2. Also shown for comparison are the years 1995-1996. Figures are given in terms of retrievals for 3 different media. Ordinary mail includes retrievals prepared by the NDS staff upon user requests and sent to them via ordinary mail. Online retrievals are made directly by users through their Telnet or Web access to the databases, libraries, files and reports. One retrieval usually contains one homogenous piece of information. This can represent one report, or a set of different data retrieved from one library or database, or computer code or codes when they are distributed as a package. Online retrieval corresponds to one user creating output either on hard disk or in screen mode. Further given in Table 2 is the number of Web sessions at the NDS server and the number of Web sessions with access to the major databases, libraries and reports. Finally, the total volume of downloaded information with details on several databases, libraries and files is shown.

Fig. 1 shows the country statistics of the NDS data services in 1997 subdivided into three categories: ordinary mail, user initiated online Telnet retrievals, and Web sessions. The countries are grouped according to four areas of the responsibility, that is those of the four major data centres.

Fig. 2 demonstrates the activity of users from different countries at the NDS server over the last two years. The NDS server provides access to many data libraries, files, computer codes and reports which are specific to IAEA activity. This is one of the reasons why the NDS server is accessed by users of other centres service areas.

The following tendencies in the user's services can be seen during the last two years:

- The number of requests fulfilled through ordinary mail remains fairly stable.

- The number of data sets and computer code packages distributed on diskettes and CD-ROMs is also relatively stable with a high share of CD-ROMs in the last two years.

- Since access to the databases through the Web is generally more comfortable than through the Telnet, about 70% of all users used the Web and only 30% used Telnet for data retrieval in 1998.

- The number of Web sessions doubled in 1998 compared to 1997, with an 8 to 10% share of users from developing countries. Users from a total of 82 different countries have visited the NDS Web server in 1998. At present, 85% of all addresses have been resolved in the analysis of the Web log records.
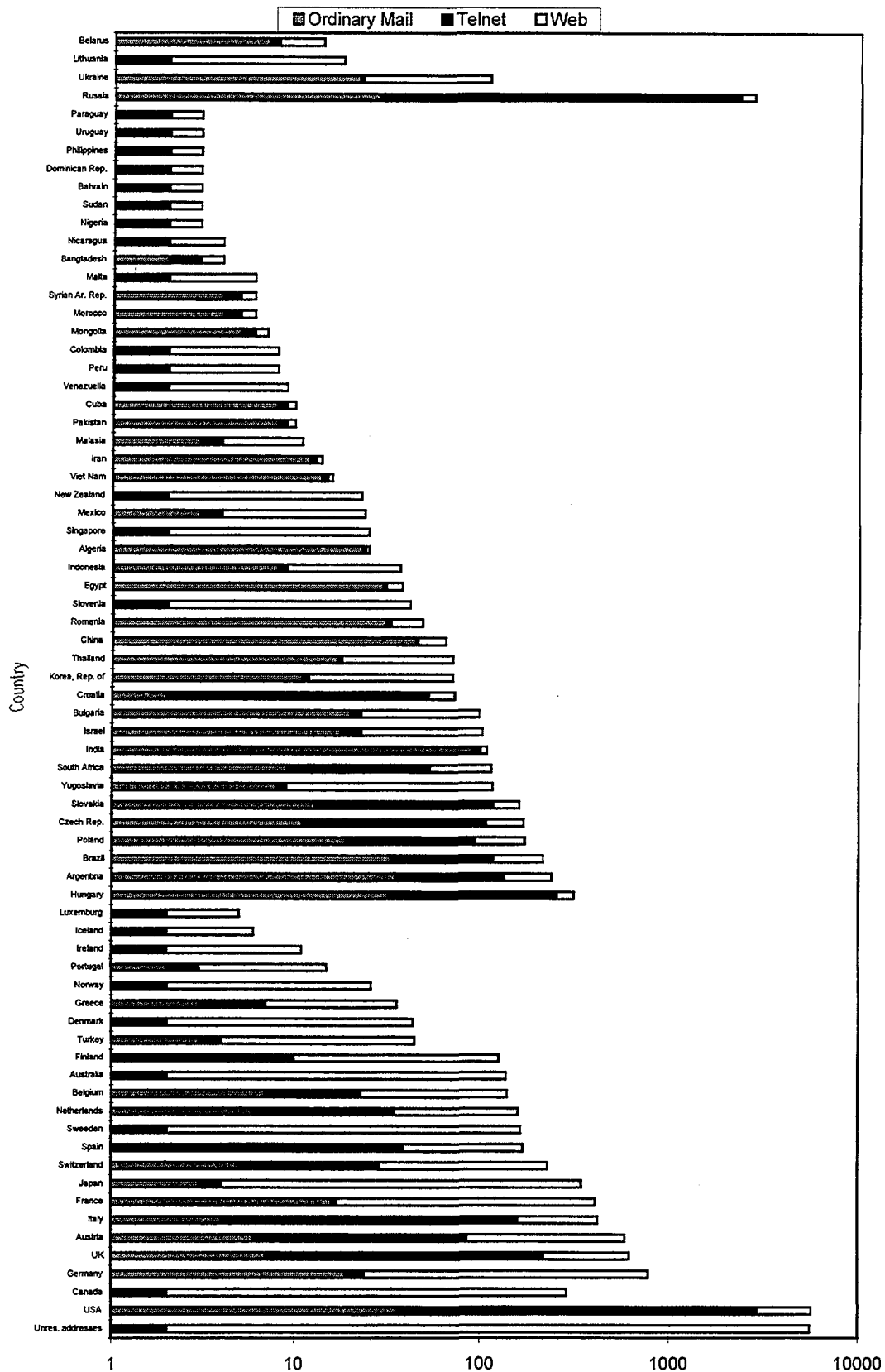
Fig.1 IAEA Nuclear Data Service provided to users in 1997, including ordinary mail, Telnet and Web. Countries are arranged in 4 groups according to their service areas.
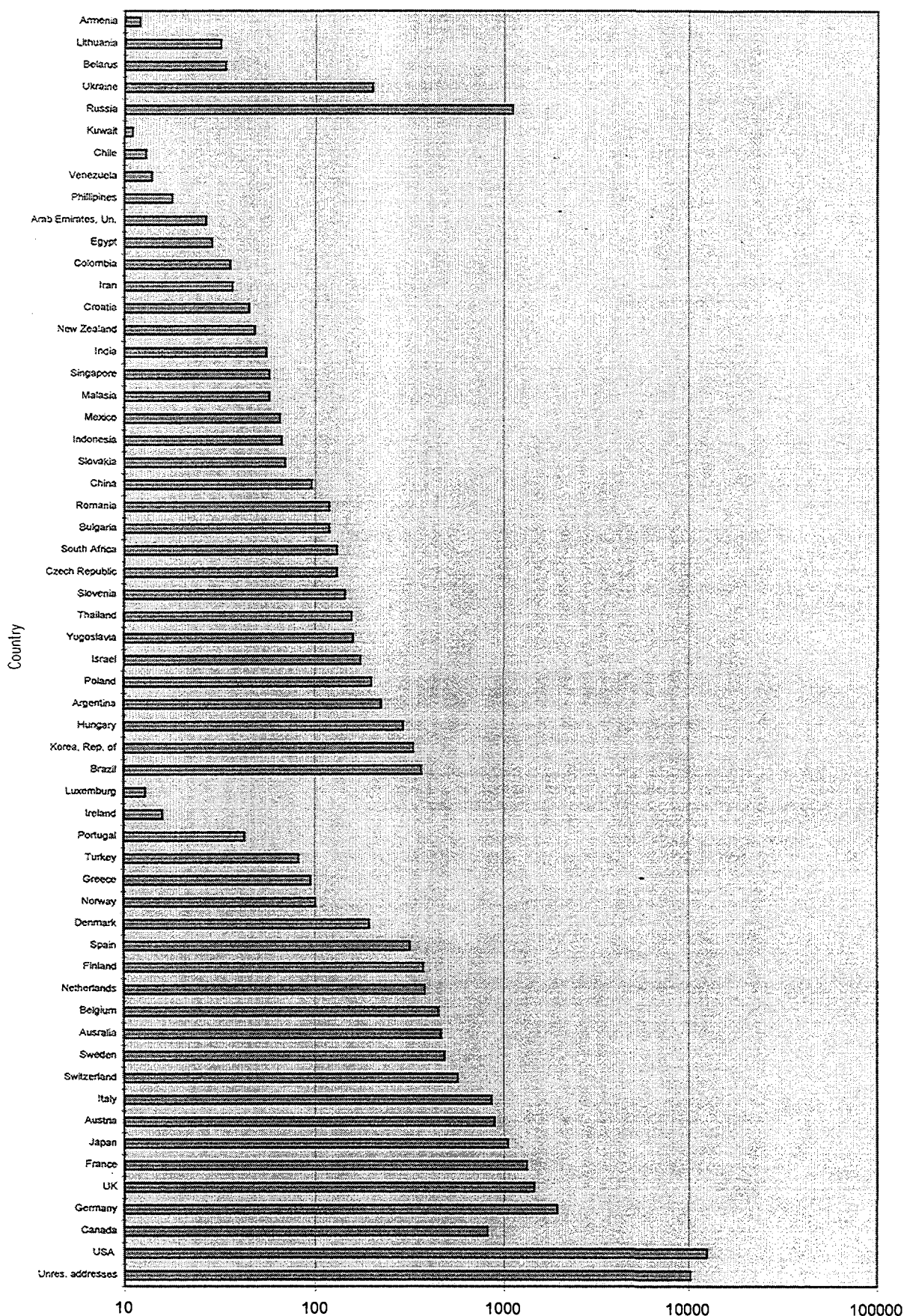
Fig. 2. Number of Web sessions provided by the IAEA Nuclear Data Service by country (sum of 1997-1998). Countries are arranged in 4 groups according to their service areas.

3.   NUCLEAR DATA CENTRE NETWORK CO-ORDINATION

Two networks of Nuclear Data Centres are co-ordinated by the IAEA NDS. The first network consists of Nuclear Reaction Data Centres (NRDC), the second network consists of the Nuclear Structure and Decay Data (NSDD) evaluators.

3.1.   Nuclear Reaction Data Centres

The NDS involvement and contribution in the co-operative work of these centres is relatively high. The NDS convenes annual network co-ordination meetings and participates in co-operative work on database and code development. The code development work is currently being intensified with the replacement of Harry Wienke (EXFOR compilation and data processing) by Victor Zerkin (EXFOR compilation and database program development) in January 1999.

The smooth co-operation between the nuclear reaction data centres continued and was co-ordinated through two network meetings and several bilateral visits. The network was extended by two additional centres, the Centre of Nuclear Physics Data in Sarov, Russia, and the Ukrainian Nuclear Data Centre in Kiev, Ukraine. At the full NRDC meeting in Vienna in May 1998 all 13 member centres were represented (see Table 3 below).

Table 3. List of 13 Nuclear Reaction Data Centres constituting the NRDC network

Centre	Main activity within the network
National Nuclear Data Centre, Brookhaven National Laboratory, Brookhaven, USA	Nuclear reaction data compilation and dissemination
OECD Nuclear Energy Agency Data Bank, Paris, France	Nuclear reaction data compilation and dissemination
Nuclear Data Section, International Atomic Energy Agency, Vienna, Austria	Nuclear reaction data compilation, processing and dissemination
Russia Nuclear Data Centre, Institute of Physics and Power Engineering, Obninsk, Russia	Neutron reaction data compilation, evaluation and dissemination
Russia Nuclear Structure and Reaction Data Centre, Kurchatov Institute, Moscow, Russia	Charged-particle data compilation and evaluation
Centre for Photonuclear Experiments Data, Moscow State University, Moscow, Russia	Photonuclear reaction data compilation, evaluation and dissemination
China Nuclear Data Centre, China Institute of Atomic Energy, Beijing, China	Nuclear reaction data compilation, evaluation and dissemination
Japan Atomic Energy Research Institute - Nuclear Data Centre, Tokai-mura, Japan	Nuclear reaction data compilation, evaluation, validation and dissemination

Centre	Main activity within the network
RIKEN Nuclear Data Group, Institute of Physical and Chemical Research, Wako-shi, Japan	Charged-particle reaction data compilation
Japan Charged-Particle Nuclear Reaction Data Group, Hokkaido University, Sapporo, Japan	Charged-particle reaction data compilation and dissemination
ATOMKI Charged-Particle Nuclear Reaction Data Group, Institute of Nuclear Research of the Hungarian Academy of Science, Debrecen, Hungary	Charged-particle reaction data compilation and evaluation
Ukraine Nuclear Data Centre, Institute for Nuclear Research, Kiev, Ukraine	Compilation of nuclear reaction data
Centre of Nuclear-Physics Data, Russian Federal Nuclear Centre - VNIIEF, Sarov, Russia	Compilation and evaluation of charged-particle reaction data for light nuclei

NRDC Network Meetings

- Consultants' Meeting on Co-ordination of Nuclear Reaction Data Centres (Technical Aspects), Vienna, 26-28 May 1997. Report: INDC(NDS)-374. The conclusions and planned actions of this meeting focused mainly on the solution of technical problems of the data centres co-operation.

- Advisory Group Meeting on Co-ordination of Nuclear Reaction Data Centres, Vienna, 11-15 May 1998. Report: INDC(NDS)-383. The conclusions and recommendations of the Meeting include the following actions:

    - to use the increased opportunities of the World Wide Web for improving customer services through the continuing development of the online access to the databases and related information;
    - to improve efficiency in computer program development by timely exchange of information on plans and progress among the Centres;
    - to continue the development of databases resident on the user's PC and their updating from one of the Nuclear Reaction Data Centres via computer networks.

Bilateral visits involving NDS

- T.W. Burrows (NNDC Brookhaven) to NDS, 1-12 December 1997 (NNDC/NDS mirror Web pages)
- W. Costello (NDS) to NNDC Brookhaven, 5-9 October 1998 (continuation of contact between IT personnel)
- O. Schwerer (NDS) to NEA-DB, 25-27 November 1998 (common databases and software, CD-CINDA)
- T.W. Burrows (NNDC Brookhaven) to NDS, 7-11 December 1998 (NNDC/NDS mirror Web pages).

3.2. Nuclear Structure and Decay Data Evaluators

The international network of nuclear structure and decay data (NSDD) evaluators sponsored by the IAEA consists of evaluation groups and data service centres in several countries. The objective of this network is to provide up-to-date nuclear structure and decay data for all known nuclides by evaluating existing experimental data. At present, the network includes 23 groups and centres (see Table 4 below).

The data resulting from this international evaluation collaboration is included in the Evaluated Nuclear Structure Data File (ENSDF) and published in the journals **Nuclear Physics A** and **Nuclear Data Sheets**. The results represent the recommended "best values" for nuclear structure and decay data quantities. The recommended values are made available to users by using various media such as online computer services, PC diskettes and compact disks, wall-charts of nuclides, handbooks, nuclear wallet cards, and others. The ENSDF master database is maintained by the US National Nuclear Data Centre at the Brookhaven National Laboratory. Data from the latest version of the ENSDF are available also from other distribution centres including the IAEA Nuclear Data Section server.

Periodic meetings of the network sponsored by the IAEA Nuclear Data Section have the objectives of co-ordinating the work of all centres and groups participating in the compilation, evaluation and dissemination of NSDD, of maintaining and improving the standards and rules governing NSDD evaluation, and of reviewing the development and common use of the computerized systems and databases maintained specifically for this activity.

The main constituent of this network, the network of ENSDF evaluators and ENSDF programmers, is co-ordinated by the NNDC Brookhaven. The network includes also centres preparing "horizontal" evaluations (evaluation of one or a few specific quantities for a set of nuclei) and data dissemination centres. The NDS holds biennial co-ordination meeting of NSDD network and has a few Co-ordinated Research Projects contributing to the "horizontal" evaluations (see the CRP list in Chapter 4.1). The involvement of the IAEA NDS in the co-ordination of the NSDD network consists primarily in holding of biennial Advisory Group Meetings. The co-ordination between the meetings should be provided by the elected chairman (D. de Frenne) and the deputy chairman (Ch. Dunford).

NSDD Network Meeting

- Advisory Group Meeting on Co-ordination of the International Network of Nuclear Structure and Decay Data Evaluators, Vienna, 14-17 December 1998. Report: INDC(NDS)-399. The important conclusions and recommendations of the meeting are the following:

    - recommendation to the IAEA to include in its future nuclear data program the proposals supported by network participants for holding of Consultant's Meetings, Workshops and CRPs related to evaluation activity and to practical

use of the ENSDF;

— agreement on the practical procedure of the incorporation of horizontal evaluations in the ENSDF;

— approved proposals about changes in the ENSDF format and program development.

Table 4: List of 23 groups and centres constituting the NSDD network

Centre	Activity within the Network
National Nuclear Data Centre, Brookhaven National Laboratory, Brookhaven, USA	ENSDF evaluation, dissemination
Nuclear Data Project, Oak Ridge National Laboratory, Oak Ridge, USA	ENSDF evaluation, dissemination
Isotope Project, Lawrence Berkeley National Laboratory, Berkeley, USA	ENSDF evaluation, dissemination
Idaho National Engineering and Environmental Laboratory, Idaho Falls, USA	ENSDF evaluation
Triangle University Nuclear Laboratory, Raleigh, USA	ENSDF evaluation, dissemination
Centre for Nuclear Structure and Reaction Data, Kurchatov Institute of Atomic Energy, Moscow, Russia	ENSDF evaluation
Nuclear Data Centre, Petersburg Nuclear Physics Institute Academy of Sciences of Russia, Gatchina, Russia	ENSDF evaluation
Fysisch Laboratorium, Utrecht, Gent, The Netherlands	ENSDF evaluation
Institute of Atomic Energy + Jilin University, Beijing + Changchun, People's Republic of China	ENSDF evaluation
Centre d'Etudes Nucleaires, Bruyeres le Chatel, Grenoble, France	ENSDF evaluation
Nuclear Data Center, Japan Atomic Energy Research Institute, Tokai-mura, Japan	ENSDF evaluation
Nuclear Data Centre, Physics Department, Kuwait University, Safat, Kuwait	ENSDF evaluation
Laboratorium voor Kernfysica, Gent, Belgium	ENSDF evaluation
Department of Physics and Astronomy, McMaster University, Hamilton, Canada	ENSDF evaluation
Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse, Orsay, France	Horizontal evaluation (Atomic Masses)
Physics Department, University of Oxford, Oxford, United Kingdom	Horizontal evaluation (Nuclear Moments)
Institute of Isotopes and Surface Chemistry, Chemical Research Centre, Budapest, Hungary	Horizontal evaluation (Neutron Capture Gammas)

Centre	Activity within the Network
School of Physics, Georgia Institute of Technology, Atlanta, USA	Horizontal evaluation (E0 Systematics)
Centre for Nuclear Information Technology, San Jose State University, San Jose, USA	Dissemination
Scientific Digital Visions, Inc., San Jose, USA	Dissemination
Department of Physics, Lund University, Lund, Sweden	Dissemination
Nuclear Data Section, International Atomic Energy Agency, Vienna, Austria	Co-ordination, dissemination
OECD Nuclear Energy Agency Data Bank, Paris, France	Dissemination

4.   NUCLEAR DATA IMPROVEMENT

An important aspect of the IAEA Nuclear Data Program is nuclear data improvement and development activity. Related projects are largely conducted under the framework of the IAEA Co-ordinated Research Programme, making use of the mechanism of Co-ordinated Research Projects (CRPs).

The bulk of the nuclear data improvement work in 1997-1998 was performed in the frame of Co-ordinated Research Projects. This was complemented by the long-term project FENDL that uses a different mechanism, and by two smaller projects based solely on our own technical work.

It should be noted that the Nuclear Data Development Unit now tends to finish each improvement/development project with the following four products:

*   Database. A project should produce a well-defined basic product, generally a database or a data library.

*   Documentation. It is being recognized that a decent description of the basic product is needed, preferably in the form of an IAEA Technical Document (TECDOC).

*   Web. The above two results have to be made available online by producing an appropriate Web interface.

*   CD-ROM. A CD-ROM version of the database along with the documentation should be produced for two reasons:

    −   IAEA should made its results available also to users from developing countries with limited access to the Internet, and
    −   In the Internet era CD-ROMs represent hard copies that can be used as references.

The above approach is being increasingly accepted and applied to all (new) projects with a positive user impact. On the other hand, it implies that a technical officer has to follow the project until the very end and make sure that the final packaging of the products such as Web and CD-ROM is duly completed. An example in this direction is the CRP on the development of the Reference Input Parameter Library for model calculations.

4.1.   Co-ordinated Research Projects

Altogether, 8 Co-ordinated Research Projects were active during the period 1997-1998. Out of them, 4 CRPs have been completed, 2 CRPs were underway, and 3 new CRPs have been initiated. This status is summarized in the Table 5 below, followed by a more detailed account of each project.

Table 5: Co-ordinated Research Projects active in 1997-1998

No.	Short Title	Duration	Participants (Contracts)	Technical Officer	Remark
1	Activation Library	1993-97	8 (5)	Herman	Completed
2	Input Parameters (RIPL-I)	1994-98	9 (3)	Obložinský	Completed
3	Photon Data	1994-98	9 (3)	Obložinský	Completed
4	Medical Radioisotopes	1995-99	7 (3)	Obložinský	
5	Photonuclear Data	1996-00	7 (3)	Obložinský	
6	Transmutation of Minor Actinides	1997-01	10 (3)	Lammer	New
7	X- and Gamma-ray Standards	1998-01	8 (3)	Herman	New
8	Input Parameter Testing (RIPL-II)	1998-01	8 (3)	Obložinský	New

4.1.1. International Reference Data Library of Neutron Activation Cross Sections (1993-1997)

Objective:

– To provide a tested and reliable, multipurpose database of neutron activation cross sections for the limited number of selected reactions of primary importance for a broad range of applications including magnetic confinement and inertial fusion, fission, geophysics and bore-hole logging, dosimetry and astrophysics.

Activities:

– List of 256 reactions together with their applications was fixed.
– 262 evaluations (including 6 reactions to isomeric states) were selected from different regional projects and assembled into the Reference Neutron Activation Library (RNAL).
– Plots comparing evaluated cross sections with all the available experimental data were produced.
– Critical analysis of the agreement has been carried out and resulted in the replacement of the 16 initially selected evaluations.
– The 1-st draft of the TECDOC was prepared and reviewed by the CRP participants, the 2-nd draft of the TECDOC is presently under review.

Reference:
None

4.1.2. Development of Reference Input Parameter Library for Nuclear Model Calculations of Nuclear Data (Phase I: Starter File) (1994-1998)

Objectives:
– Produce the Starter File of the Reference Input Parameter Library (RIPL) for model calculations of low energy nuclear reactions.
– Publish TECDOC and make data available online.

Activities:
– 3rd Research Co-ordination Meeting was held, 26-29 May 1997, Trieste, Italy, chair A.V. Ignatyuk (IPPE Obninsk).
– Consultants' Meeting on RIPL was held, 9-12 December 1997, Vienna, chair O. Bersillon (CEN Bruyeres-le-Chatel).
– Starter File was completed and checked. It consists of 7 segments:
    1. Atomic masses and deformations
    2. Discrete level schemes
    3. Average neutron resonance parameters
    4. Optical model parameters
    5. Level densities (total, fission, partial)
    6. Gamma-ray strength functions
    7. Continuum angular distributions.
– Data were made available on Web and also on a CD-ROM.
– Documentation was published as a TECDOC.

Reference:
– Summary Report of the 3rd RCM, INDC(NDS)-372, September 1997

Output:
– Web   http://iaeands.iaea.or.at/ripl/, May 1998
– CD-ROM   IAEA-NDS-CD-02, May 1998
– Documentation TECDOC-1034, August 1998
– Other   "Histogram Plots and Cutoff Energies for Nuclear Discrete Levels" by T. Belgya et al, INDC(NDS)-367, May 1997

4.1.3. Measurement, Calculation and Evaluation of Photon Production Data (1994-1998)

Objectives:
– Perform selected measurements, calculations and evaluations of photon production data from reactions induced by low energy neutrons.
– Asses status of data, improve evaluation methodology.

Activities:
– 3rd Research Co-ordination Meeting was held, 29 September - 3 October 1997, Bled, Slovenia, chair F.S. Dietrich (LLNL Livermore)

- Atlas of neutron capture gamma-rays was published.
- Review of discrete photon production at 14 MeV neutrons was published.
- Review of computer codes and data libraries pertaining to photon production data was published.

References:

- Summary Report of the 3rd RCM, INDC(NDS)-375, January 1998
- J. Kopecky et al. "Atlas of neutron capture cross sections", Report INDC(NDS)- 362, April 1997; 369 pages
- J. White et al. "Abstracts of computer programs and data libraries pertaining to photon production data", Report ORNL/RSIC-57 (1997); 163 pages
- S.P. Simakov et al. "Status of experimental and evaluated discrete γ-ray production at E_n = 14.5 MeV", INDC(CCP)-413, September 1998; 61 pages

Output:

– Web	http://iaeand.iaea.or.at/ngatlas/
– Documents	INDC(NDS)-362, April 1997, 369 pages
	ORNL/RSIC-57, 1997, 163 pages
	INDC(CCP)-413, September 1998, 61 pages

4.1.4. *Development of Reference Charged Particle Cross Section Database for Medical Radioisotope Production (1995-1999)*

Objectives:

- Produce international database of evaluated cross sections for production of diagnostic radioisotopes using cyclotron accelerators, and cross sections of related beam monitor reactions. The database will include production of gamma emitters, positron emitters and monitor reactions for protons through alpha particle with energies mostly up to about 30 MeV.
- Publish TECDOC "Charged-Particle Cross Section Database for Medical Radioisotope Production".

Activities:

- 2nd Research Co-ordination Meeting was held, 7-10 April 1997, Cape Town, South Africa, chair F. Tarkanyi (Atomki Debrecen).
- 3rd Research Co-ordination Meeting was held, 28 September - 2 October 1998, Brussels, Belgium, chair S.M. Qaim (FZ Julich).
- Preliminary version of the database was produced, including 16 reactions for gamma emitters, 10 reactions for positron emitters and 21 beam monitor reactions.

References:

- Summary Report of the 2nd RCM, INDC(NDS)-371, October 1997
- Summary Report of the 3rd RCM, INDC(NDS)-388, November 1998

4.1.5. Compilation and Evaluation of Photonuclear Data for Applications (1996-2000)

Objectives:

- Produce IAEA Photonuclear Library containing evaluated photonuclear cross sections primarily for medical and shielding applications using photons with energies up to about 25 MeV.
- Publish TECDOC "Handbook on Photonuclear Data for Applications".

Activities:

- 2nd Research Co-ordination Meeting was held, 23-26 June 1998, Los Alamos, USA, chair M.B. Chadwick (LANL Los Alamos).
- Atlas of Giant Dipole Resonances was prepared and published.

References:

- Summary Report of the 2nd RCM, INDC(NDS)-384, September 1998
- V.V. Varlamov et al, "Atlas of Giant Dipole Resonances", INDC(NDS)-394, January 1999, 311 pages

4.1.6. Fission Product Yield Data Required for Transmutation of Minor Actinides Nuclear Waste (1997-2001)

Objectives:

- Develop fission yield systematics and nuclear models as a tool for an evaluation of energy dependent fission yields up to 150 MeV.
- Produce a computer code that will allow the calculation of fission yields for any given actinide at any desired neutron energy, although with varying accuracy. The final goal is to provide the users with the desired evaluated fission yields.

Activities:

- 1st Research Co-ordination Meeting was held, Vienna, Austria, 5-7 November 1997, with the results explained below.
- A new approach to evaluation of fission yields in the energy range up 150 MeV was formulated, which uses mainly fission yield systematics to cover a wide range of fissioning nuclides and the desired energy range from thermal to 150 MeV.
- The main tasks of the CRP were defined to achieve the objectives and develop the new evaluation approach, and distributed among participants.

Reference:

- Summary Report of the 1st RCM, INDC(NDS)-387, in preparation.

4.1.7. Update of X- and Gamma-ray Standards for Detector Calibration (1998-2001)

Objectives:

− Update the existing IAEA (TECDOC-619, 1991) of X- and gamma-ray standards for calibration of nuclear detectors and spectrometers. The updated database will include precise energies and intensities for 62 radioisotopes producing X- and gamma-rays with energies up to about 3 MeV.
− Publish TECDOC "X- and gamma-ray standards for detector calibration", and make the updated file available online and on CD-ROM.

Activities:

− The project was prepared, approved and initiated in 1998.
− 1st Research Co-ordination Meeting was held, 1-5 December 1998, Vienna, chair A.L. Nichols (AEA Harwell).

Reference:

− Summary Report of the 1st RCM, INDC(NDS)-403, in preparation

4.1.8. Nuclear Model Parameter Testing for Nuclear Data Evaluation (Reference Input Parameter Library: Phase II) (1998-2001)

Objectives:

− Test and improve nuclear model parameters for theoretical calculations of nuclear reaction cross sections.
− Produce well tested Reference Input Parameter Library for calculations of nuclear reactions using nuclear reaction codes.
− Develop user oriented retrieval tools for the Reference Input Parameter Library, and develop interfaces to well established codes for nuclear reaction calculations.
− Publish TECDOC and make the library and tools available online and on CD-ROM.

Activities:

− The project was prepared, approved and initiated in 1998.
− The 1st Research Co-ordination Meeting was held in Vienna, 25-27 November 1998, chair P. G. Young (LANL, Los Alamos).

Reference:

− Summary Report of the 1st RCM, INDC(NDS)-389, February 1999

In addition to the above 8 active CRPs, two projects should be mentioned:

CRP on "Development of Database for Prompt Gamma-ray Neutron Activation Analysis".
This is a new project that was prepared and approved in 1998, to be conducted in 1999-2002, technical officer: R. Paviotti-Corcuera.

Objectives:
- Improve accuracy and completeness of the data needed in neutron prompt gamma-ray activation analysis (PGAA).
- Develop an international database of neutron capture data to be used in PGAA.
- Produce electronic and printed version of the database, publish TECDOC.

CRP on "Compilation and Evaluation of Fission Yield Data", conducted in 1991-1996, technical officer: M. Lammer. This project was completed in 1996 but publishing of the final document is pending.

The final report of the CRP will be published as an IAEA-TECDOC. About 90% of the contributions have been received and can, after minor corrections, be assembled for publication. Still missing parts, if not received until April 1999, will be replaced by abstracts, so that the document can be submitted for publication in April/May. The TECDOC will include the following 8 Chapters (1. CRP Summary and conclusions, 2. Techniques of fission yield measurements and inherent error margins, 3. Computerized information systems, 4. Model calculations, 5. Energy dependence of fission yields, 6. Evaluation of experimental yields, 7. Evaluated data files. Appendices: A. Listings of evaluated fission yields; B. Intercomparison of evaluated fission yield files; C. List of participants).

4.2. Other Projects

Three projects were performed during 1997-1998 that were using the non-CRP mechanism. The long-term FENDL project was continued at a reduced level compared to the previous period, focusing on the testing, release, improvement and maintenance aspects. The Handbook for Safeguards was updated and released, and the Fission Product Newsletter was issued. More details are given below.

4.2.1. Fusion Evaluated Nuclear Data Library (FENDL)

Activities:
- Advisory Group Meeting on Extension and Improvement of the FENDL Library for Fusion Applications (FENDL-2.0), 3-7 March 1997, Vienna.
- Consultants' Meeting on Validation and Improvement of the FENDL-2.0 Transport Sublibraries, 12-14 October 1998, Vienna.
- Release of FENDL-2.0 except of its transport sublibrary, April 1997.

- Final selection of evaluations for the transport sublibrary. Replacement of the evaluations for ^{16}O, ^{28,29,30}Si, ^{51}V, ^{nat}Ga, ^{nat}Zr, ^{nat}Mo, ^{nat}W and ^{197}Au. Release of the transport sublibrary, May 1998.
- Extensive testing and validation of FENDL-2.0 transport sublibrary was performed. In general, improvements were observed with respect to the FENDL-1 results. Testing revealed two major errors in the FENDL-2.0 library: double counting of the resonance region in the multigroup data file for ^{56}Fe, and inconsistency in the basic evaluation for ^{29}Si leading to unphysically large gamma production. These errors were corrected and the corresponding files were replaced in the FENDL-2.0 release of January 14, 1999. This version of the library is the one presently available on the NDS Web server and on the CD-ROM (IAEA-NDS-CD-06).
- Intensive validation of the FENDL-2.0 activation sublibrary was carried out at Culham and San Diego. A Consultants' Meeting on activation sublibrary is under preparation for June 1999 in Obninsk.

References:
- Summary Report of the AGM, INDC(NDS)-373, September 1997
- Summary Report of the CM, INDC(NDS)-395, March 1999

Output:
- Web   http://iaeand.iaea.or.at/fendl/, May 1998
- CD-ROM   IAEA-NDS-CD-03, June 1998
- CD-ROM   IAEA-NDS-CD-06, March 1999

4.2.2.   *Handbook of Nuclear Data for Safeguards*

The Handbook of Nuclear Data for Safeguards was modified, improved and released, using the 1991 Handbook published in INDC(NDS)-248 as the starting point. The related database has been updated by N. Kocherov (NDS) with the data collected by M. Lammer (NDS). The updated Handbook is available as a hard copy, published as INDC(NDS)-376 in December 1997.

SGNucDat is the PC version of the Handbook, available to users on a diskette with the option to view selected data on the screen or print a hard copy. It can be used to produce the hard copy of the complete updated Handbook.

Output:
- Diskette   IAEA NDS, no number, December 1997
- Hard copy   INDC(NDS)-376, December 1997

4.2.3. Fission Product Newsletter

The 15-th issue of the report series "Progress in Fission Product Nuclear Data" was published as INDC(NDS)-379 in June 1998. On 122 pages, it contains received contributions regarding work on fission product nuclear data performed between 1994-1997, and additional information about publications, meetings, data requests, CRPs etc. in this area. Upon request, a new section with publications on "Data Testing, Examination and Utilization" was included.

Reference:
- Progress in Fission Product Nuclear Data, Issue No.15, INDC(NDS)-379, June 1998, 122 pages.

5. TECHNOLOGY TRANSFER

Technology transfer to developing countries is considered to be one of the most important objectives of the IAEA's activities. This transfer is generally done under the IAEA Technical Co-operation (TC) Program that is managed by the Department of Technical Co-operation. The role of IAEA technical departments, such as the Department of Nuclear Sciences and Applications, is to provide technical guidance and expertise through its staff as technical officers. Thus, for instance, the Division of Physical and Chemical Sciences was involved in 1997-1998 in 241 TC projects, the share of the NDS being 2 (two) TC projects.

Involvement of the Nuclear Data Section in TC activities (projects) is fairly limited. The point is that the technology transfer in the field of nuclear data is done primarily via nuclear data services rather than via traditional TC projects. Another important form of NDS technology transfer is represented by nuclear data workshops. These 3 elements of the NDS technology transfer, TC projects, workshops and services, are briefly described below.

5.1. Technical Co-operation Projects

The following two TC projects were initiated in 1997-1998, technical officer: R. Paviotti-Corcuera (NDS).

5.1.1. Improved Access to IAEA Nuclear Data Services in Latin America (Project RLA/19, ARCALXLVI)

There is a difficulty in Latin America with access to the IAEA Nuclear Data online services. All Europe-oriented Internet traffic is routed initially through the USA. This routing degenerates and can fail during Northern American working hours, due to excessive network traffic and inadequate router capacity.

In 1997, the Nuclear Data Section made a proposal to solve the network saturation problem by implementing a regional computer site located directly in the Latin American region, to "mirror" the IAEA online Nuclear Data Services. At the September 1998 General Conference, the project was approved for incorporation into the ARCAL program.

To choose an optimal location, Internet performance tests are under way to test the network band width between candidate host sites and many user sites throughout the Latin American region. After the network tests are performed and results evaluated, a server, with a complete mirror copy of the IAEA nuclear databases, will be installed at the site that shows optimal performance in Internet connections.

5.1.2.   Utilization of Ghana Research Reactor 1, Phase II (Project GHA/4/011)

This project was proposed by the National Nuclear Research Institute of Ghana Atomic Energy Commission and received its final approval at the September 1998 General Conference. The project consists of 3 main parts:

(i)   Neutron activation analysis,
(ii) Nuclear data online services, and
(iii) Radiotracer applications for industry.

The IAEA Nuclear Data online services should be provided by the Nuclear Data Section. The libraries, including CINDA, EXFOR, ENDF and PC NUDAT will be installed on a Windows NT workstation, thus allowing users to access and retrieve databases through the Local Area Network.

5.2.   Workshops

Workshops on various aspects of nuclear data represented an important element in the NDS technology transfer in 1997-1998. Three Workshops were conducted. Apart of the traditional major Workshop held at the ICTP Trieste, 2 smaller Workshops were held in Vienna. In addition, a new series of Workshops to be held at the ICTP Trieste was prepared. Details are given below.

5.2.1.   Workshop on Nuclear Reaction Data and Nuclear Reactors: Physics, Design and Safety ICTP Trieste, Italy, 23 February - 27 March 1998

The 5-week Workshop was organized by the IAEA Nuclear Data Section in co-operation with the Abdus Salam International Centre for Theoretical Physics (ICTP Trieste) and Ente Nazionale per Energia ed Ambiente (ENEA Rome).

The objective of the Workshop was to train scientists and engineers, particularly from developing countries, in modern nuclear reaction theory, nuclear data production and data use, with particular emphasis on applications in nuclear reactor physics, design and safety. This type of training is of specific importance in the era of decreasing support to nuclear reactor activities in many countries, with an unfortunate consequence of vanishing infrastructure and expertise. In fact, the present Workshop represents, worldwide, the only forum where scientists and engineers can get extensive and up-to-date information on nuclear reaction data, including physical background and evaluation methodology, and their application in nuclear reactor calculations.

The Workshop followed the successful concept established by its predecessor in 1996. It included five weeks of programme, comprising nuclear reaction theory,

followed by nuclear reaction data processing, and completed by applications in nuclear reactors. In this way, the participants got up-to-date information on the whole know-how behind nuclear reactor calculations, down to the physics of nuclear interactions.

The Workshop directors included P. Obložinský (NDS), G. Reffo (ENEA Bologna) and A. Trkov (IJS Ljubljana), responsible for nuclear reaction theory, evaluation methodology and nuclear data processing.

The Workshop was attended by 55 participants from 35 countries. Particularly strong was representation from Asia (20) participants, followed by Eastern Europe (17 participants) and Africa (10 participants). The number of lecturers including directors was 29, taking care of altogether 60 lectures and 17 extensive computer exercises. The Workshop resulted in more than 300 requests for computer codes, benefiting from the cost-free service operated by the NEA Data Bank and supported by the IAEA. A strong side of the Workshop was its team of excellent lecturers, including several international celebrities.

The Proceedings of the Workshop including 28 lectures and comprising 547 pages was submitted to World Scientific, Singapore, editors P. Obložinský (NDS) and A. Gandini (ENEA Rome). It should be available by summer 1999.

5.2.2. *Workshop on Nuclear Data Online Services, Vienna, 1-5 December 1997*

This first IAEA Workshop on nuclear data online services was organised with the objective to stimulate the use of the Agency's Internet-based nuclear data services by working with nuclear data specialists from developing countries with little online experience, using lectures, demonstrations and practical computer exercises.

The Workshop was attended by 12 participants (selected by NDS from more than 30 applicants) from 12 developing countries from Asia, South America, Africa and Eastern Europe. Technical officer of the Workshop was O. Schwerer (NDS).

A follow-up workshop on advanced nuclear data services is planned for December 1999.

5.2.3. *Workshop on Nuclear Data Processing for Use in Power Reactor Pressure Vessel Lifetime Assessment, Vienna, 19-23 October 1998*

The objective was to familiarize participants with updated nuclear data libraries and associated processing codes for performing calculations of power reactor parameters of importance for pressure vessel lifetime assessment. Main emphasis was on demonstrations and exercises on subjects related to the evaluation of neutron fluence

and the analysis of neutron-induced damage in reactor pressure vessels, employing the latest available data libraries and computer codes.

The workshop was attended by 16 participants from 15 different countries (selected by the NDS from more than 40 applicants) and by 4 IAEA staff scientists. Participants came from different organizations, mostly regulatory bodies and power industry. Technical officer was R. Paviotti-Corcuera (NDS).

The participants recommended that more workshops of this type be organized and expressed the desire to have additional training courses in their respective countries. Other recommendations were: improvement in the evaluation of the inelastic scattering cross section for iron; evaluation of the uncertainties and covariances in some reactions such as ^{237}Np(n,fission), ^{238}U(n,fission), ^{93}Nb(n,n')^{93m}Nb, and ^{63}Cu(n,a)^{60}Co; updating of the IRDF-90 library.

Reference:
– Summary Report of the Workshop, INDC(NDS)-392, February 1999

5.2.4. Workshop on Nuclear Data for Science and Technology

This represents a new series of Workshops, to be held at the ICTP Trieste, aimed to supplement the traditional Workshops on nuclear data and nuclear reactors. The new series should address non-traditional topics and emerging technologies. The intention is to proceed with traditional Workshops in even years, and to held a new series in odd calendar years.

The first Workshop in this new series will be dedicated to Medical Applications. It was prepared and approved in 1998. This first Workshop will be held at the ICTP Trieste, Italy on 4-15 October 1999, directors M. Herman (NDS), Prof. S.M. Qaim (FZ Julich) and Prof. P. Andreo (Dosimetry and Medical Radiation Physics Section, IAEA).

5.3.   Services

Nuclear data services represent the most important mechanism of the technology transfer to developing countries in the field of nuclear data. These services, activities, achievements and related statistics are described in Chapter 2.2.

6. COMPUTER SUPPORT

The Nuclear Data Section provides Information Technology support to NDS staff members and external data users through its Computer Operations Unit. The Unit is also actively involved in the development and enhancement of NDS IT services, both hardware and software, and work closely with developers and scientists at NDS and the other co-operating data centres.

6.1. *Compaq Alpha Server*

The Section continues to maintain a Compaq Alpha Server 2100 4/275 computer running VMS as its core database engine. The Alpha features a single Compaq 21064A Processor running at 275 MHz with 512 MB of on-board Random Access Memory. This system supports a total of 50 GB of disk storage, a number of CD-ROM drives, printers and tape units all connected in a Local Area Ethernet Network.

The Alpha runs under Compaq's Open VMS AXP and includes the following commercial and shareware software products:

- Compaq TCP/IP and Ethernet protocol suites
- Compaq's dedicated DECnet and LAT network protocols
- The OSU Web Server and Web scripting tools
- The Open VMS Axp JAVA development Kit
- FORTRAN and C program development environments
- PMDF email services from Innosoft International Incorporated
- Disk management software from Executive Software International
- TeX and LaTeX technical document preparation utilities
- A set of third party document manipulation and viewing tools

The Alpha's Ethernet network interface was upgraded from a base 10 Mbps to a switchable 10/100 Mbps. This new technology will allow for much faster throughput and improved service.

Two new 9.1 GB Ultra SCSI disks were acquired for the Alpha in October 1998. These bring the total disk space available to 50 GB.

In the last quarter of 1998 the Alpha's Operating system, layered products and third party applications were upgraded to Open VMS v 7.1 from v 6.2. The Oracle Database management software and development environment was also upgraded to the latest available levels. This work involved carefully upgrading the Oracle Relational Database (RDB), the Common Data Dictionary (CDD) and the Database Management System (DBMS) to current

levels and ensures compatibility between all aspects of the NDS Alpha Server database environment with that in use at Brookhaven National Laboratory.

The Compaq Open VMS and layered product software update contract was discontinued at the end of 1997. Alpha operating system and layered product updates will in future be purchased on an as-needed basis. This arrangement reduces the Alpha's annual software maintenance costs by approximately 50%.

A new product maintenance agreement was entered into with Oracle Corporation in the third quarter of 1998. By that time Oracle's relationship with the then Digital Equipment Corporation was clarified and Oracle were established as the sole owners of all previous DEC database management and development products. Our original agreements with DEC were honored by Oracle at no extra charge and a new annual maintenance contract was entered into to cover the RDB, CDD, the DBMS and the developer's kit. The contract level chosen was the Oracle Bronze level, which provides for software updates on request and adequate telephone support. This level of maintenance ensures NDS' ability to continue to support and develop its Open VMS Database systems and also minimizes the costs involved.

6.2. Networking

The Vienna International Centre is wired with an IBM Type-1 Local Area Network cabling system (see Fig. 3). This allows the co-existence of several popular networking protocols. IBM Token Ring is the VIC standard networking protocol suite and is used throughout the Agency for electronic mail, inter-office communication and device and resource sharing. The network and its infrastructure is managed by NESI (Department of Nuclear Energy - Division of Scientific and Technical Information) and is protected from unauthorized external access by a NESI-managed firewall.

The Nuclear Data Section maintains a localized Ethernet with the Alpha server as its primary domain controller. This LAN which runs on the existing Type-1 infrastructure provides NDS staff access to the Alpha server. The NDS LAN is connected with the Agency networks and servers located in "F" tower via an optical fiber backbone.

The NDS Alpha is located outside the Agency Firewall. This is essential given the open nature of the service provided by NDS to external international users. A number of NDS workstations and PCs are also located outside the firewall. This is necessary to provide researchers, developers and database managers unrestricted access to the Alpha and its resources. The NDS Ethernet LAN and its relationship with the Agency network and the Internet is shown in the figure below.

In the period 1996-1997 severe bottlenecks were identified in the NDS LAN and in its connections with Central services in tower F. After a period of evaluation by NESI and NDS it was decided to replace the old Digital Equipment DELNIs at either end of the optical
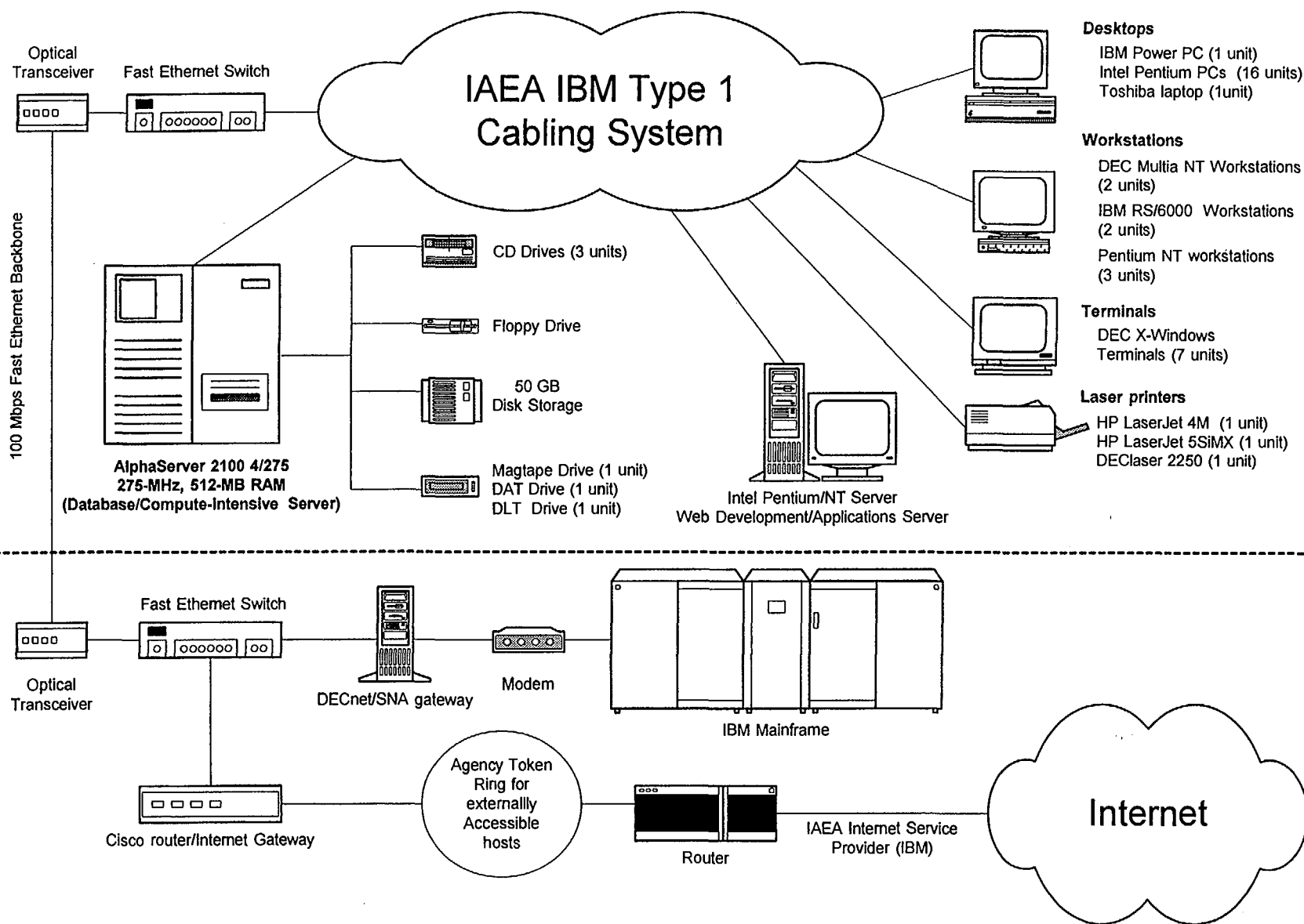
Optical Transceiver   Fast Ethernet Switch

100 Mbps Fast Ethernet Backbone

IAEA IBM Type 1 Cabling System

Desktops
IBM Power PC (1 unit)
Intel Pentium PCs (16 units)
Toshiba laptop (1unit)

Workstations
DEC Multia NT Workstations (2 units)
IBM RS/6000 Workstations (2 units)
Pentium NT workstations (3 units)

Terminals
DEC X-Windows Terminals (7 units)

Laser printers
HP LaserJet 4M (1 unit)
HP LaserJet 5SiMX (1 unit)
DEClaser 2250 (1 unit)

CD Drives (3 units)

Floppy Drive

50 GB Disk Storage

AlphaServer 2100 4/275
275-MHz, 512-MB RAM
(Database/Compute-Intensive Server)

Magtape Drive (1 unit)
DAT Drive (1 unit)
DLT Drive (1 unit)

Intel Pentium/NT Server
Web Development/Applications Server

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Fast Ethernet Switch

Optical Transceiver

DECnet/SNA gateway   Modem

IBM Mainframe

Cisco router/Internet Gateway

Agency Token Ring for externallly Accessible hosts

Router

IAEA Internet Service Provider (IBM)

Internet

Fig. 3. The IAEA/NDS Fast Ethernet LAN Configuration

fiber link between building A and building F with newer Baystack 350T switches. The $12,000 cost of the new switches was borne by NDS and the work was completed in November 1997. This has greatly improved the connectivity between NDS and Central Services and to the Internet. These improvements also allow for the possibility of expanding our existing throughput from 10 Mbps to 100 Mbps in the future.

The old PC router which was used to route the NDS LAN to the Agency Token Ring and thence the internet provider was replaced in September 1998 by a Cisco router. The cost of this change was borne by NESI.

Problems were also identified with the Agency Internet service provider and it was decided to switch to the internet service provided by IBM. This faster 1 Mbps service guarantees efficient connectivity to our external users. The changeover was made in April 1998. This relieved the previous chronic saturation of our external connection line, and we have heard reports of better service from a number of data users.

6.3.   Other Servers, PCs and Workstations

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

A Compaq Deskpro 6000 personal computer and database software applications were purchased for the A & M Data Unit in April 1998. These are used to maintain a new database on irradiated nuclear graphite properties.

A Pentium based NT server was acquired in early 1998. This machine serves primarily as a development bed for proposed enhancements to the NDS data services.

In keeping with IAEA general policy all NDS employees are equipped with a Personal Computer which conforms with the Agency recommended standard.

In the period 1997-1998, a total of seven PC systems were purchased. Five were replacements for obsolete units, four were machines with capabilities considerably larger than the standard. Details of these acquisitions are as follows: over the period 1997-1998 a total of 2 desktop PC system units were replaced with newer Agency standard models. The replaced units were returned to NESI. A further 3 PCs were replaced by models with a higher specification. The new machines have 21-inch screens, more Random Access Memory (either 64 MB or 128 MB) and larger SCSI disks than the Agency standard. These machines are used by NDS database administrators and developers and were received in November 1998. The systems replaced by these were relocated within the Section.

A portable multimedia projector was acquired in November 1997 and a Toshiba laptop computer was acquired in September 1998. These two devices are normally used as a package, for demonstrating our services at workshops and conferences. The laptop can also be used, when necessary, at remote locations.

A Hewlett-Packard LaserJet 6MP was purchased by NDS in September 1997. This printer was placed in the NDS Section Office.

The two Digital Equipment Corporation Multia workstations purchased in early 1995 were replaced by two new Pentium based workstations in December 1998. Both of these machines run Windows NT and provide a platform for intensive development and maintenance work. Both Multia's were moved into an open-access room and are available for use by visitors and short-term consultants.

The two IBM X stations were decommissioned and returned to Central Services in late 1998.

6.4. WEB Development

NDS in conjunction with BNL has exerted a considerable amount of effort in providing the latest World Wide Web facilities to its user community. The primary database server (The Alpha 2100) is running the Ohio State University Web server and this was updated to the latest revision in December 1998. All databases are now accessible via the Web and work is ongoing to improve their accessibility.

In the period 20 November 1998 - 20 February 1999 Mr. Scott Miller was employed in NDS as a Temporary Assistant Professional attached to the Computer Operations Unit. Mr. Miller was hired to work on improving the Agency's nuclear data services, especially in the area of Worldwide Web development. He has developed an infrastructure that allows staff within the Nuclear Data Section to use modern tools to easily publish their information to the web. Instead of having many independent pages, this setup allows multiple developers within NDS to collaborate on a single web page.

This infrastructure was extended to the Division level in the Division of Physical and Chemical Sciences (NAPC). Along with setting up this infrastructure for each Section's web development he also developed a set of templates for NAPC which ensure a consistent "look and feel" and give a sense of uniformity to the Sections' web presence as well as setting a structure to the information being presented.

The NDS page http://www.iaea.org/program.napc.nd/ included in the NAPC Division page is a useful supplement to our Data Services pages, as it includes extensive information on meetings, publications, coordinated research projects, technical co-operation work, staff and similar "non-data" topics.

A tool was also developed by Mr. Miller to simplify the movement of web pages from the Section's web development server to the Agency's production server. This tool is also used to download web pages to CD-ROM for distribution.

Mr. Miller also configured and installed a set of tools to determine the cause of network congestion on the NDS intra and internets. He completed a report to show where and when the congestion was occurring and verified when this congestion had been corrected (see section 6.2 above).

7. ATOMIC AND MOLECULAR DATA

The Atomic and Molecular (A+M) data activity of the Nuclear Data Section is conducted by the A+M Data Unit. The activity is focused on the establishment of recommended databases in three areas: A+M collisional and spectroscopic data, particle-surface interaction data; and material properties data.

The last two data areas are conveniently combined by the term: plasma-material interaction data. All data activities of the A+M Data Unit are primarily related to the needs of fusion energy research, but have also strong relevance to other scientific and technological areas.

In fulfilling its mission, the Unit initiates, organizes and co-ordinates activities on A+M data collection, critical assessment and data generation and operates the IAEA A+M Data Centre. The core of A+M Data Centre activities is the co-ordination of the work of an international A+M Data Centre Network (with about 15 members) and the development and maintenance of the A+M Data Information System (AMDIS) currently online available via Internet.

The activity of the A+M Data Unit is supervised and biennially reviewed by the Subcommittee on A+M Data for Fusion of the Agency's International Fusion Research Council (a standing advisory body of the IAEA for matters related to controlled fusion research and technology development).

7.1. Database establishment projects

The following six Co-ordinated Research Projects were active in the reporting period:

- "Radiative Cooling Rates of Fusion Plasma Impurities"
  (9 participants; termination: June 1997)

Output:
— Recommended radiative power losses for He, Be, C, N, O, Ne, Si, Ar, and Fe plasma impurities were generated for a broad range of plasma parameters. The results will be published in Vol. 9 of the IAEA series on "A+M and PMI Data for Fusion (APID)" scheduled to appear in 1999.

- "Thermo-Mechanical Properties Data for Fusion Reactor Plasma Facing Materials"
  (7 participants; terminated: July 1997)

Output:
— A compendium is now in preparation for the IAEA APID series, Vol. 10, to be published in 1999.

- "Tritium Retention in and Release from Fusion Reactor Plasma Facing Components" (8 participants; terminated December 1997)

  <u>Note:</u>   The work on this CRP was interrupted in May 1996 due to the loss of the position of Scientific Secretary for this CRP.

- "Atomic and Plasma-Wall Interaction Data for Fusion Reactor Divertor Modelling" (12 participants; termination: end of 2000)

  <u>Output:</u>
  - One volume of the IAEA APID series (volume 8) published in 1998. Another volume of this series will be prepared by the CRP participants during the year 2000.

- "Charge Exchange Cross Section Data for Fusion Plasma Studies" (14 participants; termination: December 2000)

  1st RCM organized in September 1998

- "Plasma-material Interaction Data for Mixed Plasma Facing Materials in Fusion Reactors" (10 participants; termination: December 2000)

  1st RCM organized in October 1998

  All the recommended data generated through the activities of the above CRPs will be (and already have been, for some CRPs) ALADDIN formatted and stored for the IAEA AMDIS database.

  In co-operation with the Technische Universität Wien and IPP Garching, the A+M database for Li-beam diagnostics of tokomak edge plasmas has been thoroughly updated. (The new database will be published in Atomic Data Nuclear Data Tables in 1999).

7.2.   Co-ordination of A+M Data Centre Network

This Network currently includes about 15 national A+M or PMI data centres from USA (three), Russia (three), Japan (two), France, Germany, UK, China, Italy, South Korea and Israel. The A+M/PWI Data Centre Network is mainly involved in co-ordinated data compilation and data assessment activities, but some of the centres have significant capabilities in the area of data generation. The level of work co-ordination within the Network can be considered very satisfactory.

The A+M Data Centre Network has meetings every second year, the last, 14th, meeting of the Network was convened in July 1997 in Vienna.

7.3. AMDIS, CIAMDA and other activities

The IAEA Atomic and Molecular Data Information System (AMDIS) contains both the numerical and bibliographic databases of the Agency related to the fusion research needs (but not exclusively). The A+M Data Unit and AMDIS have become accessible via the Worldwide Web since November 1997. A separate Website has been developed for the numerical databases in AMDIS (called also ALADDIN) during the last quarter of 1998. The ALADDIN Website is designed to be extremely user-friendly and equipped with state-of-the art software tools.

Two large numerical databases were added to AMDIS in the reporting period: (1) the chemical erosion database, and (2) the database on elastic and momentum transfer (differential and total) cross sections for all isotopic hydrogen species (ions, atoms and molecules).

Volumes 52 and 53, and volumes 54-55 of the International (bibliographic) Bulletin on A+M Data for Fusion were published during 1997 and 1998, respectively.

CIAMDA '98, which comprises all A+M bibliographic entries in AMDIS from the ten-year period 1988-1998, was published in the last quarter of 1998.

The publication of the IAEA Series on "Atomic and Plasma-Material Interaction Data for Fusion" continued. Two volumes of this series (Vol. 7, part A, and Vol. 8) were published in the reporting period. Two other volumes of the series are currently under preparation.

An extra-budgetary project on the establishment of an "International Database on Irradiated Nuclear Graphite Properties" has been initiated in August 1997. The database is expected to become operational by the end of June 1999.

Meetings and Workshops 1997 - 1998

Altogether 16 nuclear data meetings were conducted in the period 1997-1998, including 1 Technical Committee Meeting, 3 Data Centre Co-ordination Meetings, 1 Scientific Advisory Group Meeting, 8 Research Co-ordination Meetings and 3 Consultants' Meetings. In addition, 3 Workshops were conducted.

A.   Technical Committee Meetings

A.1.   21st Meeting of the "International Nuclear Data Committee"

- Venue & date: Vienna, Austria, 24-27 February 1997
- Report: INDC/P(97)-20, November 1997
- Responsible officer: D. Muir

B.   Data Centre Co-ordination Meetings

B.1.   Consultants' Meeting of "Network of Nuclear Reaction Data Centres"

- Venue & date: Vienna, Austria, 26-28 May 1997
- Report: INDC(NDS)-374; October 1997
- Responsible officers: O. Schwerer and H. Wienke

B.2.   Advisory Group Meeting of "Network of Nuclear Reaction Data Centres"

- Venue & date: Vienna, Austria, 11-15 May 1998
- Report: INDC(NDS)-383; July 1998
- Responsible officers: V. Pronyaev and O. Schwerer

B.3.   Advisory Group Meeting "Network of Nuclear Structure and Decay Data (NSDD)"

- Venue & date: Vienna, Austria, 14-17 December 1998
- Report: INDC(NDS)-399; March 1999
- Responsible officer: V. Pronyaev

C.   **Scientific Advisory Group Meetings**

C.1.   Extension and Improvement of the FENDL Library for Fusion Applications
(FENDL-2)

  • Venue & date: Vienna, Austria, 3-7 March 1997
  • Report: INDC(NDS)-373; September 1997
  • Responsible officers: M. Herman and A.B. Pashchenko

D.   **Research Co-ordination Meetings**

D.1.   RCM on "Development of Reference Charged-Particle Cross Section Database for
medical Radioisotope Production Database for Medical Radioisotope Production"

  • Venue & date: Faure, Cape Town, South Africa, 7-10 April 1997
  • Report: INDC(NDS)-371; October 1997
  • Responsible officer: P. Obložinský

D.2.   RCM on "Development of Reference Input Parameter Library for Nuclear Model
Calculations of Nuclear Data (Phase I: Starter File)"

  • Venue & date: Vienna, Austria, 26-29 May 1997
  • Report: INDC(NDS)-372; September 1997
  • Responsible officer: P. Obložinský D.3. RCM on "Measurement, Calculation
and Evaluation of Photon Production Data"

D.3.   RCM on "Measurement, Calculation and Evaluation of Photon Production Data"

  • Venue & date: Bled near Ljubljana, Slovenia, 29 September - 3 October 1997
  • Report: INDC(NDS)-375; January 1998
  • Responsible officer: P. Obložinský

D.4.   RCM on "Fission Product Yield Data required for Transmutation of Minor Actinide
Nuclear Waste"

  • Venue & date: Vienna, Austria, 5-7 November 1997
  • Report: INDC(NDS)-386; to be published
  • Responsible officer: M. Lammer

D.5.   RCM on "Compilation and Evaluation of Photonuclear Data for Applications"

  • Venue & date: Los Alamos, USA, 23-26 June 1998
  • Report: INDC(NDS)-384; September 1998
  • Responsible officer: P. Obložinský

D.6.　RCM on "Development of Reference Charged-Particle Cross Section Database for Medical Radioisotope Production"

- • Venue & date: Brussels, Belgium, 28 September - 2 October 1998
- • Report: INDC(NDS)-388; November 1998
- • Responsible officer: P. Obložinský

D.7.　RCM on "Nuclear Model Parameter Testing for Nuclear Data Evaluation (Reference Input Parameter Library: Phase II)"

- • Venue & date: Vienna, Austria, 25-27 November 1998
- • Report: INDC(NDS)-389; February 1999
- • Responsible officer: P. Obložinský

D.8.　RCM on "Update of X- and Gamma-ray Decay Data Standards for Detector Calibration"

- • Venue & date: Vienna, Austria, 9-11 December 1998
- • Report: INDC(NDS)-403; April 1999
- • Responsible officer: M. Herman

E.　Consultants' Meetings

E.1.　CM on "Preparation of the Proposal for a Co-ordinated Research Project to Update X- and Gamma-ray Decay Data Standards for Detector Calibration"

- • Venue & date: Vienna, Austria, 24-25 November 1997
- • Report: INDC(NDS)-378; May 1998
- • Responsible officer: M. Herman

E.2.　CM on the detailed proposal for a new RCM on "Nuclear Model Parameter Testing (Reference Input Parameter Library: Phase II)"

- • Venue & date: Vienna, Austria, 9-12 December 1997
- • Report: no report published
- • Responsible officer: P. Obložinský

E.3.　CM on "Validation and Improvement of the FENDL-2.0 Transport Sublibraries"

- • Venue & date: Vienna, Austria, 12-14 October 1998
- • Report: INDC(NDS)-395; March 1999
- • Responsible officer: M. Herman

F.   Workshops

F.1.   Workshop on Nuclear Reaction Data and Nuclear Reactors

- Venue & date: Trieste, Italy, 23 February - 27 March 1998
- Report: Proceedings submitted to print (World Scientific)
- Responsible officer: P. Obložinský

F.2.   Workshop on Nuclear Data Services

- Venue & date: Vienna, 1-5 December 1997
- Report: none
- Responsible officer: O. Schwerer

F.3.   Workshop on Nuclear Data for Use in Power Reactor Pressure Vessel Lifetime Assessment

- Venue & date: Vienna, Austria, 19-23 October 1998
- Report: INDC(NDS)-392; January 1999
- Responsible officer: R. Paviotti-Corcuera

Publications 1997 - 1998

Publications on nuclear data topics produced by the IAEA Nuclear Data Section in 1997-1998 include 93 items that can be grouped into four categories as follows:

A) Formal publications approved by the IAEA Publishing Committee.

B) Newsletters and reports prepared for the IAEA Nuclear Data Service. The related series of IAEA-NDS reports represent summary documentation of data libraries and files, prepared by the NDS staff and distributed with the data upon request.

C) The INDC(NDS) reports that, as a rule, were directly prepared by the staff of the Nuclear Data Section. A small part of these reports, representing important output of the Co-ordinated Research Projects, was prepared by other authors.

D) The INDC reports that were prepared by authors in Member States and submitted to NDS for publication. A few of those reports are translations from the Russian originals. Each of these reports was reviewed by one of the NDS staff before its accepting for publication.

A. Publications approved by the IAEA Publishing Committee

Series and No.	Title
Annual Publication	CINDA 97 (Index to Literature and Computer Files on Microscopic Neutron Data)
	CINDA 98, Supplement to CINDA 97
IAEA-TECDOC-992	Nuclear Data for Neutron Therapy: Status and Future Needs
IAEA-TECDOC-1034	Handbook for Calculations of Nuclear Reaction Data - Reference input parameter library

B. Newsletters and IAEA-NDS Reports

4 Newsletters and 24 reports of the IAEA-NDS series were published. Out of these 24 reports, 15 are new, 8 represent significant updates, and 1 represents minor update.

Series and No.	Title
Newsletter	Nuclear Data Newsletter No. 23, 24, 25 and 26.
IAEA-NDS-0	Index to the IAEA-NDS Documentation Series.
IAEA-NDS-7	Index of Nuclear Data Libraries (Revision 97).
IAEA-NDS-30	WinMerger. Visual Merging and Retrieval of Information from ENDF Format Libraries.
IAEA-NDS-33	IRSENDF. Information Retrieval System for ENDF Format Libraries.
IAEA-NDS-76	ENDF-6 Formats Manual. Data formats and Procedures for the Evaluated Nuclear Data File ENDF-6.
IAEA-NDS-87	DROSG-96. Charged-Particle Induced Neutron Source Reactions Data, for Angular Dependences of Neutron Energies, Cross Sections and Neutron Yields.
IAEA-NDS-100	The U.S. Evaluated Nuclear Data Library for Neutron Reaction Data.
IAEA-NDS-105	ENDF/B-6 Charged-Particle Sublibraries. Interaction Data between Hydrogen and Helium Isotopes/Nuclei.
INDC-NDS-113	ENDF/B-6 High-Energy Data Library.
IAEA-NDS-150	Online Nuclear Data Services, a User's Manual (Revision 97).
IAEA-NDS-164	"Maslov". Evaluated neutron reaction data for Am, Cm and Pu isotopes.
IAEA-NDS-173	FENDL/A-2.0. Neutron Activation Cross Section Data Library for Fusion Applications.
IAEA-NDS-174	FENDL2/A-MCNP, FENDL2/A-VITJ_E and FENDL2/A-VITJ_FLAT. Processed FENDL-2 neutron activation cross section data files.

Series and No.	Title
IAEA-NDS-175	FENDL/E-2.0, Evaluated nuclear data library of neutron-nucleus interaction cross sections, photon production cross sections and photon-atom interaction cross sections for fusion applications.
IAEA-NDS-176	FENDL-MG-2.0 and FENDL/MC-2.0. The processed cross-section libraries for neutron-photon transport calculations.
IAEA-NDS-177	FENDL/C-2.0. Charged-particle reaction data library for fusion applications. Version of March 1997.
IAEA-NDS-178	FENDL/D-2.0. Decay data library for fusion applications. Version of June 1996.
IAEA-NDS-195	XMuDat: Photon attenuation data on PC.
IAEA-NDS-196	EPDL97: The Evaluated Photon Data Library, '97 Version.
IAEA-NDS-201	NRABASE 2.0. Charged-particle nuclear reaction data for ion beam analysis.
IAEA-NDS-203	BISERM Version 2. Nuclear data library for evaluation of radiation effects in materials induced by neutrons of intermediate energies.
IAEA-NDS-204	MENDL-2P. Proton reaction data library for nuclear activation (Medium Energy Nuclear Data Library).
IAEA-NDS-205	NUDAT. System for Access to Nuclear Data.
IAEA-NDS-248	SGNucDat Version 2. Safeguards Nuclear Data for Windows PC code.

C. INDC(NDS)-Reports

25 reports of this series were published in 1997-1998, out of them 19 were prepared by the NDS staff.

Series and No.	Title
INDC(NDS)-361	Establishment of an International Reference Data Library of Nuclear Activation Cross Sections.
INDC(NDS)-362	Atlas of Neutron Capture Cross Sections.
INDC(NDS)-363	Co-ordination of the International Network of Nuclear Structure and Decay Data Evaluators.
INDC(NDS)-364	Summary Report of the 1st Research Co-ordination Meeting on Compilation and Evaluation of Photonuclear Data for Applications.
INDC(NDS)-365	Status of Nuclear Data Needed for Radiation Therapy and Existing Data Development Activities in Member States.
INDC(NDS)-366	Report of the IAEA Nuclear Data Section to the International Nuclear Data Committee for the Period 1995/1996.
INDC(NDS)-367	Histogram Plots and Cutoff Energies for Nuclear Discrete Levels.
INDC(NDS)-368	Update to Nuclear Data Standards for Nuclear Measurement.
INDC(NDS)-369	IAEA Consultants' Meeting on Critical Assessment of Electron-Impact Cross Section Database for Be and B Plasma Impurity Ions.
INDC(NDS)-371	Summary Report of the 2nd RCM on Development of Reference Charged-Particle Cross Section Database for Medical Radioisotope Production.
INDC(NDS)-372	Summary Report of the 3rd RCM on Development of Reference Input Parameter Library for Nuclear Model Calculations.

Series and No.	Title
INDC(NDS)-373	Extension and Improvement of the FENDL Library for Fusion Applications (FENDL-2).
INDC(NDS)-374	Co-ordination of the Nuclear Reaction Data Centres (Technical Aspects).
INDC(NDS)-375	Summary Report of the 3rd RCM on Measurement, Calculation and Evaluation of Photon Production Data.
INDC(NDS)-376	Handbook of Nuclear Data for Safeguards.
INDC(NDS)-378	Summary Report on the CM on "Preparation of the Proposal for a Co-ordinated Research Project to Update X- and Gamma-ray Decay Data Standards for Detector Calibration".
INDC(NDS)-379	Progress in Fission Product Nuclear Data.
INDC(NDS)-381	The CENDL-2.1 Library - Neutron Data Library for MCNP.
INDC(NDS)-382	The WIMSLIB Library - Neutron Data Library for WIMS-D.
INDC(NDS)-383	Summary Report of the AGM on Co-ordination of the Nuclear Reaction Data Centres.
INDC(NDS)-384	Summary Report of the 2nd RCM on "Compilation and Evaluation of Photonuclear Data for Applications".
INDC(NDS)-387	Nuclear Data Libraries and Online Services - An introduction to the data types and services available from the IAEA Nuclear Data Section.
INDC(NDS)-388	Summary Report of the 3rd RCM on Development of Reference Charged-Particle Cross Section Database for Medical Radioisotope Production.
INDC(NDS)-389	Nuclear Model Parameter Testing for Nuclear Data Evaluation, Summary Report of the 1st RCM.
INDC(NDS)-391	Analysis of Low and Medium Energy Physics Records in Databases.

D. *Other INDC Reports (Member States)*

46 reports of this series were published with the following distribution:

Report	Country of Origin	Number of Reports
INDC(BLR)	Belorussia	7
INDC(CCP)	Russia	15
INDC(CPR)	China	6
INDC(EGY)	Egypt	1
INDC(GER)	Germany	2
INDC(HUN)	Hungary	2
INDC(JPN)	Japan	5
INDC(PAK)	Pakistan	1
INDC(POL)	Poland	1
INDC(SUD)	Sudan	1
INDC(UK)	United Kingdom	2
INDC(UKR)	Ukraine	2
INDC(VN)	Vietnam	1

New Products 1997-1998

The Appendix summarizes specific output of the activities of the Nuclear Data Section in the period 1997-1998 that can be termed as 'products'. The list is prepared for reader's convenience, more details can be found in other parts of the present report.

Databases and Libraries:

- FENDL 2.0
  Fusion Evaluated Nuclear Data Library, version 2.0, partially released in April 1997, release completed in May 1998.
- NGATLAS
  Atlas of Neutron Capture Cross Sections, output of the CRP, released in April 1997.
- SGNucDat, Nuclear Data for Safeguards, completed and released in December 1997.
- RIPL Starter File
  Starter File of the Reference Input Parameter Library, output of the CRP, released in May 1998.

Books and Handbooks:

- Histogram Plots and Cutoff Energies for Nuclear Discrete Levels, output of the CRP, published in May 1997.
- CINDA 97, published in July 1997.
- Handbook of Nuclear Data for Safeguards, updated version, published in December 1997.
- Handbook for Calculations of Nuclear Reaction Data: Reference Input Parameter Library, output of the CRP, published in August 1998.
- CINDA 98, Supplement to CINDA 97, published in September 1998.

Web:

Porting of own databases and libraries on the NDS Web server started in 1997, followed by porting of documents in 1998. In addition, a page was prepared for the main IAEA server in 1998.

- EXFOR put on the NDS Web server in 1998.
- FENDL, version 1.0 put on the NDS Web server in 1997, followed by version 2.0 in May 1998.
- Libraries NGATLAS and RIPL put on the NDS Web server in April 1997 and in May 1998.
- Documents, including 22 IAEA-NDS reports, 6 INDC reports, and also 6 NDS Newsletters put on the NDS Web server in 1998.
- Web page "Nuclear Data Section" put on the main IAEA server in September 1998.

CD-ROMs:

Production of CD-ROMs started in 1998, four series of CD-ROMs were produced, typically 50-100 pieces each.

- EXFOR
  Experimental Nuclear Reaction Cross Sections, IAEA-NDS-CD-01, produced in January 1998.
- RIPL
  Reference Input parameter Library: Starter File and Handbook, IAEA-NDS-CD-02, produced in May 1988.
- FENDL-2.0
  Fusion Evaluated Nuclear Data Library, IAEA-NDS-CD-03, produced in May 1998.
- ENDF
  Five major evaluated nuclear data libraries (ENDF/B, JENDL, BROND, JEF and CENDL), IAEA-NDS-CD-04, produced in May 1998.