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I N D C INTERNATIONAL NUCLEAR DATA COMMITTEE

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

January – December 1999

Edited by

M.A. Lone and D.W. Muir

July 2000

IAEA NUCLEAR DATA SECTION, WAGRAMER STRASSE 5, A-1400 VIENNA

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Abstract

This report describes the activities of the IAEA Nuclear Data Section in 1999. It provides information on the staff and budget, activities of the Nuclear Data Center, coordination of the Nuclear Data Center Networks, nuclear data development projects, technology transfer, computer support, and atomic and molecular data activities. This is complemented by additional information on activities in the reporting period, including meetings, publications and new data products.

July 2000

Table of Contents

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	Center of Nuclear Data, Obninsk, Russia
CM	Consultants' Meeting of the IAEA
CRP	Coordinated 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 Center 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 Center, Brookhaven National Laboratory, USA
NRDC	Nuclear Reaction Data Centers
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 Cooperation and Development, Paris, France
PPAS	Programme Performance Assessment
RCM	Research Coordination Meeting (compare CRP)
RIPL	Reference Input Parameter Library
TC	Technical Cooperation
TECDOC	Technical document published by the IAEA
VMS	Operating systems of the Compaq Alpha Server

Preface

The IAEA Nuclear Data Section is one of four Sections of the Division of Physical and Chemical Sciences which in turn is one of five Divisions of the Department of Nuclear Sciences and Applications. The PPAS (Programme Review) of the Department of Nuclear Sciences and Applications (NA), which was underway when the INDC met in Vienna in May 1999, has now been completed and has been reviewed within the Agency. The results are generally supportive of the activities of the Nuclear Data Section. The general mission of the Department in providing scientific services was strongly endorsed, and nuclear and atomic data services, in particular, received excellent reviews. The sections's data development emphasis in the area of non-energy-related nuclear data was also endorsed (also see discussion of the AGM in 2000 below).

The panel made no specific recommendation on the future role of the INDC or the International Fusion Research Council (IFRC), which provides advice on the fusion programme carried out in the Physics Section. The INDC and the IFRC are the only two standing committees that advise the Department of Nuclear Sciences and Applications at the level of individual Sections. In the absence of an indication to the contrary, it can be assumed that these bodies will continue to provide their useful services to the Agency. The panel did recommend that the terms of reference of all standing committees contain mechanisms for regular rotation of membership.

This document is the progress report of the IAEA Nuclear Data Program and activities during the year 1999. 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. These are regularly reviewed by a subcommittee of the IFRC.

The Section is internally organized into four Units as shown in the organization chart on the following page. The contributions to various sections of this progress report have been coordinated by the senior staff in their capacity as Unit Heads. Pavel Oblozinsky left the Agency on 31 March 2000 to join National Nuclear Data Centre at BNL, USA. The contributions to Section 4 of this report were coordinated by Mike Herman.

The main text of the report is complemented by 3 Appendices that provide additional information on the activities of the Section in 1999 and 2000. Appendix 1 gives a list of meetings and workshops organized by the Section, Appendix 2 summarizes its publications, and Appendix 3 lists new data products prepared by the Section.

Vienna, 2 May 2000 M.A. Lone and D.W. Muir

Nuclear Data Section

Organization Chart
(11 May 2000)

Section Head: **D.W. Muir**
Nuclear Data Physicist
(04914-33-P5)
(21709/21710)

Deputy Section Head: **A. Trkov***
Nuclear Data Physicist
(04923-33-P5)
(21712/21711)

INDC Secretariat
Section Head
Deputy Section Head
E. Baumgartner

Nuclear Data Centre Unit	**Nuclear Data Development Unit**	**Computer Operations Unit**	**Atomic & Molecular Data Unit**
V.G. Pronyaev (Head) Nuclear Data Physicist (04950-33-P4) (21717) **P.K. McLaughlin** Programmer Analyst (06619-33-P3) (21723) **V. Zerkin** Nuclear Physicist/ Programmer (05069-33-P2) (21714) **M. Lammer** Asst. Nucl. Data Phys. (05078-33-G7) (21727) **O. Schwerer** Asst. Nucl. Data Phys. (05133-33-G7) (21715) **G. Bush** Production Progr. (05106-33-G5) (21725) **M. Wirtz** Secretary (05050-33-G4) (21716)	**A. Trkov** * (Head) Nuclear Data Physicist (04923-33-P5) (21712) **M. Herman** Nuclear Physicist (04969-33-P4) (21713) **R. Paviotti de Corcuera** Nuclear Data Information Physicist (05023-33-P3) (21708) **A. Scherbaum** Secretary (05115-33-G4) (21711)	**D.W. Muir** (Head) Section Head (04914-33-P5) (21709) **W. Costello** Systems Analyst (04941-33-P3) (21724) **M. O'Connell** Applications Progr. (05124-33-G5) (21722) **E. Baumgartner** Secretary (05087-33-G4) (21710)	**R. Clark** (Head) Atomic Physicist (04932-33-P4) (21731) **J.A. Stephens** Atomic Physicist/ Programmer (04987-33-P3) (21729) **K. Sheikh** Database Clerk (06499-33-G5) (21730)

- Andrej Trkov took up his duties in the Nuclear Data Section on 11 May 2000.

1. NUCLEAR DATA SECTION OVERVIEW

The budget and staffing level of the Nuclear Data Section has been relatively stable during the current reporting period. 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.

The previous Deputy Section Head, Pavel Oblozinsky, resigned his position effective 31 March 2000, in order to accept employment with the National Nuclear Data Center, Brookhaven. His successor, Dr. Andrej Trkov, took up his duties in the Section on 11 May 2000. The Head of the Atomic and Molecular Data Unit Ratko Janev retired after 11-plus years of outstanding service. His successor, Dr. Robert Clark, arrived in August 1999. The period from May 1996 to May 2000 has been characterized by an unusually high level of staff rotation, with a net turnover of 90% of the P-staff positions.

As shown in Table 1, the draft budget for 2001 is nearly unchanged in dollars. 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, and there has been increased staff activity in the development of Technical Cooperation projects. The increased dissemination of online documents via direct download from Web has reduced the hard-copy printing expenditures.

Table 1. Budget and staff summary 1998-2001

	1998	**1999**	**2000**	**2001**
Authorized Staff Level	18	18	18	18
Actual Staff Level	19	18.1	18	18
Staff Cost Budget	1,600,000	1,600,000	1,550,000	1,643,000
Programmatic Budget	602,000	570,000	636,000	573,000
Total Budget US$	**2,202,000**	**2,170,000**	**2,186,000**	**2,216,000**

In support of the PPAS of the Department of Nuclear Sciences and Applications, the Nuclear Data Section 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/ripc/nd/. The NDS portion of this site containing programme overviews, staff contact information, details of meetings, project, publications, etc.) provides a useful supplement to the Section's nuclear and atomic data dissemination sites, which continue to be developed separately.

2. DATA CENTER ACTIVITIES

The main objectives of the NDS Nuclear Data Center activity in 1999 were:

- to collect, assess, recommend and disseminate nuclear data required in the application of nuclear technology,
- to promote the international exchange of nuclear data for applications,
- to coordinate worldwide networks of national and regional nuclear reaction and nuclear structure and decay data centers,
- to maintain manuals and software for internationally agreed database formats and exchange procedures, and
- to improve the means by which the data center provides information to its users.

2.1 Nuclear Data Compilation

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

The general purpose evaluated nuclear reaction data libraries are created under the national or regional programs. After international release, they are placed in the ENDF database by NNDC, Brookhaven. Special purpose nuclear databases, data libraries and files are prepared in the framework of the IAEA Coordinated Research Projects or national and regional programs. They are documented by the IAEA NDS and, after checking and testing, are disseminated via online access or off-line on diskettes and CD-ROM upon request.

2.1.1 CINDA

There were no activities in the NDS toward the development of the new CINDA format and the new file "CINDA2001". Presently all CINDA operations (compilation, storage, data exchange and retrievals/transmission to customers) continue to be performed using the old CINDA format.

During 1999, the NDS has prepared and transmitted about 900 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.

CD-CINDA, the CD-ROM version of CINDA including a search software developed by the NEA Data Bank was completed in 1999. This was thoroughly tested by M. Lammer. Many suggestion for improvements to the search software were communicated by Lammer to M. Kellett of the Data Bank. Thus the NDS has made a considerable contribution towards the development of the CD-CINDA. The CD-CINDA could be an alternative or a supplement of the hardcopy CINDA book.

CINDA 99 was published again as a supplement to CINDA 97 and superseded CINDA 98. Plans were developed in November 1999 together with M. Kellett (NEA Data Bank) for a joint distribution of CINDA 2000 as a hardcopy book and a CD-ROM.

2.1.2 EXFOR

Since January 1999, two neutron-EXFOR transmissions were distributed containing new works from China (13), Ukraine (4), Argentina (4), Brazil (1) and Australia (1). These included 5 entries compiled at the China Nuclear Data Center which were checked and processed at NDS, and data received from Ukraine and Argentina in a "raw EXFOR" format which were finalized at NDS. In addition, 3 photonuclear entries were received in "raw EXFOR" format from Brazil. These were finalized (with help from CDFE Moscow) and transmitted on a separate EXFOR transmission file.

Considerable time was spent in updating the common CINDA/EXFOR dictionaries and related software originating from NNDC, and in quality control checking of EXFOR transmissions from all participating compilation centers

2.1.3 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):

- JENDL-3.2 Library. Pointwise data reconstructed by JAERI at 300 K.

- ENDF/B-VI Library, Release 6. It includes revisions up to September 1999. Basic and pointwise data are available online and on CD-ROM. The following materials were added, replaced or updated: 1-H-1, 1-H-2, 6-C-0, 7-N-14, 8-O-16, 13-Al-27, 14-Si Isotopes, 15-P-31, 20-Ca-40, 24-Cr Isotopes, 26-Fe Isotopes, 28-Ni Isotopes, 29-Cu-63, 29-Cu-65, 41-Nb-93, 74-W Isotopes, 82-Pb Isotopes.

- ENDF/B-VI Charged-Particle Sublibraries, Version: September 1999. The 1998 and 1999 updates includes complete presentation of the nuclear data for H-1, H-2, He-3, C-12, N-14, O-16, Al-27, P-31, Ca-40, Nb-93 and isotopes of Si, Cr, Fe, Ni, Cu, W, Pb, needed for transport, damage, heating, radioactivity and shielding applications over the incident proton energy range from 1 to 150 MeV.

- Table of Nuclear Root-Mean-Square Charge Radii, by I. Angely (June 1999), contains bibliographic information, data selection, evaluation procedures and tables with experimental and evaluated data.

- TLAPrfl: Package for Calculation of Depth Profile for Thin Layer Activation by G. Wallace.

- PCNuDat: a PC Nuclear Data Program, by R.R. Kinsey (Release 2.7, October 1998).

- EXFOR+ENDF retrieval + interactive plotting software by ZVVIEW. A tool for retrieval of integral reaction cross sections from experimental database EXFOR and major evaluated data libraries and their graphical comparison using ZVVIEW (a package specially designed for interactive plotting of nuclear reaction cross sections).

- PHYSCO - Nuclear Structure Calculation Tools – HSICC and LOGFIT. Tools for calculations of internal conversion coefficients and Log-ft values for beta and electron capture decay, average beta energies, and capture fractions.

- JENDL Dosimetry File 99 (JENDL/D-99) on CD-ROM, by JAERI. Data for 67 dosimetry reactions in pointwise and 641-group structure form and figures of comparison between JENDL/D-99 and IRDF-90 are given.

- NMF-90. Neutron Metrology File is an integrated database for performing neutron spectrum adjustment (unfolding) calculations. It contains four different adjustment codes, the group structure version of the dosimetry reaction cross section library IRDF-90/NMF-G with covariance files, six input data sets for reactor benchmark neutron fields and a number of utility codes for processing and plotting of the input and output data.

- DROSG-2000: Neutron Source Reactions. Data files with computer codes for 56 monoenergetic neutron source reactions.

- SaBa: The Library of Evaluated and Experimental Data on Charged Particles for Fusion Applications. Evaluated and experimental data for 52 reactions with a set of data processing procedures which provide a user-friendly interface for presentation and evaluation of cross sections.

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

2.2 Nuclear Data Services: Improvement and Development

The main innovations, development and improvements in the user services in the last year are:

- About 50% of all new INDC reports have been made available on the Internet. This lowered the printing cost by reducing the distribution of hardcopies of these reports. More than 1200 reports were downloaded by users in 1999.

- A new EL series of INDC reports, published and distributed in electronic form only, was introduced. The hardcopies of these reports are available only on special request by the user. Users are informed of the publication of these reports through an announcement in the Nuclear Data Newsletter.

- A new Web statistics system based on the Alpha Web server was developed. The system provides online monitoring and statistics reports of the retrievals from nuclear databases and accesses to data files, programs and documents. The access rate is tabulated for various categories such as data topics, countries and regions and is given in daily, monthly and year time frames. The system provides information on client activity with respect to country, database accessed, etc. The system is available through the Web from any computer and at any time.
- A new multi platform software package ZVView, designed for interactive graphical display of nuclear reaction cross sections retrieved from experimental and evaluated nuclear reaction cross sections was released to the user community. This software and its documentation are available from the NDS Web page.
- A new Web-based service was developed in collaboration with NNDC, BNL. This combines the EXFOR and ENDF cross section retrievals on Alpha VMS with interactive plotting by ZVView on a client's local computer. This service is now available from the NDS Web page.
- A new NDS Web site content-navigation tool was developed. This provides "explorer" type access to the most important pages, databases, libraries, files and documents. In addition, the NDS pages were enhanced with hyper-links to other sites containing important information on nuclear data and related topics. The tool provides fast overview of NDS Web site, allows to view information and services from various viewpoints depending on the client's interests.
- A new EXFOR CD-ROM retrieval system was developed. This is based on ACCESS-97 and is designed as a relational database. It allows flexible SQL search of information from EXFOR dictionaries. The system is integrated with ZVView interactive plotting program. A test version of the system was sent to the network of Nuclear Reaction Data Centers.

2.3 Nuclear Data Services: Statistics

Due to the variety of requirements from users, different media are used for user services. These include ordinary mail for hardcopies of documents, PC diskettes and CD-ROMs,
e-mails with attached retrieved data or electronic documents, and online transfer of data retrieved by the users themselves through the Telnet or Web interfaces.

The general statistics of user services in 1995 - 1999 is shown in Table 2. Figures are given for three different categories. Ordinary mail includes retrievals prepared by the NDS staff upon user requests and sent to them via ordinary mail. Online retrievals from NDS major databases are made directly by users themselves through 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 a 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. The number of Web accesses to other important databases, libraries programs and reports is also listed in Table 2.

Fig. 2.1 presents summary report of Web based Nuclear Data Services and includes statistics of accesses to the NDS data and information sources for the last four years starting from 1997. Statistics for year 2000 is given for first three months of the year.

The following trends in the user services can be seen during the last year:

- The total number of offline retrievals shows a slight increase with a wider use of CD-ROM media for distribution.

Table 2. NDS nuclear data retrieval and access [a] statistics by year

Type of Medium	Year				
	1995	**1996**	**1997**	**1998**	**1999**
Offline retrievals [b] prepared upon request, including:	**1556**	**786**	**1846**	**1995**	**2290**
Documents (hardcopies)	1155	554	1547	1533	1060
Data (diskettes)	373	219	286	115	105
Data (CD-ROM)		-	-	205	420
Online retrievals (Telnet)	**4462**	**5688**	**7350**	**2700**	**2180**
Online retrievals (Web)		-	**40**	**4964**	**9070**
Including retrievals from:					
ENDF		-	-	2618	4820
EXFOR		-	32	784	568
CINDA		-	3	470	498
NUDAT		-	5	1092	3185
Web pages accessed		-	**3690**	**6953**	**7319**
NGAtlas		-	286	613	1074
MIRD		-	257	453	493
Thermal Neutron Capture		-	353	714	514
IRDF90-NMF90		-	259	322	263
Masses		-	337	479	428
Programs		-	1109	1695	1769
FENDL		-	279	580	440
RIPL	-	-	23	841	962
Newsletters and Reports	-	-	787	1256	1376

[a] Data given in Table for Web accesses in 1997 – 1998 differ from what was given in previous reviews because a new statistics program and database for IP addresses of 'real users' was used in the analysis.

[b] Data for total offline retrievals in 1998 and for number of documents distributed are corrected. Number of physical media used for distribution (hardcopies, diskettes and CD-ROMs) may not coincide with the number retrievals.

- In 1999 the number of retrievals by hardcopy decreased by 30% probably due to downloading of online documents by users themselves instead of requesting hardcopy from NDS.

- Most of the users prefer to use Web access because of ease of use compared to Telnet. However the number of retrievals through Telnet is stable at around 2000 per year.

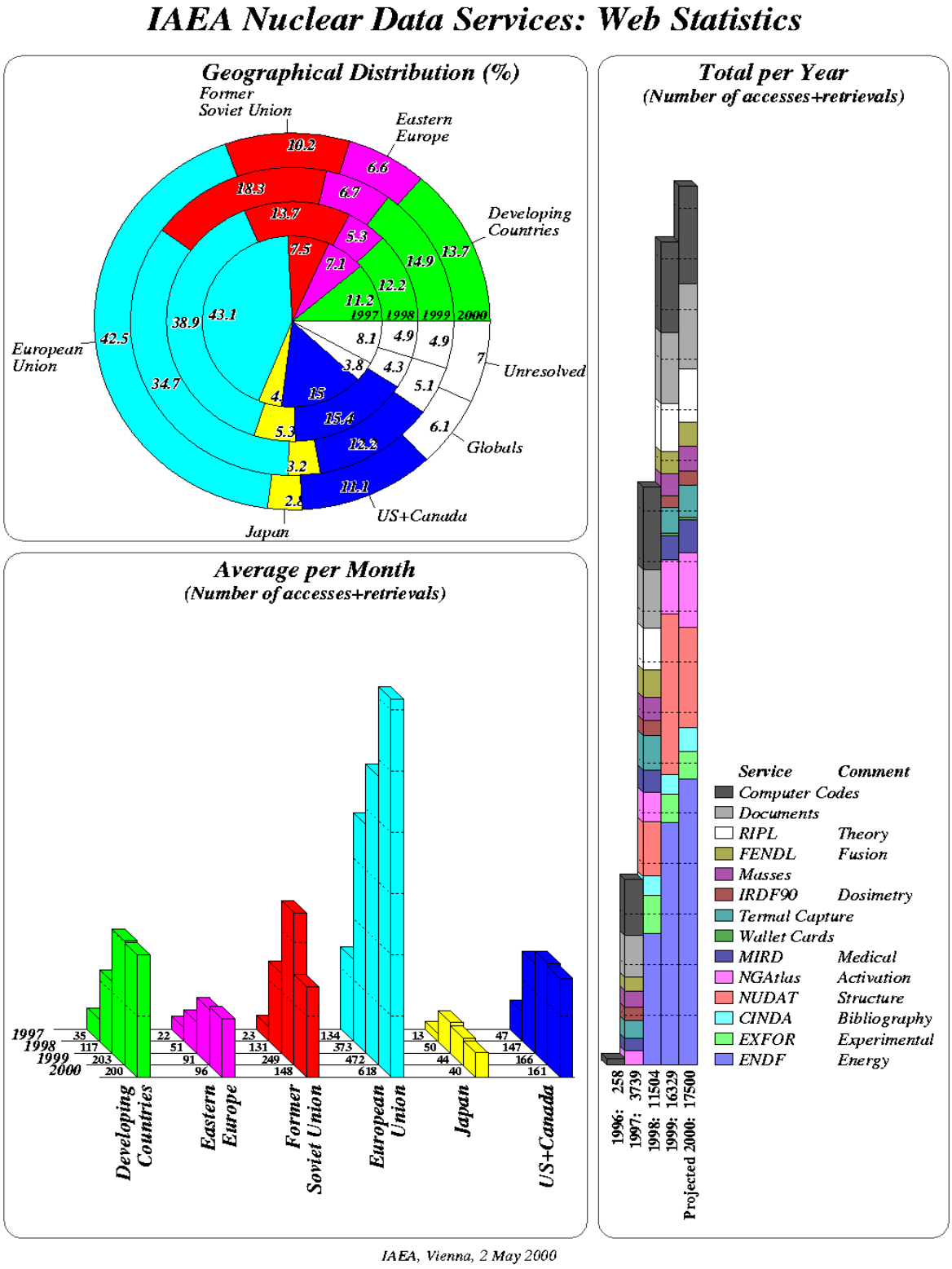

Fig. 2.1 Summary statistics of the user accesses at the NDS Web server.

The number of Web accesses increased by about 30% in 1999 compared to 1998. The geographic breakdown of the increase is, developing countries 14.8%, FSU countries 18.4%, East European region 6.7% and European Union 34.6%.

3. NUCLEAR DATA CENTER NETWORK COORDINATION

Two networks of Nuclear Data Centers are coordinated by the Nuclear Data Section. The first network consists of Nuclear Reaction Data Centers (NRDC), and the second consists of the Nuclear Structure and Decay Data (NSDD) evaluators.

3.1 Nuclear Reaction Data Centers

The NDS involvement and contribution to the cooperative work with the nuclear reaction data centers is relatively high. The NDS convenes annual network coordination meetings and participates in cooperative work on database and code development. The code development work in the NDS is limited to CD-ROM development of the nuclear databases, retrieval codes and graphical utilities for presentation of experimental and evaluated nuclear reaction cross sections. The NDS considers this as its contribution to the cooperative program development work. A result of the cooperation between NNDC and NDS is the development of a Web interface program which allows the retrieval of integral cross sections from EXFOR, major Evaluated Nuclear Data Libraries and includes an interactive graphical tool for data plotting and comparison.

The continuing successful cooperation between the nuclear reaction data centers is coordinated through nuclear reaction data centers network meetings and bilateral visits. The number of cooperating centers has grown up to 14 (see Table 3 below) with the addition of the KAERI Nuclear Data Evaluation Laboratory (Yusong, Republic of Korea).

3.1.1 NRDC Network Meeting

- Consultants' Meeting on Co-ordination of Nuclear Reaction Data Centers (Technical Aspects), Vienna, 18-20 May 1999. Report: INDC(NDS)-407. The conclusions and planned actions of this meeting focused on the solution of technical problems of the data centers cooperation.

- **Bilateral visits involving NDS**

- R.R. Kinsey (NNDC, Brookhaven) to NDS, 3–21 May 1999 (development of BNL325 type of plotting for Web, upgrading of Web access to the CINDA, ENDF and NuDat).

- M. Lammer (NDS) to NEA-DB, 15-18 October 1999 (CINDA development, CD-CINDA testing).

- V. Zerkin (NDS) to NNDC, Brookhaven, 27 September – 8 October 1999 (EXFOR CD-ROM development, use of ZVView graphical package for nuclear reaction cross section and nuclear structure data plotting).

- V.G. Pronyaev (NDS) to NNDC, Brookhaven, 1-9 November 1999, (discussion of the tasks in the common database development work, participation in the CSEWG meeting).
- T.W. Burrows (NNDC, Brookhaven) to NDS, 29 November – 10 December 1999 (lecturer at Online Workshop, ENSDF Web updates).

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

Center	Main activity within the network
National Nuclear Data Center, 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 Center, Institute of Physics and Power Engineering, Obninsk, Russia	Neutron reaction data compilation, evaluation and dissemination
Russia Nuclear Structure and Reaction Data Center, 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 Center, China Institute of Atomic Energy, Beijing, China	Nuclear reaction data compilation, evaluation and dissemination
Japan Atomic Energy Research Institute - Nuclear Data Center, Tokai-mura, Japan	Nuclear reaction data compilation, evaluation, validation and and dissemination
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 Center, Institute for Nuclear Research, Kiev, Ukraine	Compilation of nuclear reaction data
Center of Nuclear-Physics Data, Russian Federal Nuclear Center - VNIIEF, Sarov, Russia	Compilation and evaluation of charged-particle reaction data for light nuclei
KAERI Nuclear Data Evaluation Laboratory (KAERI/NDEL), KAERI, Yusong, Republic of Korea	Compilation of bibliographic and numerical information for the works done in Korea. Evaluation of nuclear reaction data

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 centers 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 21 groups and centers (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 Center at the Brookhaven National Laboratory. Data from the latest version of the ENSDF are available also from other distribution centers including the IAEA Nuclear Data Section server.

Periodic meetings of the network held by the IAEA Nuclear Data Section have the objectives of coordinating the work of all centers 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 coordinated by the NNDC Brookhaven. The network includes also centers preparing "horizontal" evaluations (evaluation of one or a few specific quantities for a set of nuclei) and data dissemination centers. The NDS holds biennial coordination meeting of NSDD network and has a few Coordinated Research Projects contributing to the "horizontal" evaluations (see the CRP list in Chapter 4.1). The involvement of the IAEA NDS in the coordination of the NSDD network consists primarily in holding the biennial Advisory Group Meetings. The coordination between the meetings is provided by the elected chairman (D. de Frenne) and the deputy chairman (C. Dunford).

4. NUCLEAR DATA IMPROVEMENT

Important aspects of the IAEA Nuclear Data Program are its nuclear data development activities. Related projects are largely conducted under the framework of the IAEA Coordinated Research Programme, making use of the mechanism of Coordinated Research Projects (CRPs).

The bulk of the nuclear data improvement work in 1999 was performed under Coordinated Research Projects. This was complemented by the long-term FENDL project that uses a different mechanism, namely a series of thermatically linked Advisory Group Meetings.

Table 4. List of 21 groups and centers constituting the NSDD network

Center	**Activity within the Network**
National Nuclear Data Center, 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
Center for Nuclear Structure and Reaction Data, Kurchatov Institute of Atomic Energy, Moscow, Russia	ENSDF evaluation
Nuclear Data Center, Petersburg Nuclear Physics Institute Academy of Sciences of Russia, Gatchina, Russia	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 Center, 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 Center, Budapest, Hungary	Horizontal evaluation (Neutron Capture Gammas)
School of Physics, Georgia Institute of Technology, Atlanta, USA	Horizontal evaluation (E0 Systematics)
Center for Nuclear Information Technology, San Jose State University, San Jose, USA	Dissemination
Scientific Digital Visions, Inc., San Jose, USA	Dissemination
Nuclear Data Section, International Atomic Energy Agency, Vienna, Austria	Dissemination
OECD Nuclear Energy Agency Data Bank, Paris, France	Dissemination

The objectives of the data improvement and the development projects are to provide:

- Database. A well defined basic product, generally a database or a data library.
- Documentation. Preferably an IAEA Technical Document (TECDOC).
- Web. Data and documentation available online with an appropriate Web interface.
- CD-ROM. A CD-ROM version of the database along with the documentation for users in developing countries that have limited access to the Internet and as a substitute for a hardcopy.

The above approach is being applied to all (new) projects with a positive response from users. This does however increases the responsibility of an NDS technical officer who has to follow the project through to the very end to and make sure that the final package of the products such as Web and CD-ROM is duly completed.

Table 5. Coordinated Research Projects active in 1999 or to be initiated in 2000-2001

No	Short Title	Duration	Participants (Contracts)	Technical Officer	Status May 2000	Section
1	Fission Yield Data (<20 MeV)	1991-96	7 (1)	Lammer	Complete	4.1.1
2	Photon Data	1994-98	9 (3)	Oblozinsky	Completed	4.1.2
3	Medical Radioisotopes	1995-99	7 (3)	Oblozinsky	Completed	4.1.3
4	Photonuclear Data	1996-00	7 (3)	Oblozinsky	Completed	4.1.4
5	Fission Yield (<150 MeV)	1997-01	10 (3)	Lammer	Ongoing	4.1.5
6	X- and Gamma-Ray Standards	1998-01	8 (3)	Herman	Ongoing	4.1.6
7	Input Parameter Testing (RIPL-II)	1998-01	8 (3)	Herman	Ongoing	4.1.7
8	PGAA – Prompt Gamma Activation Analysis	1999-02	5 (2)	Paviotti	New	4.1.8
9	Nuclear data for Th-U fuel cycle	2001-05	8 (3)	Pronyaev	Start in 2001	4.1.9.
10	Transport Simulation of Photon/Electron Radiotherapy	2000-03	4 ( )	Trkov (Andreo)	Deferred to 2001	4.1.10

4.1. Coordinated Research Projects

Altogether, 8 Coordinated Research Projects were active during 1999. Out of these, 4 CRPs have been completed, 2 CRPs were underway, and 3 new CRPs have been initiated. Two are scheduled to start in 2001. This status is summarized in the Table 5 below, followed by a more detailed account of each project.

4.1.1 CRP on the Compilation and evaluation of fission yield nuclear data (neutron induced fission below 20 MeV)

The CRP was completed in 1998 but the documentation is still pending. During 1999, all contributions to the IAEA TECDOC containing the final report of the CRP were collected. The TECDOC document was completed and a copy was submitted to the IAEA Publications Committee for approval.

The contents of the TECDOC has been changed in comparison to the last progress report insofar as Chapter 8 was merged with Chapter 1. The “Introduction” now contains background information (fission yields in application fields, history of fission yield evaluation, justification of the CRP, and summary of the CRP work, achievements, conclusions and recommendations. Further, Chapter 7 contains only descriptions of evaluations, whereas the voluminous data listings and file intercomparisons are included on a CD-ROM.

4.1.2 Measurement, Calculation and Evaluation of Photon Production Data (completed)

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:

- Final Report of a Coordinated Research Project has been published.

References:

- Final Report of a Coordinated Research Project "*Measurement, Calculation and Evaluation of Photon Production Data"* INDC(NDS)-412, December 1999, 214 pages

Output:

Web http://iaeand.iaea.or.at/ngatlas/
Documents NDC(NDS)-412, December 1999, 214 pages

4.1.3 Development of Reference Charged Particle Cross Section Database for Medical Radioisotope Production (completed)

Objectives:

- Produce international database of evaluated cross sections for production of diagnostic radioisotopes using cyclotron accelerators, and cross sections of related beam monitor reactions.
- Publish TECDOC "Charged-Particle Cross Section Database for Medical Radioisotope Production".

Activities:

- The database has been prepared. It contains evaluated cross sections for 48 reactions induced by light charged-particles with incident energies up to several tens of MeV (maximum 100 MeV). Production cross sections for the most important diagnostic radioisotopes are given, with 16 reactions for gamma emitters, and 10 reactions for positron emitters. Cross sections for beam monitor reactions are given for 22 reactions induced by protons, deuterons, tritons, 3-He and alpha particles. A complete documentation has been prepared, including evaluation methodology, detailed bibliography, graphical and tabulated results.

Outputs:

- Documents: IAEA-TECDOC of 283 pages was prepared in March 2000 and is expected to be published by summer 2000.
- Web: http://www-nds.iaea.or.at/medical under review by participants

4.1.4 Compilation and Evaluation of Photonuclear Data for Applications (completed)

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:

- The IAEA Photonuclear Data Library has been prepared. It contains data for 164 materials at incident energies up to 140 MeV, in ENDF-6 format suitable for transport calculations.
- Detailed description of the library has been prepared containing review of experimental data, outline of theoretical models, evaluation procedures and contents of the library.

Outputs:

Documents: Handbook on photonuclear data for applications: Cross sections and spectra, IAEA-TECDOC (March 2000), 274 pages, submitted for publication.
Web: http://www-nds.iaea.or.at/photonuclear in preparation
ftp: iaeand.iaea.or.at, user: photonuclear, no password required

References:

- Summary Report of the 2nd Research Coordination Meeting on "'Compilation and Evaluation of Photonuclear Data for Applications", 23-26 June 1998 Los Alamos, Report INDC(NDS)-384 (IAEA, Vienna 1998).
- Summary Report of the 3-rd Research Coordination Meeting on "Compilation and Evaluation of Photonuclear Data for Applications", 25-29 October 1999 JAERI Tokai, Report INDC(NDS)-409 (IAEA, Vienna 2000).
- Handbook of Photonuclear Data for Applications, IAEA-TECDOC (IAEA, Vienna) submitted for publication.

4.1.5 Fission Product Yield Data Required for Transmutation of Minor Actinides Nuclear Waste (up to 150 MeV) (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:

2nd Research Co-ordination Meeting was held, in Vienna, Austria, from 11-15 October 1999, with the following results.

- Files for bibliographic and experimental data of relevance to the CRP were created and made accessible to all participants. The compilation workload was distributed among participants.
- Results of experiments were presented which are valuable for the development of models and systematics.
- Theoretical investigations and models for the prediction of fission yields: Good progress was reported. A. Wahl's charge and mass distribution models were further developed. Simple models as well as new empirical and theoretical approaches were introduced and first results were presented
- Tasks and work for the remaining time of the CRP were fixed and distributed among participants.
- Contributions to the final publication and titles of papers were defined.

Next (final) meeting: was scheduled for October 2001.

Reference:

Summary Report of the CRP (including 2 RCMs), INDC(NDS)-387, in preparation.

4.1.6 Update of X- and Gamma-Ray Standards for Detector Calibration (1998-2001)

Objectives:

- Update the existing IAEA database (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:

- Evaluation activities have been carried out at the participating laboratories. The 2nd RCM was held 10-12 May 2000 at PTB Braunschweig.

Reference:

- Summary Report of the 1st RCM, INDC(NDS)-403, July 1999.

4.1.7 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 activities have been carried out in the participating laboratories.
- The 2nd Research Coordination Meeting will be held in Varenna (Italy) in June 2000.

4.1.8 Development of Database for Prompt Gamma-ray Neutron Activation Analysis

Objectives

- Improve the accuracy and completeness of the data needed in the technique of prompt gamma activation analysis (PGAA). This powerful analytical technique is of growing importance in fields such as materials science, chemistry, geology, mining, archaeology, environment, food analysis, medicine and other areas.
- Develop an international database of neutron capture data to be used in PGAA.
- Produce in electronic and printed form, a database for use in PGAA and corresponding TECDOC publications.

Activities

- Measurements and or evaluations tasks are being performed in the participating laboratories.
- The 1st RCM was held in IAEA, Vienna, from 2-4 November 1999.
- The 2nd RCM will be held in IAEA, Vienna, April-May 2001.

Reference:

- Summary Report of 1st RCM, INDC(NDS)-411.

4.1.9 Nuclear data for Th-U Fuel Cycle

The Nuclear Energy Department of IAEA has programs which are aimed at the investigation of parameters of systems based on Th-U fuel cycles with participation of many Member States. A CM meeting, held in 1999 concluded that a large part of uncertainties in the prediction of such parameters is related to uncertainty in nuclear data.

Objectives

- Estimate in more detail what variances of the nuclear data are responsible for the discrepancies observed Th-U fuel cycle parameters. Improve and update data base.

Activities

- A CM was held in Vienna on 19-22 April 1999
- CRP to start in 2001

Reference

- Summary report of the Consultants' Meeting on Assessment of Nuclear Data Needs for Th and other Advanced Cycles, INDC(NDS)-408, August 1999.

4.1.10 Transport Simulation for Photon/Electron radiotherapy

This is a joint CRP with the Dosimetry and Medical Radiation Physics Section of the Department of Nuclear Application in Human Health. The CRP corresponds to the needs of the Member States for improving nuclear data relevant to medical applications and their utilization in the physical aspects of radiotherapy techniques. The CRP is related to the ongoing CRP's on Photoneutron Data for Applications (NAPC) and on Dose Determination in Therapeutic Electron and Photon Beams (NAHU).

Objectives

- Improve the accuracy of the absorbed dose determination in radiotherapy, both in absolute and relative calculations (calibration of radiation sources and planning of patient treatment), using photon and electron beams produced by medical electron accelerators.

Activities

- Start in 2001

4.2. Other Projects

One project was performed during 1999 that used a 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.

4.2.1. Fusion Evaluated Nuclear Data Library (FENDL)

Activities:

- Consultants' Meeting on Extension and Improvement of the FENDL-Library for Fusion Applications, 22-24 June 1999, Obninsk, Russia.

  The discussions and conclusions at the meeting showed that the FENDL-2.0 activation sublibrary was validated successfully. However, a number of deficiencies were identified and possible improvements were proposed which should lead to the release of the FENDL-2.1 version of the library early in 2001. It was recommended that the IAEA investigate the possibility of substantially improving the capabilities of the FENDL activation sublibrary by including data at energies greater than 20 MeV to make the library useful for other applications (e.g. accelerator driven systems).

  References:

- Summary Report of the CM, INDC(NDS)-406, November 1999

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 Cooperation (TC) Program that is managed by the Department of Technical Cooperation. 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.

Involvement of the Nuclear Data Section in TC activities (projects) is fairly limited. 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 the series of nuclear data workshops. These 3 elements, namely TC projects, workshops and services, are briefly described below.

5.1. Technical Cooperation Projects

Two TC projects were programmed during 1997-98 and finally approved by the September 1998 IAEA General Conference. Their implementation has been successfully achieved (1999-2000) Technical officer R. Paviotti Corcuera (NDS).

5.1.1 Improved Access to IAEA Nuclear Data Services in Latin America (Project RLA/0/19, ARCAL XLVI)

In 1992 the Agency initiated the Internet-based Nuclear Data Information Service (NDIS). Although many of our data users are well served by this fast and user-focused data dissemination service, we find that data users in the region of Latin America and the Caribbean are currently having very limited success in accessing NDIS over the Internet. The difficulty in Latin America is that all Europe-bound Internet traffic is routed initially through the U.S. This routing fails during Northern American working hours, due to excessive network traffic and inadequate router capacity.

In 1997, the Nuclear Data Section, within the framework of the Technical Co-operation programme, provided technical support for the implementation of a regional computer site located directly within the Latin American region, to "mirror" IAEA online Nuclear Data Services. At the September 1998 IAEA General Conference, the project was approved for incorporation into the ARCAL (Acuerdos Regionales de Co-operacion para America Latina) program.

Following approval of the project, extensive tests were performed to evaluate the Internet data transmission rates between candidate host sites and user sites located throughout the Latin American Region. Detailed results of the network performance tests were discussed, during a meeting held from 7-9 April 1999 at IAEA headquarters in Vienna, by representatives of Argentina, Brazil, Chile, Cuba, and Mexico. The Institute IPEN in Sao Paulo, Brazil, was selected to host the mirror server. Since February 2000, the site has provided improved Internet access to IAEA online Nuclear Data Services in the Latin American region.

During 20-24 March 2000, a Regional Workshop on Nuclear Data Online Services, was successfully held in IPEN, Sao Paulo, Brazil. The workshop was attended by thirteen participants from 8 different Latin American countries Five lecturers recruited in the region, two IAEA Staff members, the local director of the workshop and the local operator/manager of the mirror NDS site took part in the organization of this event.

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

The project Utilization of Ghana Research Reactor-1. Phase II, was proposed by the National Nuclear Research Institute of Ghana Atomic Energy Commission and received final approval at the September 1998 General Conference. It consist of three main parts:

i) Neutron Activation Analysis
ii) Nuclear Data Online services
iii) Radiotracer applications for industry

IAEA nuclear data services are provided by the Nuclear Data Section. Under Part (ii) of this TC project, nuclear data libraries most useful in the planned applications, such as CINDA, EXFOR, ENDF and PC applications derived from ENSDF, were installed on a Windows NT workstation, thus allowing users to access and retrieve the databases at the NDS in Vienna and the equipment has been sent to Ghana.

Engineers and physicists who are involved in data processing for reactor physics and activation analysis will benefit from fast access to up-to-date nuclear data. An additional benefit arising from this TC Project is that training and research activities related to nuclear data will be greatly facilitated.

5.2 Workshops

Workshops on various aspects of nuclear data represented an important element in the NDS technology transfer in the reported period. Four Workshops were conducted. Two major Workshops were held at the ICTP Trieste, and 2 smaller Workshops were held in Vienna. In addition, a Workshop on Nuclear Data for Accelerator Driven Waste Incineration is scheduled to be held at the ICTP Trieste in 2001. Details are given below.

5.2.1 Workshop on Nuclear Data for Science and Technology: Medical Physics, ICTP Trieste, Italy, 4-15 October 1999

This Workshop was the first from 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 Workshop was directed by M. Herman (NDS), Prof. S.M. Qaim (FZ Julich) and Prof. P. Andreo (Dosimetry and Medical Radiation Physics Section, IAEA).

The objective of the Workshop was to facilitate application of modern nuclear technology in therapy and diagnostics, by training scientists, medical physicists, and engineers, especially from the developing countries, in understanding and use of nuclear data relevant to medical applications

The total number of visitors was 88, including 6 directors, 17 lecturers and 65 participants from 32 developing countries. The Workshop was organised on a 5 days per week basis with morning and afternoon sessions. Both of these consisted of two 1.5-hour lectures (or exercises) followed by discussion. The lecturers were the top rank specialists in their respective fields.

The participants became familiar with the role and use of nuclear data in: radiotherapy with photon, electron, proton and neutron beams, radioisotope cancer therapy, nuclear imaging techniques (PET and SPECT), production of radioisotopes relevant to radiotherapy and diagnostics, and dose determination in radiotherapy and diagnostics. Nuclear models and

nuclear data evaluation methodology were covered in 6 lectures. One lecture and a presentation were dedicated to the availability and retrieval of nuclear data. Two hands-on exercises on online retrieval of nuclear data were provided.

The Proceedings of the Workshop will be published in Radiochimica Acta, Munich, Germany, editors S.M. Qaim (Julich) and M. Herman (NDS)

5.2.2 Workshop on Nuclear Reaction Data and Nuclear Reactors: Physics, Design and Safety ICTP Trieste, Italy, 13 March - 14 April 2000

This 5-week Workshop was organized by the IAEA Nuclear Data Section in cooperation with the Abdus Salam International Centre for Theoretical Physics (ICTP Trieste).

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.

The Workshop directors included P. Oblozinsky/M. Herman (NDS), A. Koning (ECN Petten) and A. Trkov (IJS Ljubljana), responsible for nuclear reaction theory, evaluation methodology and nuclear data processing.

The Workshop followed the successful concept established by previous Workshops. It included five weeks of programme, comprising nuclear reaction theory, nuclear reaction data processing, and nuclear reactor applications. In this way, the participants received up-to-date information on the physics of nuclear interactions and techniques for reactor physics calculations.

The Workshop was attended by 87 visitors including 7 directors, 26 lecturers and 54 participants (the latter from 29 countries). The geographical distribution of participants was the following: Africa - 9, America - 7, Asia - 17, Europe - 21. Particularly strong represented were China (7), Spain (4), India (3), Morocco (3), Russia (3), and Italy (3). It is noted that for the first time there was a considerable number (12) of participants form the developed countries.

The programme of the Workshop covered nuclear data (2 weeks), followed by nuclear data processing (1 week) and nuclear reactor calculations (2 weeks). There were 65 lectures and 29 exercises (each of 1.5 h). The audience appeared to be interested and actively participated in most of the lectures and exercises.

The Proceedings of the Workshop will be published in World Scientific, Singapore, with editors M. Herman (NDS), N. Paver (INEN Trieste) and A. Gandini (ENEA Rome).

5.2.3 Workshop on Advanced Nuclear Data Online Services, Vienna, 29 November to 3 December 1999

This second IAEA workshop on nuclear data online services (the first one having been held in December 1997) had the objective to acquaint the participants with the Internet technologies, nuclear data libraries and retrieval strategies necessary to obtain the nuclear data information required for their field of application. From about 30 applicants, 14 participants were selected from Albania, Bangladesh, Belarus, Brazil, China, Cuba, India, Israel, Kenya, Pakistan, South Africa, the Ukraine and Venezuela. Technical officer of the workshop was O. Schwerer (NDS). Lecturers included T. Burrows (NNDC) and IAEA staff from NDS, INIS, and the VIC Library.

5.2.4 Workshop on Installation and Use of Linux for Nuclear and Atomic Data Computation on Personal Computers. IAEA, Vienna, 13-17 December 1999

Linux is a freely-distributable, independent, POSIX compliant, Unix-type operating system supported for Intel x86, Motorola 68k, DEC Alpha, Sparc, Mips, and Motorola PowerPC computer platforms. It supports a wide range of software, including X Windows, Emacs and TCP/IP networking. Many timing benchmarks have been run on Intel PC systems running Linux and the results are comparable with the scientific workstations mentioned above. Linux is now used throughout the world for software development, networking (intra office and Internet), and as an end-user platform. It is available over the Internet from numerous FTP sites, and from various vendors.

The objective of this Workshop was to assist developing Member States in the establishment of local centers for the evaluation of nuclear and atomic data. Most of the computer programs available for data modelling, analysis of experimental data, and graphical display of data were developed on Unix-based computer platforms, especially mid-range scientific workstations produced by companies such as Sun Microsystems and Digital Equipment. The recent remarkable worldwide collaboration to develop the Linux operating system has made it possible for scientists to implement this rich set of Unix-based data evaluation tools even on inexpensive personal computers.

The workshop was attended by 14 participants from Argentina (1), Bangladesh (1), Brazil (2), Bulgaria (1), Belarus (1), China (2), India (1), Romania (2), Russia (1), Ukraine (1) and Vietnam (1). The participant were provided with a package of operating system and applications software distributed by Red Hat. Each participant had the opportunity to perform a Linux installation with guidance. There were a series of lectures on understanding and managing of the operating system and the user work environment, description of Nuclear and Atomic data processing applications available for Unix and Linux, and practical exercises on installing and configuring Nuclear and Atomic data applications on Linux.

5.2.5 Workshop on Nuclear Data for Science and Technology: Accelerator Driven Waste Incineration, ICTP Trieste, Italy, 2001

The objective of the Workshop is to stimulate nuclear data activities by training young scientists in the understanding, production and use of the nuclear data relevant to accelerator driven systems (ADS). The participants will be familiarised with the modern theoretical models used to predict nuclear reaction cross sections. Emphasis will be given to practical exercises with relevant computer codes. They will learn principles of evaluation methodology and become acquainted with the existing data libraries and highlights of data processing and transport calculations. The Workshop will also provide a forum for discussion of the current projects and identification of needs for nuclear data relevant to accelerator driven systems.

Programme of the Workshop will include:

- ADS designs proposed for waste incineration
- nuclear data in ADS design
- impact of data uncertainties on core performance, structure damage and shielding
- experimental activities related to nuclear data development
- theory of nuclear reactions
- nuclear data libraries
- highlights of transport calculations at high and low energies

6. COMPUTER SUPPORT

The Nuclear Data Section provides computer hardware and software support to NDS staff members and to external data users through its Computer Operations Unit. The Unit employs three personnel, one G-5 (M. O'Connell), one P-3 (W. Costello) and one P-5 (D.W. Muir, part-time). Unit members are actively involved in the development and enhancement of NDS computer services, and work closely with developers and scientists in the NDS and other co-operating data centres.

There have been a number of major developments since the 1999 INDC meeting, principally:

- The completion of the Latin American Mirror project
- The commencement of the Vienna (NDS) mirror project
- A new Agency Firewall and IP renumbering programme

These and other developments affecting the Computer Operations Unit are detailed below.

6.1 MIRROR PROJECT

A major component of the Unit's activities over the past year has been the initiation of a programme to improve the level of user access to IAEA Nuclear Data Services. The current main activities include the creation of a mirror of the main server in Vienna and a mirror for the Latin American region.

The Section continues to maintain a Compaq Alpha Server 2100 4/275 computer (AS 2100 for short) as its core database engine. This system supports a total of 50GB of disk storage, a number of CD-ROM drives, printers and tape units and is connected to a local Ethernet Network.

The Alpha runs under Compaq's Open VMS AXP V 7.1-2. The databases ENDF, ENSDF, NSR, CINDA and ADLIST are in Oracle CODASYL format. The Oracle CODASYL DBMS is presently at version 7.0-0. The other Databases are in mixed Indexed and flat ASCII formats and do not require a DBMS.

We will migrate the existing AS 2100 from its former role as the primary production data server to a development role, with a new AlphaServer (see below) taking over the production server role. Incoming data updates and software modifications will be applied on the AS 2100 first and then mirrored simultaneously to both the new production server in Vienna and a mirror in Brazil. An overview of this process is given in figure 6.3 below.

6.1.1 LATIN AMERICA MIRROR

March 2000 saw the conclusion of TC project RLA/0/019, the Latin America Mirror project. A Compaq Alpha Server AlphaServer 800 5/500 was ordered in June 1999, at a total cost of US$ 32,000, for eventual shipment to IPEN (Instituto de Pesquisas Energeticas Nucleares), Sao Paulo, Brazil.

The purchased system includes the following:

1 AlphaServer 800 model 5/500 with 512 MB RAM
49.1 GB Disks
14 mm DAT tape drive
1 CD-ROM drive
1 Ethernet Card/Ultra SCSI Controller
1 Operator's Console with 17" colour monitor
6 VMS User Licenses
8 Oracle CODASYL DBMS current device licenses
1 Oracle Bronze maintenance for one year

Delivery was taken on the above equipment and software in late June 1999 and work was begun on its configuration in the Nuclear Data Section. The system was functional by early September 1999 and this was followed by a test period. In January 2000 the unit was shipped to Brazil and was installed by personnel of the IPEN Computer Centre in the first week of March 2000.

Systems Analyst W. Costello subsequently travelled to IPEN in March for two weeks to confirm the correct installation of the mirror system and to assist at the First Regional

Workshop on Nuclear Data Online Services, which was held at IPEN over the period 20-24 March 2000.

The AS 800 system at IPEN is a full mirror of the existing NDS VMS-based data services, it can be reached at **www-nds.ipen.br**.

6.1.2 VIENNA MIRROR

In late July 1999 a new Compaq Alpha Server model DS20 was ordered for delivery to the NDS in Vienna at a total cost of US$ 50,000. The system was delivered in October 1999 and consists of the following components:

1 AlphaServer DS20 model 6/500 with 256 MB RAM
69.1 GB Disks
14-mm DAT tape drive
1 CD ROM drive
1 10/100 Mbps dual Ethernet Card/Ultra SCSI Controller
1 3 Channel RAID Controller with 8 MB Cache
1 Operator's Console with 17" colour monitor
1 Uninterruptable Power supply
8 VMS User Licenses
8 Oracle CODASYL concurrent device licenses
1 Oracle Bronze maintenance for one year

This system will eventually replace the AS 2100 as the primary NDS data server. Work has begun on the preparation of the new DS 20 with a deployment target date of June 2000.

6.2 AGENCY FIREWALL AND IP RENUMBERING PROGRAMME

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

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

The NDS Alpha and Ethernet LAN have traditionally been located outside the Agency Firewall. Given the then extant Firewall technologies and Internet bandwidths this was seen as necessary to maximize an uninterrupted Nuclear Data service. The NDS Ethernet LAN and its physical relationship with the Agency network and the Internet is shown in figure 6.2 below.

As of April 2000 NDS has begun cooperating with an Agency-wide initiative to place all networks inside a new firewall. The NDS Ethernet will become part of a new Agency "De-Militarized Zone" (DMZ). Its connectivity with the outside world and with the internal Agency networks will be defined by a set of rules resident at the Firewall. An overview of this arrangement is given in Figure 6.1.

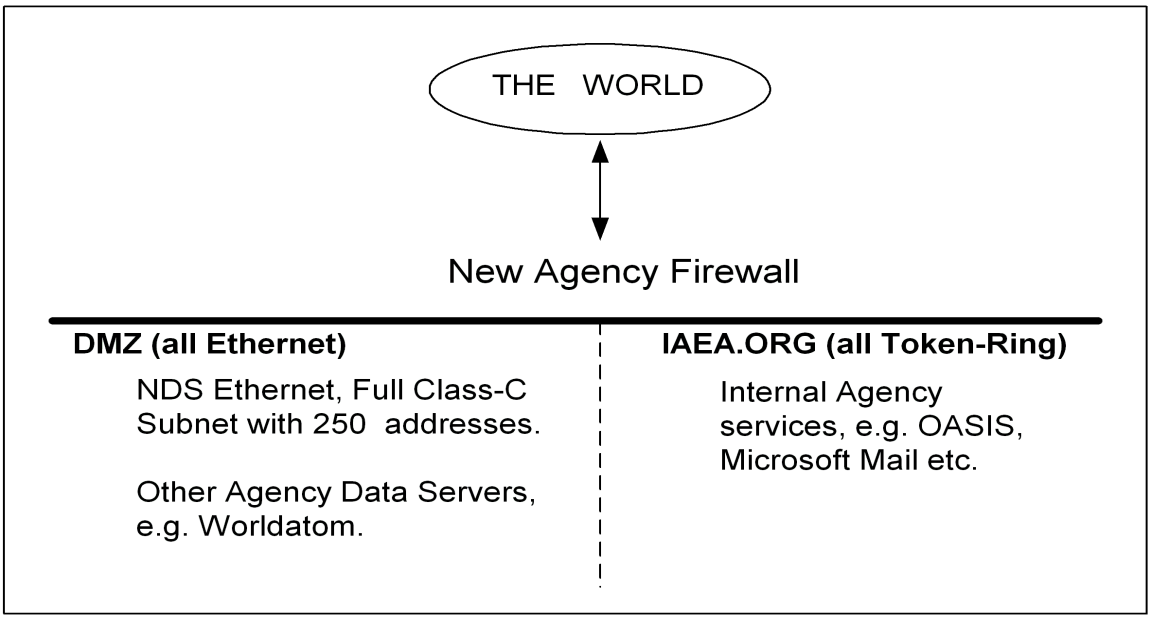

Figure 6.1 Overview of New Agency Firewall

A side effect of this program is that the NDS Ethernet will be assigned a new Class-C sub-network addressing range. At present the Section is limited to a total 10 IP addresses assigned to it by the Internet service provider. The new arrangement will make a total of 250 IP addresses available for the exclusive use of the Nuclear Data Section.

In addition it is expected that the section will be able to migrate from its existing 10 Mbps Ethernet physical layer to a 100 Mbps Ethernet.

Furthermore it is foreseen that the Section will be able to dispense with the need to have two PCs on many of its desks. Traditionally this has been necessary to allow personnel access to both the Agency Network and the NDS Ethernet. The former requiring a Token-Ring based PC and the later using a PC with an Ethernet network card.

6.3 WORKSHOPS

The NDS Computer Operations Unit organized a “Workshop on the Installation and Use of Linux for Nuclear and Atomic Data Computation on Personal Computers”. The workshop was held at IAEA headquarters, Vienna during the period 13-17December 1999 (see section 5.2.4).

6.4 PERSONAL COMPUTERS AND PRINTERS

In the year since the last INDC meeting the following Personal Computers were acquired:

- Compaq DeskPro EP 500MHz Pentium III PCs, each with 128 MB RAM.
- 2 XDS XTRA PCs with 550 MHz Processors and 128 MB RAM.
- A dedicated PC for writing CD ROMs was also acquired. It is also an XDS XTRA as described above but with an 18 GB fixed disk.
- A new HP LaserJet 5000 GN printer was requisitioned to replace an older model located in the NDS library. This printer will be networked.
- The total cost of these items came to US$ 17,300.

In February 2000, six older PCs were declared excess and returned to Central Services.

6.5 WEB DEVELOPMENT

NDS, in collaboration with the National Nuclear Data Centre (NNDC) at Brookhaven, has exerted a large effort in providing the latest World Wide Web facilities to its user community. All databases except NSR are now accessible via the Web from the NDS server. Work is ongoing to include NSR Web retrieval and to enhance the functionality of the other Web interfaces. The NDS Web can be entered at **www-nds.iaea.or.at.**

As a result of the mirror programme, described earlier in Section 6.1, it became necessary to redesign the Web retrieval programmes in a more generic form. These programmes, which are mostly written in PERL and JAVA script, now allow for the existence of several servers namely: NNDC (Brookhaven), WWW-NDS (Vienna), WWW-NDS (IPEN), CJD (Obninsk) and the future deployment of the NDS (Vienna) mirror server.

In this way updated versions of the Nuclear Data Web can be more easily mirrored from their origin to any of the servers listed above.

6.6 STAFF CHANGES

There have been no staff changes in the Computer Operations Unit since the last INDC meeting.

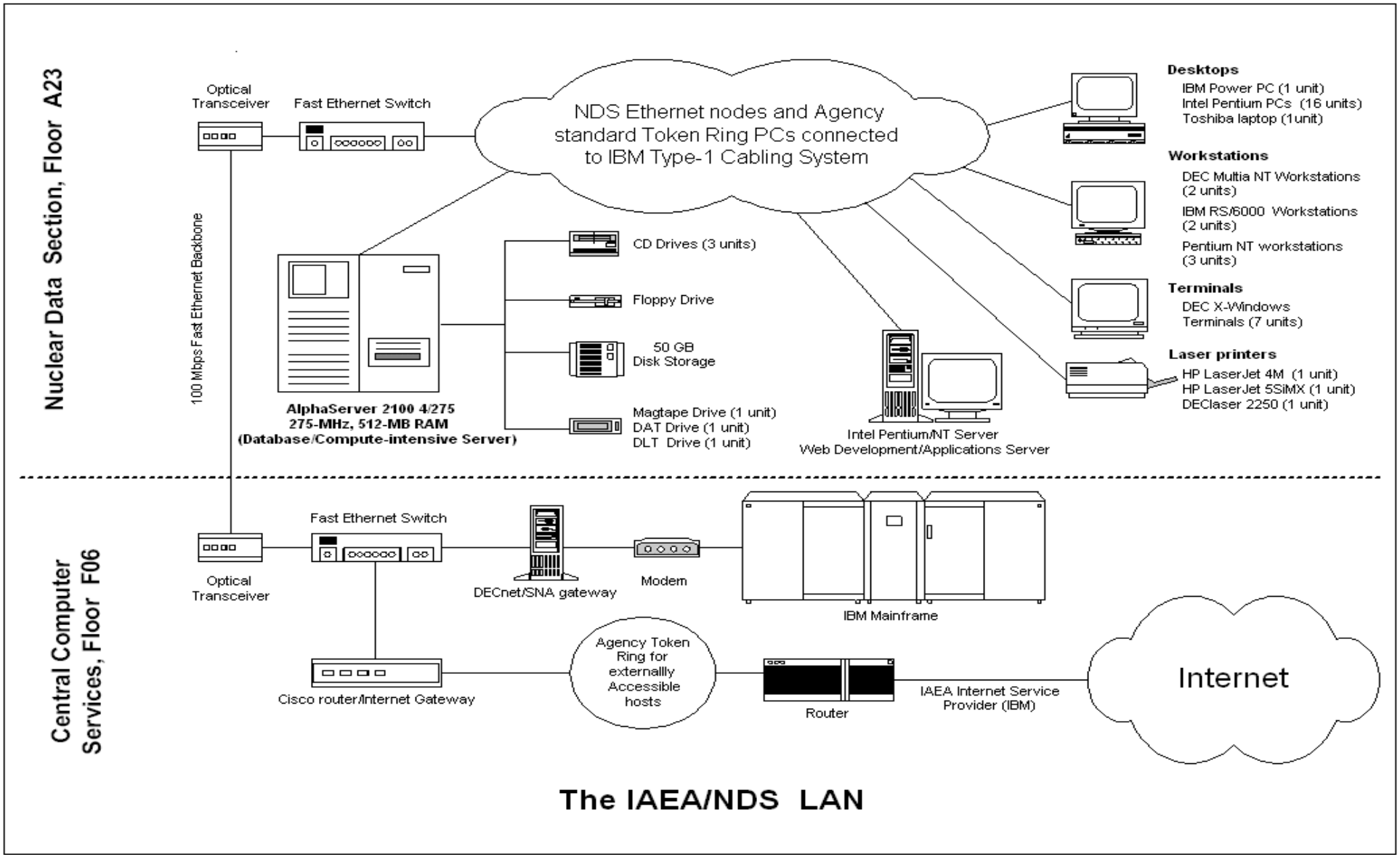

Figure 6.2 The Nuclear Data Section LAN - Physical configuration

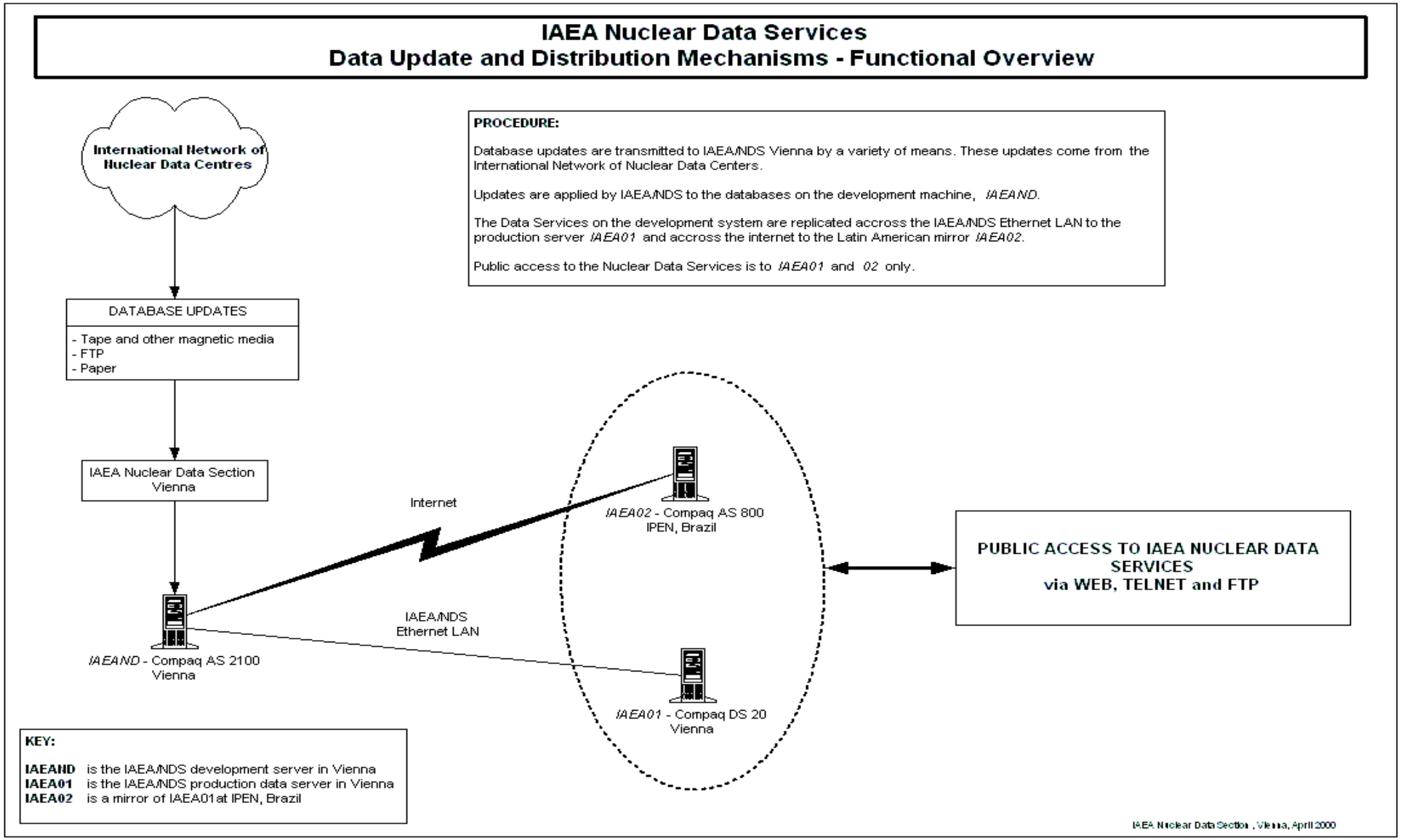

Figure 6.3 Functional Overview of the IAEA Nuclear Data Services

7. ATOMIC AND MOLECULAR DATA

The Atomic and Molecular (A+M) Data Unit of the Nuclear Data Section has the goal of providing data relevant to magnetic fusion energy (MFE) and other nuclear energy activities. To achieve this goal the A+M Data Unit carries out a number of different activities to enhance the databases and to make the databases accessible to users in the MFE community.

The databases maintained by the A+M Data Unit include interactions of isolated atoms and ions with other particles, particle-surface interactions, and materials property data. These last two sets are combined under the term plasma-material interaction data.

The A+M Data Unit co-ordinates Co-ordinated Research Projects (CRPs) with associated Research Co-ordination Meetings (RCMs) as well as co-ordinating the work of a Data Centre Network (DCN). Data gathered from these sources and from Consultant Meetings (CMs) are evaluated and added to the databases maintained by the A+M Data Unit.

The activities of the A+M Data Unit are supervised and reviewed by the Atomic and Molecular Data for Fusion subcommittee of the International Fusion Research Council (IFRC). This subcommittee normally meets biennially, but has met more frequently to maintain continuity with changes in the Agency budget cycle.

7.1 Database Establishment Projects

Three CRPs are currently active in the Unit. As these three CRPs come to a close, two new CRPs will be initiated.

The CRP on "Atomic and Plasma-Wall Interaction Data for Fusion Reactor Divertor Modelling" held its third and final RCM in March 1999. Much data from this CRP is in the process of being assessed. Final summary reports from the CRP are to be gathered and incorporated into a final report in May 2000. Much data from this CRP will be added to the Units databases on plasma-material interaction data.

The CRP on "Plasma-interaction Data for Mixed Materials" will hold its final RCM in October 2000. At this time deadlines for submission of final reports and data from this CRP will be established. It is expected that a great deal of useful data for the Unit databases will be generated from the final reports.

The CRP on "Charge Exchange Cross Section Data for Fusion Plasma Studies" will hold its final RCM in September 2000. There is already a large amount of valuable data from this CRP in the process of being assessed. At the final RCM deadlines will be established for submission of final reports and data files. It is expected that this CRP will greatly increase the amount of charge exchange cross section data available through the Unit databases.

In the year 2001 two new CRPs will be initiated, one on the topic of plasma diagnostics, the other on molecular process in plasmas. These two CRPs should be extremely useful in studies of fusion plasmas relevant to reactor facilities. These two CRPs are scheduled for three years duration each and should result in a large amount of data relevant to the cool divertor region of fusion devices where molecular processes play an important role.

7.2 Co-ordination of A+M Data Centre Network

The Data Centre Network (DCN) currently consists of 13 members from USA, Russia, Japan, France, Germany, Italy, China, and Korea. The DCN meets every two years to discuss data needs and to co-ordinate DCN activities. The DCN met in September 1999 at the IAEA. Each Data Centre gave a report on recent activities. Thorough discussion took place on planned activities for the next two year period. Specific recommendations for each Data Centre were discussed and adopted. There has been and continues to be a high level of co-operation in the co-ordination of the DCN. This remains one of the most effective tools of the A+M Data Unit.

7.3 Other Activities

Besides the normal data gathering activities of the Unit, several other significant activities have taken place. These include the access to the databases, publications, presentations at scientific conferences, and an extra-budgetary project.

The A+M Unit now has a very effective Worldwide Web interface to the databases. This interface runs the ALADDIN interface and allows a user to select data for specific interactions, set energy or temperature ranges, view the parameters of fitting functions, view tables of data, and view graphs of data. The user interface is simple to use and allows quick and easy access to any data in the entire database. This interface was recently completed and enjoys a very high level of use. The older Telnet access is slowly being phased out. It is planned to make the bibliographic database accessible in a similar manner in the next year.

The Unit continues to publish the “Atomic and Plasma-Material Interaction Data for Fusion” series. Three editions are in varying stages of production and should all be published within the coming year. In addition the Unit continues to publish the International Bulletin containing bibliographical information for Fusion related A+M physics data.

During the past year the two professional staff of the Unit attended and presented papers at several international scientific conferences. The purpose of this activity was to raise the awareness in the A+M physics community to the A+M Data Unit. This has been highly successful. Several possible strong participants for the upcoming new CRPs were identified through this activity. In addition the possibility of the addition of a new member of the Data Centre Network has arisen from one such conference. Also, the Unit continues to maintain a strong connection with the International Conference on Atomic and Molecular Data and Their Applications through membership in the International Co-ordinating committee of that conference.

Finally, During 1999 the extra-budgetary project on “International Database on Irradiated Nuclear Graphite Properties” was officially turned over to the A+M Data Unit. There was a meeting of the Steering Committee for this project in October 1999 at which the initial version of the database was presented to the members on CD-ROM. The A+M Data Unit continues to co-ordinate the activities of the members of this project. The next steering committee meeting will be held in the USA in September 2000 and will be attended by a member of the A+M Data Unit.

MEETINGS AND SCIENTIFIC VISITS IN 1999

Month/Duration	Responsible Officer	Type	Meeting Title/Type of Visit	Home Institute	Location
February					
24 - 25	Janev	CM	Technical Aspects of the International Database on Irradiated Nuclear Graphite Properties		Vienna
March					
3 - 5	Pronyaev		Consultant; N. Kocherov	St. Petersburg, Russia	Vienna
8 - 9	Janev	RCM	Atomic and Plasma-wall Interaction Data for Fusion Reactor Divertor Modelling		Vienna
April					
19 - 22	Pronyaev		Consultant; V. Goulo	Minsk, Belarus	Vienna
26 - 28	Pronyaev	CM	Assessment of Nuclear Data Needs for Thorium Cycle and other Advanced Fuel Cycles		Vienna

Month/Duration	Responsible Officer	Type	Meeting Title/Type of Visit	Home Institute	Location
May					
3 - 4	Janev	TCM	11th Meeting of the A+M Subcommittee of the International Fusion Research Council (IFRC)		Vienna
3 - 21	Zerkin		Consultant; R. Kinsey	BNL	Vienna
11 - 14	Muir	TCM	22nd Meeting of the International Nuclear Data Committee		Vienna
18 - 20	Schwerer	CM	Technical Aspects of the Co-operation of Nuclear Reaction Data Centres (NRDC)		Vienna
June	Janev	AGM	Review Status and Requirements for Tritium Retention in Fusion Reactor Materials		Vienna
7 - 8					
22 - 24	Herman	CM	Validation of FENDL-2 Activation Library		Obninsk, Russia
September					
6 - 10	Pronyaev	Visit	A. dos Santos (within TC)	São Paulo, Brazil	Vienna
13 - 14	Stephens	AGM	A+M Data Centres and ALADDIN Network		Vienna
23 - 24	Clark	TCM	Technical Steering Committee of the International Irradiated Nuclear Graphite Properties Database		Vienna

Month/Duration	Responsible Officer	Type	Meeting Title/Type of Visit	Home Institute	Location
October					
4 - 15	Herman/ Andreo	WS	Workshop on Nuclear Data for Science and Technology: Medical Applications		Trieste, Italy
11 - 15	Lammer	RCM	Fission Product Yield Data required for Transmutation of Minor Actinide Nuclear Waste		Vienna
25 - 29	Oblozinsky	RCM	Compilation and Evaluation of Photonuclear Data for Applications		Tokai, Japan
November					
2 - 4	Paviotti	RCM	Cross-section Database for Prompt Gamma Ray Neutron Activation Analysis		Vienna
18 - 26	Muir		Consultant; U. Kannan (Ms.)	BARC, Mumbai, India	Vienna
22 - 24	Pronyaev		Consultant; V.P. Chechev	Russia	Vienna
29 Nov. - 3 Dec.	Schwerer	WS	Workshop on Advanced Nuclear Data Online Services		Vienna
29 Nov. - 10 Dec.	Muir		Consultant; H. Wienke	SCK-CEN, Mol, Belgium	Vienna

Month/Duration	Responsible Officer	Type	Meeting Title/Type of Visit	Home Institute	Location
<u>December</u>					
29 Nov. to 10 Dec.	Schwerer		Consultant; T.W. Burrows	BNL	Vienna
1 - 3	Oblozinsky	CM	Charged-particle Database for Medical Radioisotope Production		Vienna
6 - 10	Clark		Consultant; J. Peek	Los Alamos, NM	Vienna
	Stephens		Consultant; C. Greene	Boulder, CO	Vienna
7 - 13	Muir		Consultant; C. Dunford	BNL	Vienna
			Consultant; R.A. Meyer	DOE, Germantown	Vienna
13 - 17	Costello	WS	Installation and Use of Linux for Nuclear and Atomic Data Computation on Personal Computers		Vienna
13 - 17	Clark		Consultant; Yong-ki Kim	NIST, Gaithersburg	Vienna
15 - 23	Pronyaev		Consultant; S. Dunaeva	Arzamas, Russia	Vienna

MEETINGS AND SCIENTIFIC VISITS IN 2000

Month/Duration	Responsible Officer	Type	Meeting Title/Type of Visit	Home Institute	Location
January					
17	Pronyaev		Discussion about IRDF-2000 Seminar with Presentation of 'SPALLDOS"		Vienna
26	Muir	Visit	Klaus Guber	ORNL	Vienna
February					
16 - 18	Oblozinsky	CM	Validation of Photonuclear Data Library		Culham (UK)
March/April					
13 March to 14 April	Herman	WS	Workshop on Nuclear Reaction Data and Nuclear Reactors: Physics, Design and Safety		Trieste
1 April to 31 May	Muir		Consultant; A. Lone		Vienna
May					
8 - 9	Clark	TCM	12^{th} of the A+M Subcommittee of the International Fusion Research Council (IFRC)		Vienna
8 - 12	Clark		Consultant; R.K. Janev	National Institute for Fusion Science, Japan	Vienna

Month/Duration	Responsible Officer	Type	Meeting Title/Type of Visit	Home Institute	Location
May (cont'd) 10 - 12	Herman	RCM	Update of X- and Gamma-ray Decay Data Standards for Detector Calibration		Braunschweig, Germany
15 - 19	Pronyaev	AGM	Network of Nuclear Reaction Data Centres (NRDC)		Obninsk, Russia
24 - 26	Muir/Lone	TCM	23rd Meeting of the International Nuclear Data Committee		Vienna
June 12 - 16	Herman	RCM	Nuclear Model Parameter Testing for Nuclear Data Evaluation (RIPL: Phase II)		Varenna (Milan), Italy
19 - 20	Clark	CM	Plasma Diagnostics and Molecular Processes		Vienna
September 7 - 8	Stephens	TCM	Technical Steering Committee of the International Irradiated Nuclear Graphite Properties Database		ORNL, USA
18 - 19	Clark	RCM	Charge-exchange Cross Section Data for Fusion Plasma Studies		Vienna

Month/Duration	Responsible Officer	Type	Meeting Title/Type of Visit	Home Institute	Location
<u>October</u>					
16 - 17	Clark	RCM	Plasma-material Interaction Data for Mixed Plasma-facing Materials in Fusion Reactors		Vienna
28 November to 1 December	Herman/Muir	AGM	Assess Long-term Nuclear Data Needs for Applications in Medicine, Transmutation and Safeguards		Vienna
<u>December</u>					
4 - 7	Pronyaev	AGM	Network of Nuclear Structure and Decay Data Evaluators (NSDD)		Vienna
(to be scheduled)	Paviotti/Andreo	CM	Transport Simulation for Photons/Electrons in Radiotherapy (joint with the Dosimetry and Medical Radiation Physics Section, NAHU)		Vienna
(to be scheduled)	Oblozinsky	CM	Validation of a Cross-section Library for Cyclotron Production of Medical Radioisotopes		Vienna

Appendix 2

Publications 1999

Series and No.	Titles
Annual Publications	CINDA-99 (Index to Literature and Computer Files on Microscopic Neutron Data). Supplement 2 to CINDA-97.
Periodicals	Bulletin on Atomic and Molecular Data for Fusion No. 56/57
Newsletter	Nuclear Data Newsletters No. 27 and 28
IAEA-NDS-0 (Rev.)	Index to the IAEA-NDS Documentation Series
IAEA-NDS-100 (Rev.)	The U.S. Evaluated Nuclear Data Library for Neutron Reaction Data, 1990, including revisions up to August 1999
IAEA-NDS-105 (Rev.)	ENDF/B-6 Charged-Particle Sublibraries. 1999 Version.
IAEA-NDS-141 (Rev.)	IRDF-90. The International Reactor Dosimetry File.
IAEA-NDS-163	Table of Nuclear Root Mean Square Charge Radii
IAEA-NDS-171	Neutron Metrology File NMF-90
IAEA-NDS-192	Package for Calculation of Depth Profile for Thin Layer Activation
IAEA-NDS-193	RRDF-98. Russian Reactor Dosimetry File.
IAEA-NDS-194	Program EPICSHOW. A computer code to allow interactive viewing EPIC data libraries (Version 98-1)
IAEA-NDS-CD-04	Updated in 1999. Contains all comprehensive evaluated data library (ENDF/B-VI, Release 5, JENDL-3.2, JEF-2.2, BROND-2 and CENDL-2) retrieval and merger system for MS Windows, Manuals and Documentation in PostScript format, utilities and pre-processing codes.
IAEA-NDS-CD-05	EXFOR. Database of experimental nuclear reaction cross sections (version January 1999). Updated and revised version of the IAEA-NDS-CS-01.
IAEA-NDS-CD-06	FENDL-2.0. Fusion Evaluated Nuclear Data Library (Version 14, January 1999). Comparing with previous version, corrections were introduced in 29Si and 56Fe files and html interface was added. Platform has to be specified when CD-ROM is requested.

CD-ROM with NMF-90 Integrated database and software package for neutron spectrum adjustment and radiation damage (exposure) parameter calculations.

INDC(NDS)-392 Summary Report of Workshop on Processing of Nuclear Data for Use in Power Reactor Pressure Vessel Lifetime Assessment, IAEA Headquarters, Vienna, 19 - 23 October 1998, edited by R. Paviotti-Corcuera, L.R. Greenwood and D.W. Muir, 22 p

INDC(NDS)-393 State-Selective and Total Electron Capture, Excitation and Ionization Cross Sections in Slow Collisions of H(2s) and He(2s) with H+, He2+, Li3+, Be4+, B5+, R.K. Janev, E.A. Solov'ev, J.A. Stephens, 35 p

INDC(NDS)-394 Atlas of Giant Dipole Resonances Parameters and Graphs of Photonuclear Reaction Cross Sections. Report prepared by A.V. Varlamov, et. al., 311 p

INDC(NDS)-395 IAEA Consultants Meeting on “Validation and Improvement of the FENDL-2.0 Transport Sublibraries”, 12-14 October 1998, Vienna, Austria. Summary Report prepared by M. Herman, 83 p

INDC(NDS)-396 IAEA Technical Committee Meeting: 10th Meeting of the IFRC Subcommittee on Atomic and Molecular Data for Fusion, 27-28 May 1998, Vienna, Austria. Summary Report prepared by R.K. Janev, 35 p

INDC(NDS)-397 Cross Section Data for Electron-Impact Inelastic Processes of Vibrationally Excited Hydrogen Molecules and their Isotopes. Report prepared by A. Celiberto, et. al., 253 p

INDC(NDS)-398 1st IAEA Research Co-ordination Meeting on "Charge Exchange Cross Section Data for Fusion Plasma Studies", 24-25 September 1998, Vienna, Austria. Summary Report prepared by R.K. Janev, 13 p

INDC(NDS)-399 IAEA Advisory Group Meeting on the “Co-ordination of the International Network of Nuclear Structure and Decay Data Evaluators”, 14-17 December 1998, Vienna, Austria. Summary Report prepared by V.G. Pronyaev, 122 p

INDC(NDS)-400 Report of the IAEA Nuclear Data Section to the International Nuclear Data Committee for the Period 1997-98. Report prepared by P. Oblozinsky, 62 p

INDC(NDS)-401 The Nuclear Data Centres Network. Report prepared by V.G. Pronyaev, 38 p

INDC(NDS)-402 3rd IAEA Research Co-ordination Meeting on "Atomic and Plasma-Wall Interaction Data for Fusion Reactor Divertor

Modeling", 8-9 March 1999, Vienna, Austria. Summary Report prepared by R.K. Janev, 73 p

INDC(NDS)-403 — 1st IAEA Research Co-ordination Meeting on “Update of X- and Gamma-Ray Decay Data Standards for Detector Calibration and other Applications”, 9-11 December 1998, Vienna, Austria. Summary Report prepared by M. Herman and A. Nichols, 80 p

INDC(NDS)-404 — IAEA Technical Committee Meeting: 11th Meeting of the IFRC Subcommittee on Atomic and Molecular Data for Fusion, 3-4 May 1999, Vienna, Austria. Summary Report prepared by R.K. Janev, 43 p

INDC(NDS)-405 — IAEA Advisory Group Meeting on "Critical Assessment of Tritium Retention in Fusion Reactor Materials", 7-8 June 1999, Vienna, Austria. Summary Report prepared by R.K. Janev, G. Federici and J. Roth, 16 p

INDC(NDS)-406 — IAEA Consultants Meeting on “Extension and Improvement of the FENDL Library for Fusion Applications”, 22-24 June 1999, Obninsk, Russia. Summary Report prepared by M. Herman, 40 p

INDC(NDS)-407 — IAEA Consultants Meeting on “Co-ordination of the Nuclear Reaction Data Centres (Technical Aspects)”, 18-20 May 1999, Vienna, Austria. Summary Report prepared by O. Schwerer, M. Lammer and V.G. Pronyaev, 143 p

INDC(NDS)-408 — IAEA Consultants Meeting on “Assessment of Nuclear Data Needs for Thorium and other Advanced Cycles”, 26-28 April 1999, Vienna, Austria. Summary Report prepared by V.G. Pronyaev, 21 p

INDC(NDS)-409 — IAEA Research Co-ordination Meeting on “Compilation and Evaluation of Photonuclear Data for Applications”, 25-29 October 1999, Tokai, Japan. Summary Report prepared by P. Oblozinsky, 54 p

INDC(NDS)-410 — IAEA Advisory Group Meeting on “Technical Aspects of Atomic and Molecular Data Processing and Exchange (15th Meeting of the A+M Data Centres and ALADDIN Network)”, 13-14 September 1999, Vienna, Austria. Summary Report prepared by J. Stephens, 178 p

INDC(NDS)-411	IAEA Research Co-ordination Meeting on "Development of a Database for Prompt Gamma-Ray Neutron Activation Analysis", 2-4 November 1999, Vienna, Austria. Summary Report prepared by R. Paviotti-Corcuera and R. Lindstrom, 76 p
INDC(NDS)-412	Final report of a IAEA Co-ordinated Research Project on "Measurement, Calculation and Evaluation of Photon Production Data". Report edited by P. Oblozinsky, F.S. Dietrich and A. Mengoni, 214 p

Other INDC Reports

Report	**Country of Origin**	**Number of Reports**
INDC(CCP)	Russia	4
INDC(CPR)	China	2
INDC(CZR)	Czech Republic	1
INDC(GER)	Germany	1
INDC(HUN)	Hungary	2
INDC(JPN)	Japan	2
INDC(POL)	Poland	1
INDC(SUD)	Sudan	1
INDC(UK)	United Kingdom	1

Appendix 3

New Products 1999

The Appendix summarizes specific output of the activities of the Nuclear Data Section in 1999 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, Libraries, Files and Computer Packages:

The new Web statistics system with current on-line monitoring and generation of statistics reports on the retrievals and accesses to nuclear databases, libraries, files, computer codes and materials placed on NDS Web site.

- ZVView, multi platform software package for interactive plotting of nuclear reaction cross sections (experimental and evaluated data). The package is integrated to new several products of the NDS. Package and documentation is available on NDS Web-site.

- New Web-based service combining the EXFOR, ENDF and interactive plotting of reaction cross section by graphic utility ZVView.

- New NDS Web site Contents-navigation tools with the easy explorer-type access to the most important pages, databases, libraries, files, documents was developed.

- Test version of a new EXFOR CD-ROM retrieval system based on ACCESS-97 was released and distributed to the Network of Nuclear Reaction Data Centers. The system presents EXFOR as a relational database. Main features are flexible SQL search, included EXFOR dictionaries, integration with ZVView for interactive plotting.

- FENDL-activation file and comparison with experimental data retrieved from EXFOR is presented as Web pages with static plots and interactive graphics (ZVView).

Books:

- CINDA99, November 1999.

Web:

Porting of own and contributions by other centers of databases, libraries, files and computer packages on the NDS Web server in 1999.

- RRDF-98, Russian Reactor Dosimetry File put on NDS Web server in January 1999.

- DROSG-2000, Neutron Source Reactions.

- Table of Nuclear Root Mean Square Charge Radii, June 1999.

- TLAPrfl, Package for calculation of Depth Profile for Thin Layer Activation.

- Documents, including 11 IAEA-NDS reports, 13 INDC reports, and also 2 NDS Newsletters put on the NDS Web server in 1999.

- New Web statistics system with current online monitoring and generation of statistics report on retrievals and accesses to nuclear databases, libraries, files, computer packages and materials placed on NDS Web site.

- New Web-based service combining retrievals from EXFOR and ENDF and interactive plotting of reaction cross sections with graphical utility ZVView.

CD-ROMs:

Production of CD-ROMs started in 1998, each series of CD-ROM includes 50-100 pieces.

- EXFOR
  Experimental Nuclear Reaction Cross Sections, IAEA-NDS-CD-05 produced in January 1999. Updated and revised version of the IAEA-NDS-CD-01.

- FENDL-2.0
  Fusion Evaluated Nuclear Data Library, IAEA-NDS-CD-06, produced in January 1999. Corrected version with new user friendly html interface.

- ENDF
  Five major evaluated nuclear data libraries (ENDF/B, JENDL, BROND, JEF and CENDL), retrieval and merger system for MS Windows, manuals and documentation in PostScript format, utilities and preprocessing codes, IAEA-NDS-CD-04, updated in September 1999 with inclusion of new releases.

- CINDA on CD-ROM prepared by NEA Data Bank, Paris, December 1999.

- PCNuDat on CD-ROM, prepared by NNDC Brookhaven, release 2.7, October 1998.

- NMF-90 on CD-ROM, Neutron Metrology File with adjustment codes, the group version of dosimetry reaction cross section library.

Nuclear Data Section
International Atomic Energy Agency
P.O. Box 100
A-1400 Vienna
Austria

e-mail: services@iaeand.iaea.org
fax: (43-1) 26007
cable: INATOM VIENNA
telex: 1-12645
telephone: (43-1) 2600-21710

Online: TELNET or FTP: iaeand.iaea.org
username: IAEANDS for interactive Nuclear Data Information System
usernames: ANONYMOUS for FTP file transfer;
FENDL2 for FTP file transfer of FENDL-2.0;
RIPL for FTP file transfer of RIPL;
NDSONL for FTP access to files sent to NDIS "open" area.
Web: http://www-nds.iaea.org