

Report of the National Nuclear Data Center to the 2001 US Nuclear Data Program Meeting

NNDC Operations

The NNDC has added one new staff member since the last meeting of the US Nuclear Data Program, Ivan Sirakov. Ivan comes from the Institute for Nuclear Research in Sofia, Bulgaria. He will assume responsibilities for maintaining the nuclear reaction databases, for processing incoming ENDF evaluations and in the future for compilation of nuclear reaction data. The NNDC now consists of 11 scientific/professional staff, 4 support staff and 3 guest scientists.

We continue to provide secretariat functions and chair for the US Nuclear Data Program (USNDP) and for the US Cross Section Evaluation Working Group (CSEWG). In December 2000, the final report on the accomplishments of the Nuclear Data Program for fiscal year 2000 was completed and distributed. The Work Plan for fiscal year 2002 was completed and distributed in February 2001. Both of these documents were completed with the assistance of the Coordinating Committee of the USNDP. Charles Dunford assumed the chair of the NEA Working Party on Evaluation Cooperation for a two-year term. This group coordinates the international nuclear data evaluation activities for applied nuclear technologies. Pavel Oblozinsky has been chosen to replace Richard Meyer as the US representative on the International Nuclear Data Committee, which advises the International Atomic Energy Agency on its nuclear data program. Tom Burrows presented an invited paper on medical needs for nuclear radioactivity data at an IAEA Advisory Group Meeting on future nuclear data requirements.

The main work of the NNDC continues to be performed on our Compaq Alpha Server 4100. The nuclear databases reside on this computer and are served electronically from it. In addition, we operate several servers running Windows-NT or Linux to support the Database Migration Project described below.

Nuclear Database Migration Project

The use of modern relational database management systems could help the nuclear data community to administer and disseminate information in an efficient and flexible manner. During the last few years, the NNDC has been investigating the use of this type of software for nuclear data.

As a pilot project, the NSR database was converted to relational format. This version of the database, which uses Microsoft SQL Server software, is updated on a weekly basis and has been publicly available on the web since June, 1999.

Over the last year, several relational database packages have been evaluated in order to choose software for eventual migration of NNDC-hosted databases. Among the criteria considered were performance, price, support, and cross-platform capability. Software was tested on the OpenVMS, Windows NT, and Linux operating systems. It was recently decided that the Adaptive Server Enterprise (ASE) software from Sybase would best meet our needs. Purchase of ASE is underway, and we plan to install it on a Linux system during the next few months.

In September 2000 the NNDC hosted a workshop for international collaborators to discuss issues related to the migration to and use of the relational format. At that meeting, a strategy for the migration of data and application programs was outlined. It is expected that full migration will take four or five years. We expect to maintain the current database systems on VMS in parallel with the new systems while development is taking place. The current "exchange" formats for the various databases will be maintained as long as there is a need for them.

A large part of the effort over the coming year will be in defining the relational structures for the various databases. At present, Vicki McLane is heading up an international group to define structures for reaction databases. A group at NNDC, led by Tom Burrows, Jag Tuli, and Alejandro Sonzogni, has begun investigating options for nuclear structure databases. As these structures are defined and tested, existing programs will be converted to access the new databases. In addition, there are plans to investigate the use of technologies such as XML and Java into the new systems.

Nuclear Structure Data

Evaluation Work:

The following A-chain evaluations were completed: A=139 (Burrows), 141 (Tuli,Winchell), 144 (Sonzogni); first two have been published and A=144 is undergoing post-review corrections. The following nuclides were evaluated and added to ENSDF: 82Sr, 82Rb, and 94Kr (Tuli).

Nuclear Data Sheets:

Twelve issues of Nuclear Data Sheets have been edited, prepared and sent to Academic Press for publication (Blennau,Dixon,Tuli). Revised introductory material for NDS has been prepared with help of NSDD committees (Tuli).

Evaluated Nuclear Structure Data File (ENSDF) and NUDAT:

The ENSDF database has been continuously updated and maintained (Tuli) during the past year. The contents of the database have been distributed to the network in August 2000 and March 2001 (Blennau,Tuli). NuDat has been updated following each distribution.

Nuclear Wallet Cards File:

The Wallet Cards file has been updated twice, following ENSDF distribution (Tuli).

ENSDF Manual :

The ENSDF manual “Evaluated Nuclear Structure Data File – A Manual for Preparation of Data Sets” was revised and published as a BNL report BNL-NCS-51855-01/02-Rev, February 2001 (Tuli). This is the first published update since 1987.

Experimental Unevaluated Nuclear Data List (XUNDL) :

XUNDL continues to operate as an archive of unevaluated data. B. Singh, McMaster U., coordinates collection and compilation of the data. The NNDC maintains, updates, and distributes the database. There are currently (as of 3/20/01) 635 data sets for 513 nuclides. XUNDL can be accessed via the NNDC online service as well as its web site. (Winchell)

ENSDF Analysis and Utility Codes :

The ENSDF analysis and utility codes are maintained and upgraded (Burrows, Kinsey). The current status of these codes will be available on the Web prior to the USNDP meeting.

Other Activities :

1. A talk “The Nuclear structure data resource and repository” presented at the International Nuclear Structure meeting at MSU, 8/00. Published as NP A682, 236c (2001) (Tuli).
2. Four staff members, Burrows, Dunford, Oblozinsky, and Tuli, participated in the Nuclear Structure and Decay Data meeting sponsored by the IAEA in Vienna, December 2000.

3. Alejandro Sonzogni collaborated with ANL researchers performing experiments on proton radioactivity in transfermium nuclei . He also attended Nuclear Theory workshop on Proton Radioactivity.
4. David Winchell collaborated with J. Saladin, U. of Pittsburgh on analysis of a ^{232}Th Coulomb Excitation experiment done at Yale in early 2000.

Nuclear Reaction Data

CSISRS/ENDF/CINDA Related Codes

The NNDC continues to provide updates of CSISRS, CINDA, and ENDF codes to the following data centers: NDS (IAEA), VNIIEF (Russia), Slavutych (Ukraine), and the CNDC (China). (McLane)

Version 6.12 of the ENDF utility programs has been completed and tested. The new versions have been upgraded to handle all new ENDF formats and procedures agreed before November 2000. The programs were written originally in Fortran 77. The three quality control programs (contents checking) were modernized to use the improved structuring capabilities offered by Fortran 90. The next release will be fully FORTRAN 90 compliant. We also hope to have a windows (rather than command line) interface for the PC versions of the codes. (Dunford)

Viktor Zerkin of the NDS has made two visits, each for two weeks, to discuss the design of a new relational nuclear reaction database. A proposal has been prepared and distributed for comment.

Nuclear Reaction Evaluation

A collaboration with LANL and IAEA Vienna on the development of a modular code for nuclear reaction data evaluations was initiated. The pre-equilibrium Monte Carlo code HMS was extended to account for angular momentum conservation, of importance for modeling isomer and discrete gamma-ray production. The modular code Empire was extended by adding a module based on the exciton model code DEGAS, motivated by the need to handle direct-semidirect capture in the fast neutron energy region. (Oblozinsky)

The cooperation with the Korean Atomic Energy Research Institute (KAERI) on fission product cross-section evaluations focused on the fast neutron energy range. Yong-Deok Lee spent 3 months at the NNDC; 8 preliminary evaluations were completed. (Oblozinsky)

An intercomparison of available fission product cross sections from the five international data files (ENDF/B, JEF, JENDL, Brond and CENDL) has been completed in order to assess the quality of evaluated neutron reaction data available for these nuclides. (Sirakov)

NNDC initiated a workshop on nuclear reaction physics and codes, which was prepared jointly with LANL and LLNL, and was hosted by LANL in Santa Fe, April 10-11, 2001.

Nuclear Reaction Data

The compilation of charged-particle nuclear data (CPND) continues. Svetlana Dunaeva of the Russian Nuclear Data Center at VNIIEF, Sarov, Russia, spent ten weeks at the NNDC assisting with the compilation of data reported in the literature since 1980. As of March 30, 2001, the NNDC has entered more than 800 references of data measured in the U.S. and Canada. The database now contains almost 900,000 data points for CPND, and about 6 million data points for all nuclear reactions. (McLane, Dixon)

The contract with Oak Ridge to compile neutron data measured by J. Harvey has been completed. All recoverable data has been received by NNDC and are being processed or have already been added to the CSISRS database.

Release 7 of ENDF/B-VI was issued. The last planned release of ENDF/B-VI will be issued this year. (McLane, Sirakov)

Data Dissemination

Internet

Internet access to the data and information available at the NNDC consists of:

1. TELNET (T.W. Burrows, C.L. Dunford, V. McLane)
2. World Wide Web (R.E. Arcilla, M. Blennau, T.W. Burrows, C.L. Dunford, R.R. Kinsey, V. McLane, Y. Sanborn, J.K. Tuli, D.F. Winchell)
3. Anonymous FTP (T.W. Burrows, C.L. Dunford, R.R. Kinsey)

As shown in Fig. 1, there was an approximately 36% increase in the number of retrievals over the Internet between 1999 and 2000. NuDat and NSR continue to be the most popular with 23% and 22% of the 2000 retrievals. Retrievals from the nuclear reaction databases (CINDA, CSISRS, ENDF) accounted for 18% of the retrievals.

Usage of the ENSDF and NSR link managers continued to increase this last year. In addition to NNDC pages, URL's using at least one of these include:

nucleardata.nuclear.lu.se, radware.phy.ornl.gov, trinity.digitalcreativity.com,
us.f14.mail.yahoo.com, www-nds.iaea.or.at, www-nds.ipen.br,
www.fysik.lu.se, www.google.com, www.lucas.lu.se, and
www.tunl.duke.edu.

NNDC staff members participated in the Joint Dissemination Project.

Additions and Improvements

1. 6th Edition of the Nuclear Wallet Cards added to Web and Anonymous FTP. The previous version was retained for archival purposes.
2. Nick Stone's Table of Nuclear Moments updated. The previous version was retained for archival purposes.
3. EXFOR Basics manual added to Web and Anonymous FTP and the ENDF-102 and ENSDF manuals updated.
4. Links to the Nuclear Physics Electronics Link Manager added for CINDA, CSISRS, and NSR HTML retrievals and links to the APS Link Manager extended back to 1970. About 31,000 NSR entries now have links to the abstracts from 15 journals dating back to 1970 in the case of APS journals.
5. Linux versions for most of the ENSDF analysis and utility codes added.

Under Development

1. A Web interface to CSISRS and ENDF has been developed which allows data to be downloaded in a format allowing ZVView¹ to be used as a helper application. This is already available on the IAEA Nuclear Data Section's Web sites and will be implemented at the NNDC after integration with the current CSISRS interface.
2. Although the activities of the Joint Dissemination Project have terminated, we still hope to finish the interface to the ENSDF and XUNDL databases, which formats the information for the Isotope Explorer Java Applet. This implementation will be hampered by lack of documentation on the formats and syntax required by the applet.
3. An improved HTML presentation of ENSDF and XUNDL data has been implemented and is being tested. HTML will be served in three different character encodings dependent on the browser and client operating system to best display Greek characters and symbols:
 - a. Standard HTML with most Greek characters and symbols spelled out: Mozilla 2- for all platforms and Mozilla 3 (except Sun HotJava 2+) under X-11.
 - b. "": Mozilla 3+ (except Sun HotJava 2+) under MS Windows and MacOS.
 - c. UNICODE: Mozilla 4+ for operating systems other than MS Windows and MacOS and Sun HotJava 2+ on all operating systems.

¹ Developed by Viktor Zerkin, IAEA Nuclear Data Section.

4. A data link manager is under development. This will allow Physical Review C and other journals to provide links from their articles to the corresponding experimental data in databases resident at the NNDC.
5. A Web interface for the utility code QCALC is being developed.

Future Plans

1. Work will begin on porting the Web database interfaces to the new relational databases being developed.
2. The collaboration with San Jose State University and Scientific Digital Visions, Inc. in the development of new Internet and database technologies and scientific data management tools will continue.

Hard Copy and CD-ROM

(M. Blennau, P. Dixon, R.R. Kinsey, V. McLane, J. Tallarine, J.K. Tuli, D.F. Winchell)

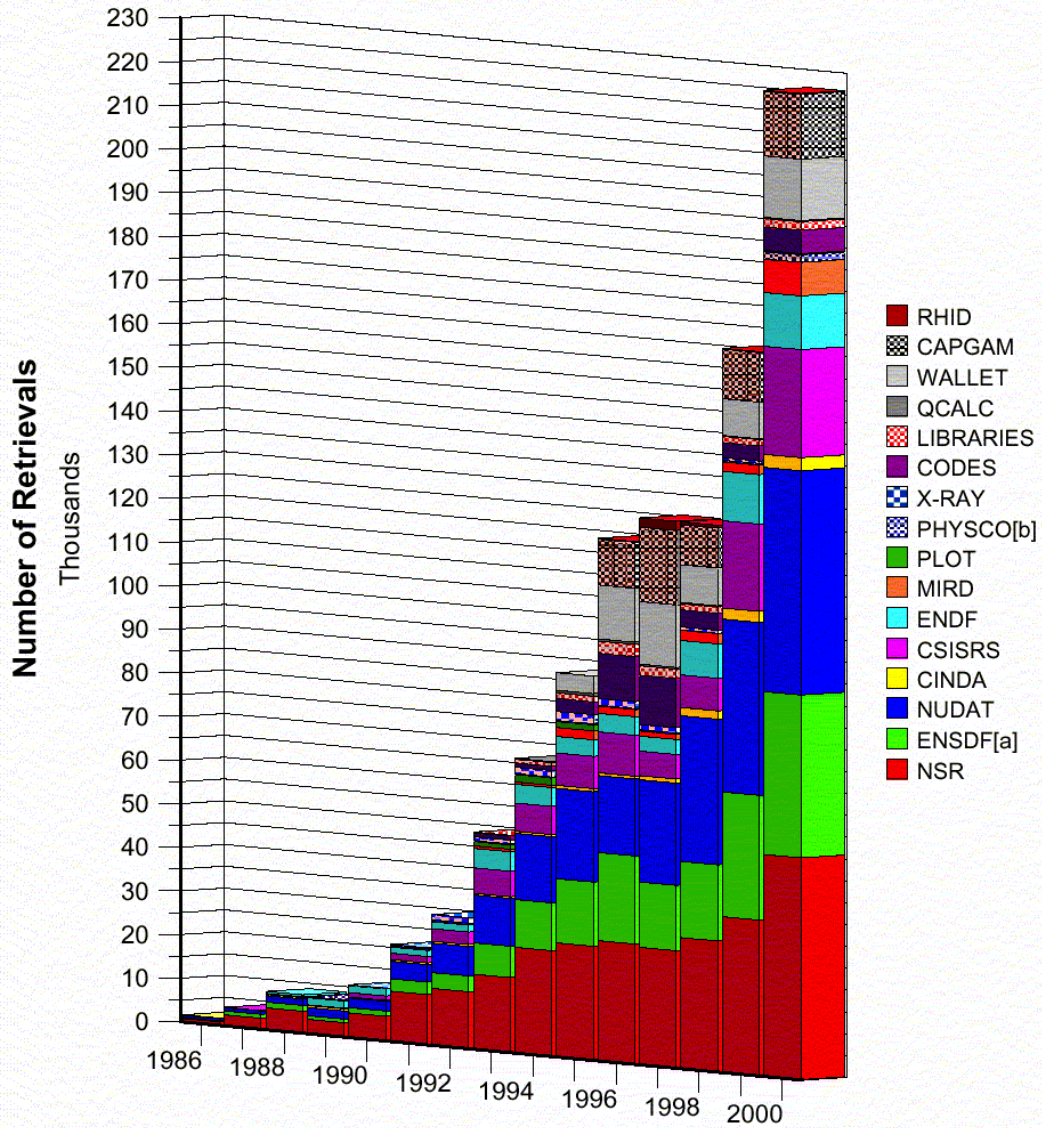
The *Nuclear Data Sheets* continue to be edited and produced by the NNDC for publication by Academic Press. The cost of this activity is fully covered by royalties and other payments received from Academic Press. Eleven issues are devoted to publication of ENSDF evaluations. The December issue is devoted to "Recent References" which are the yearly updates to Nuclear Science References. Academic Press continues to make the *Nuclear Data Sheets* available over the Web. It is now possible to display RadWare-style band drawings in the *Nuclear Data Sheets*.

The 6th edition of the *Nuclear Wallet Cards* has been published. The NNDC satisfied 1 request for Nuclear Data and References on CD-ROM and 4 requests for the EPDL97 CD-ROM between April 1, 2000 and March 19, 2001.

User Outreach

The NNDC continues to host the USNDP Web site and also now hosts the CSEWG Web site.

NNDC On-Line Data Service, World Wide Web (W³), and FTP Retrievals 1986-2000



^a Includes XUNDL retrievals since January 1 (OnLine) and January 11 (Web), 1999.

^b Added to Web August 18, 1999.

Figure 1

