National Nuclear Data Center Activity Report

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Abstract

This report reviews the activities of the National Nuclear Data Center (NNDC) for the period April 1999 through March 2000, for the third meeting of the U.S. Nuclear Data Program (USNDP), April 27-28, 2000. The activities of the Center in this period include the compilation and evaluation of nuclear structure and decay data; compilation of nuclear reaction data; maintenance of bibliographic databases in the areas of nuclear physics; support of various national and international groups concerned with the collection, evaluation, and dissemination of nuclear data; dissemination of the data resident in the NNDC's databases *via* the Internet and other means; and serving as the U.S. repository of low- and medium-energy nuclear data. The name of the person with lead responsibility for the activities described in each of the sections is underlined.

Staff Changes

During the past year, two staff members, Mulki Bhat and Said Mughabghab have retired. A new Deputy Center Head, Pavel Oblozinsky has been hired to replace Mulki Bhat. Pavel has spent the past seven years as Deputy Head of the IAEA's Nuclear Data Section. In addition, one nuclear structure evaluator, Alejandro Sonzogni has been hired. Alejandro worked most recently on charged-particle reaction data experiments at Argonne and before that at the University of Washington.

Computing and Databases

(R. Arcilla, T. W. Burrows, R. Kinsey, Y. Sanborn, A. Sonzogni, D.Winchell)

For the past eighteen months, the NNDC has been investigating database technology in order to determine the future directions in both hardware and software. A report will be completed in July 2000. In September, the NNDC will host a workshop with participation from the cooperating international data centers in order to review the report and its implications to the international nuclear data center network. One-half of a staff member working on this project was supported by Clark University.

Nuclear Structure Data and Related Activities

Nuclear Structure Data Evaluations

(M. R. Bhat, T. W. Burrows, A. Sonzogni, J. K. Tuli, D.Winchell)

Evaluations submitted for updating the ENSDF: A=61, 69 and 142
Evaluations in Progress: 139, 141 and 144
Number of evaluations reviewed: 6 A-chains, and 11 nuclides

The Evaluated Nuclear Structure Data File (ENSDF)

(M. T. Blennau, P. Dixon, C. L. Dunford, J. K. Tuli)

The ENSDF is continuously updated on the basis of new evaluations submitted. These are processed by running them through format and physics checking codes, and the errors found are corrected. A hard copy of the output is sent for review, post review corrections and changes are included, and finally checked and approved by the editor. The final corrected evaluation is published as *Nuclear Data Sheets* (NDS) by the Academic Press in 11 issues per year. The December issue of the NDS is devoted to Recent References which are the yearly updates to the Nuclear Science References. Beginning in July 1996, the Academic Press has made the contents of each NDS issue available on the Web as Adobe Portable Document Format (PDF) files. There are 17 new evaluations in the processing pipeline.

The current status of mass-chains in the ENSDF for A>44 is shown in Fig. 1. The ENSDF is distributed twice a year -- generally in February and August. It is distributed in two forms, as a complete file as well as an update file containing only those data sets which have been modified since the last distribution. Users may also update their local databases easily by using the Web ENSDF access. Super-deformed bands and high-spin evaluations submitted by network evaluators are also part of the ENSDF. Evaluators can retrieve datasets as they existed prior to their translation. A Y2K compliant ENSDF was distributed in September 1999.

Nuclear Wallet Cards and NuDat databases are also updated periodically to include additions to the ENSDF. The year 2000 edition of the Nuclear Wallet Cards is in press.

The Experimental Unevaluated Nuclear Data List (XUNDL)

(B. Singh [McMaster], D. F. Winchell)

The XUNDL database has been set up in order to archive compiled, unevaluated data sets prepared from recent high-spin and other nuclear structure publications. Collection and compilation of data sets have been coordinated by Balraj Singh at McMaster University, Ontario, Canada. When data sets are ready for insertion into the database, they are sent to the NNDC where they are stored in the ENSDF format. This allows the use of existing programs such as the Isotope Explorer and ENSDAT for accessing this database. As of March 23rd, there were 417 data sets for 351 nuclides (158 masses) in the database. Data can be accessed through the NNDC Web Site or *via* the NNDC On-Line service.

The Nuclear Science References (NSR)

(J. Tallarine, D. F. Winchell)

The NSR database is continuously updated as new articles are published. In calendar year 1999, more than 4500 entries were added to the NSR. In addition, approximately 7000 previously incomplete entries have been updated since April 1999. The list of journals scanned regularly for the NSR is given in the Recent References issue of the *Nuclear Data Sheets*. Furthermore, relevant secondary references that appear in laboratory reports and conferences are coded and entered into the NSR, as well as the secondary references and private communications used by mass-chain evaluators. All papers appearing in *Physical Review* ***C***, *Nuclear Physics* ***A***, and the *European Journal of Physics* ***A***, are entered into the NSR.

Secondary source entries have been received from the RIKEN Data Center, Japan and Gatchina, Russia. These entries were checked, corrected and merged into the NSR. Monthly distributions of the NSR retrievals are being transmitted to the various data centers on schedule. Distribution of exchange-format files, formerly distributed three times a year, are now distributed monthly.

All corrections brought to the attention of the NSR file manager by evaluators and others are checked and the file is promptly updated with the corrections and the user is notified by letter as to the results.

A relational database version of NSR has been available on the web since June 1999.

Procedures for author keyword preparation for *Physical Review* ***C*** articles were modified to allow electronic submission.

ENSDF Related Codes

(T. W. Burrows, R. R. Kinsey, J. K. Tuli)

The ENSDF analysis and utility programs continue to be maintained and improved, along with COMTRANS and ENSDAT. With the exception of RadList, all distributed versions are current with the in-house versions at the NNDC and available *via* anonymous FTP, the Web, and the NNDC OnLine Data Service. In addition, OpenVMS and Windows 95/98/NT executables are available through the Web and anonymous FTP. The current status of these programs will be available on the Web prior to the USNDP meeting.

The program NDSPUB, which produces author proofs and publication, output from the ENSDF database continues to be maintained and modified as required.

Lack of manpower has delayed development of the Evaluator's Corner described at last year's meeting. However, HSICC and LOGFT are available through the NNDC PHYSCO site (http://www.nndc.bnl.gov/nndc/physco/) and the development is included in the FY2001 work plan.

Nuclear Structure and Decay Data (NSDD) Network Evaluator Services

(M. T. Blennau, J. Tallarine, J. K. Tuli)

The NNDC provides many services to the NSDD network evaluators and others on a routine basis. At present these are the following:

1. Monthly NSR updates are sent to those evaluation centers that request them for the A-chains assigned to them.

2. Complete NSR and ENSDF retrievals are sent at the start of an evaluation only to those who cannot access online the NSR or the ENSDF from the NNDC, the NEA Databank, Paris, or the NDS, IAEA, Vienna. Others do their own retrievals.

3. Copies of hard-to-get references are sent to evaluators.

4. ENSDF updates are sent twice a year. The NNDC also sends the complete ENSDF as well, every six months.

5. NSR updates are sent once in four months.

6. Special retrievals are made from the NSR and the ENSDF. Requests for these specialized retrievals are considered on a case-by-case basis. Users are encouraged to take advantage of the full potential of the NNDC On-Line and Web systems; only if their needs cannot be met by the system, then their requests are processed in-house.

7. ENSDF, NSR, NuDat database updates are sent to the IAEA, the NEA Data Bank, Paris, France and CJD Nuclear Data Center, Obninsk, Russia on a regular basis.

Nuclear Reaction Data and Related Activities

CSISRS/ENDF/CINDA Related Codes

(C.L. Dunford, V. McLane)

The NNDC continues to provide code updates to the following data centers: NDS (IAEA), VNIIEF (Russia), Slavutych (Ukraine), and the CNDC (China).

Viktor Zerkin of the NDS (IAEA) visited the NNDC for two weeks to discuss cooperation on the implementation of a CSISRS/EXFOR plotting code and the production of an EXFOR CD Rom.

International Cooperation

(S. Mughabghab)

The cooperation with the Korean Atomic Energy Research Institute (KAERI) on Fission Product Evaluation has resulted in the production of 17 evaluations that have been submitted to CSEWG for review prior to inclusion in the next release of ENDF/B-VI. Soo Youl Oh of KAERI visited the NNDC for one week to work on the publication of the results. Although Said Mughabghab has retired, he will continue to work on the evaluation of neutron resonance parameters.

Nuclear Reaction Data

(V. McLane, P. Dixon)

The compilation of charged-particle nuclear data (CPND) continues. As of March 30, 2000, the NNDC has entered almost 600 references for data measured in the U.S. and Canada. The database now contains more than 700,000 data points for CPND, and more than 5 million data points for all nuclear reactions.

The contract with a consultant to work with Oak Ridge National Laboratory to compile neutron data measured by J. Harvey before the termination of the ORELA measurement program has been extended for a second year. More than 140 data sets have been received to date which are being processed at NNDC for inclusion in the CSISRS database.

The final specifications for the CINDA2001 database are awaiting a decision on future database systems at the NNDC.

Release 6 of ENDF/B-VI was issued.

The NNDC is hiring a PostDoc to work on reaction data compilation, processing of evaluated data for ENDF/B-VI, and evaluation of nuclear reaction data.

Compilation of Relativistic Heavy-Ion Data

(M. R. Bhat, T. W. Burrows, C. L. Dunford, V. McLane)

After discussions within BNL, it was decided to hold a workshop on the compilation of relativistic heavy ion data, perhaps in the fall. The objective of this workshop will be to determine the need for such compilation and what kinds of data should be compiled.

Data Dissemination Activities

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 (R.E. Arcilla, T.W. Burrows, C.L. Dunford, R.R. Kinsey)

As shown in Fig. 2, there was an approximately 31% increase in the number of retrievals over the Internet between 1998 and 1999. NuDat and NSR continue to be the most popular with 24% and 21% of the 1999 retrievals. Retrievals from the nuclear reaction databases (CINDA, CSISRS, ENDF) almost doubled last year and accounted for 21% of the retrievals. Extrapolation of the first quarter statistics suggests a possible increase in 2000 of 45% over the 1999 retrievals.

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

nucleardata.nuclear.lu.se, trinity.digitalcreativity.com, www-nds.iaea.or.at, www-nds.ipen.br, and www.tunl.duke.edu.

NNDC staff has been active in the Joint Dissemination Project.

Major Additions and Improvements

A. A Web version of PHYSCO was added allowing users to use the latest versions of the ENSDF analysis codes HSICC and LOGFT. The user may either upload an ENSDF-formatted file or manually enter data.
B. An HTML/GIF option was added to MIRD on the Web. In addition to providing HTML tables of the data and GIF images of the decay scheme, the interface will also provide links to the radioactive daughter and parent information in the MIRD format and to related data in the CSISRS, ENSDF, NSR, and NuDat databases.
C. HTML tables and PostScript level schemes and band drawings options were added to ENSDF and XUNDL on the Web. These options were in response to comments made at last year's USNDP meeting and now seem to be the preferred method of obtaining data from these databases.
D. The SQL version of NSR has been available for public testing since late June 1999 and now accounts for about 9% of the NSR retrievals.
E. The Web and FTP directory structures for the ENSDF analysis and utility codes and the ENDF utility codes were reorganized and OpenVMS and Windows 95/98 executables provided.
F. An interface from NNDC conference registration forms to the NNDC ADLIST database was developed and used for this meeting's registration.
G. The 6th Edition of the Nuclear Wallet Cards will be available as HTML, PostScript, and PDF files before the USNDP meeting. The PostScript and PDF versions of the 5th edition will be retained for archival purposes.

Under Development

A. A Web interface to CSISRS and ENDF has been developed which allows data to be downloaded in a format allowing ZVView[1] 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.
B. An interface to the ENSDF and XUNDL databases, which formats the information for the Isotope Explorer Java Applet, has been prototyped along with an interface to master NSR database that will allow the applet to access this database. Further testing and implementation are waiting on feedback from LBNL.
C. An improved HTML presentation of ENSDF and XUNDL data is under development and testing. Dependent on further testing, this may use UNICODE for Mozilla 4 compatible browsers (*e.g.*, Internet Explorer 5+ and Netscape Navigator 4+).
D. 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.

Future Plans

A. Work is planned to produce the necessary Java components to allow Isotope Explorer 3 to display drawings and bands in the Nuclear Data Sheets style. This work will commence after receipt of the necessary documentation from LBNL.
B. A Web interface for the utility code QCALC will be developed.
C. 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. Staff of the NNDC will also continue to participate in the Joint Dissemination Project.

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. The possibility of displaying RadWare-style band drawings in the *Nuclear Data Sheets* is still under investigation.

The 6th edition of the *Nuclear Wallet Cards* is in press and should be available for distribution by the time the USNDP meeting takes place. The NNDC satisfied 21 requests for the Gamma-Ray Spectrum on CD-ROM, 10 for Nuclear Data and References on CD-ROM, and 2 for the EPDL97 CD-ROM between April 1999 and March 2000.

[1] Developed by Viktor Zerkin, IAEA Nuclear Data Section.

The NNDC is cooperating with the IAEA Nuclear Data Section in the production of an EXFOR (CSISRS) CD-ROM. Our role is aiding in the design of the database structure and providing the necessary software components to extract data in the format used by ZVVIEW.[2]

User Outreach

The NNDC continues to host the USNDP Web site. An NNDC staff member lectured at the Workshop on Advanced Nuclear Data Online Services (Vienna, November 29 – December 3, 1999). Information was provided for a presentation at the Long Beach APS meeting. The centerfold of the 6th edition of the Nuclear Wallet Cards was redesigned and now covers the USNDP, NSDD and NRDC networks.

[2] Developed by Viktor Zerkin, IAEA Nuclear Data Section.

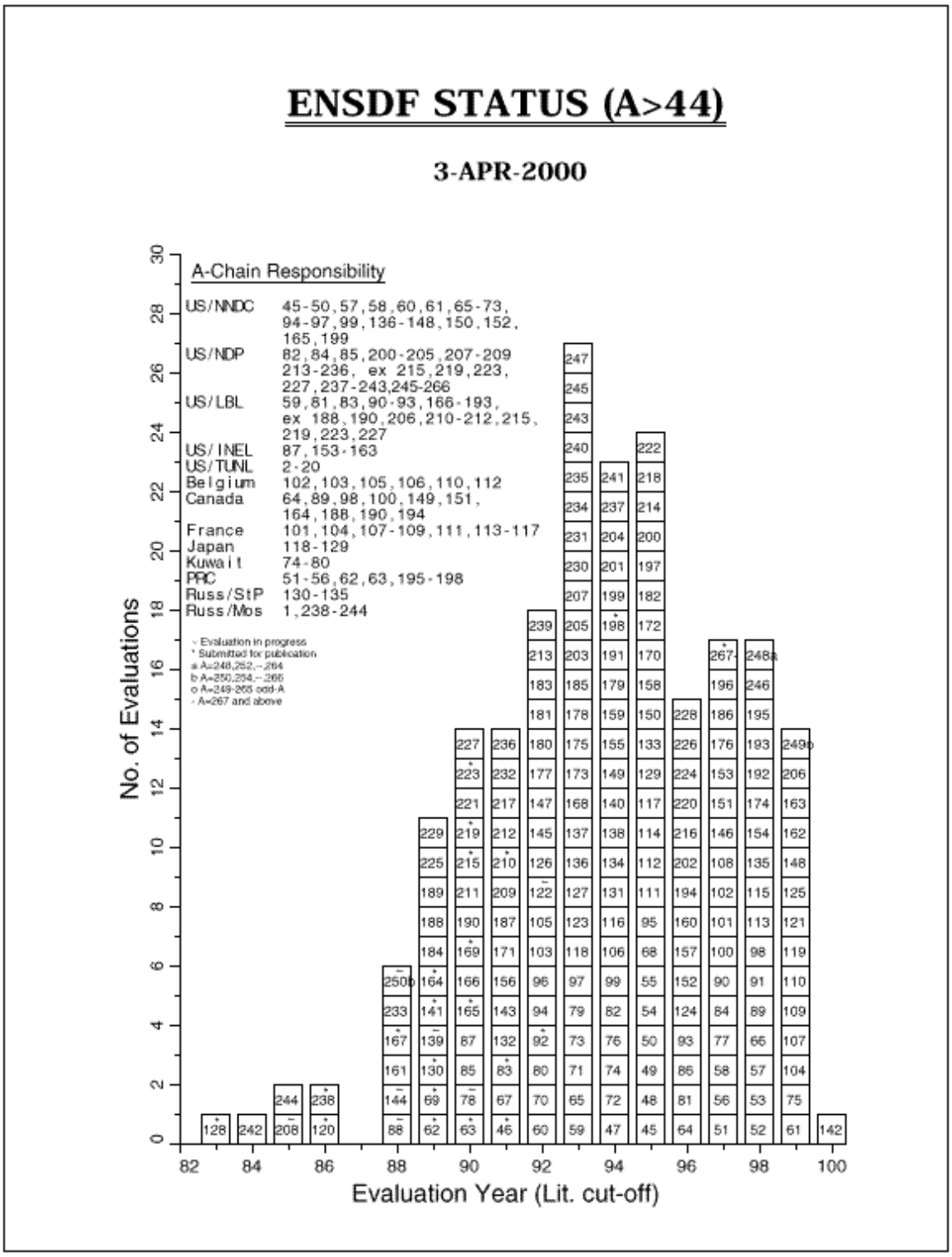
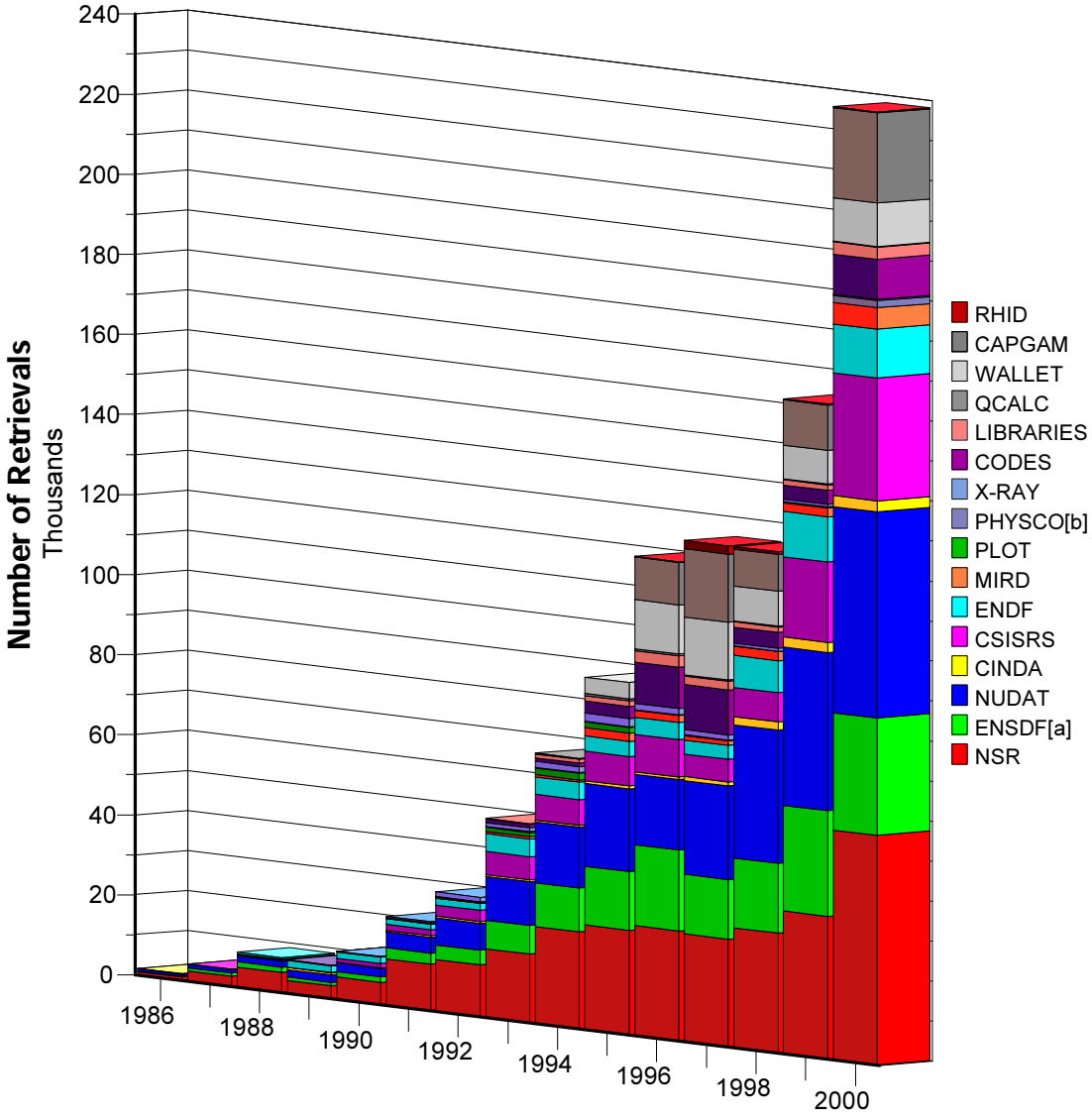

ENSDF STATUS (A>44)
3-APR-2000
A-Chain Responsibility
US/NNDC 45-50,57,58,60,61,65-73, 94-97,99,136-148,150,152, 165,199
US/NDP 82,84,85,200-205,207-209 213-236, ex 215,219,223, 227,237-243,245-266
US/LBL 59,81,83,90-93,166-193, ex 188,190,206,210-212,215, 219,223,227
US/INEL 87,153-163
US/TUNL 2-20
Belgium 102,103,105,106,110,112
Canada 64,89,98,100,149,151, 164,188,190,194
France 101,104,107-109,111,113-117
Japan 118-129
Kuwait 74-80
PRC 51-56,62,63,195-198
Russ/StP 130-135
Russ/Mos 1,238-244
- Evaluation in progress
* Submitted for publication
a A=248,252,--,264
b A=250,254,--,266
o A=249-265 odd-A
- A=267 and above
No. of Evaluations
Evaluation Year (Lit. cut-off)

Figure 1

*NNDC On-Line Data Service, World Wide Web (W^3), and FTP Retrievals 1986-2000**



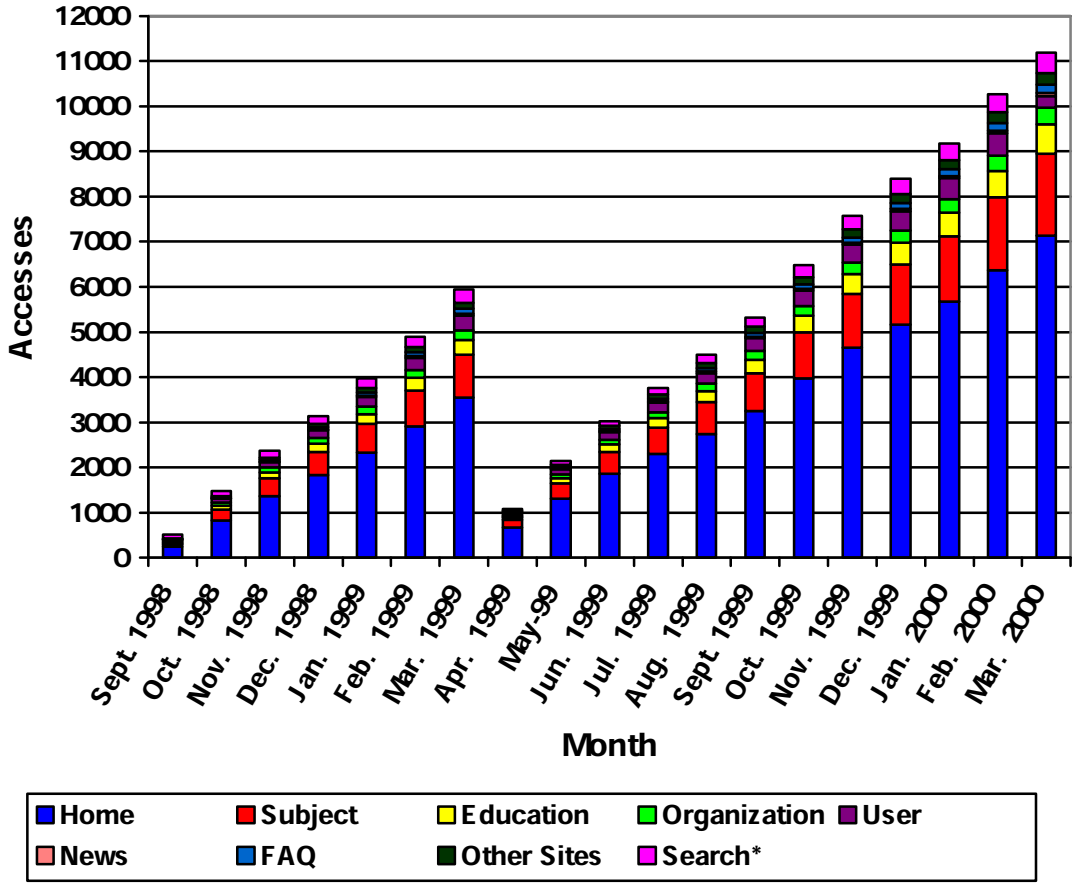
* Extrapolated as of March 31, 2000.

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

[b] Added to Web August 18, 1999.

Figure 2

U.S. Nuclear Data Program Accesses
(September 1998 through March 31, 2000)



* Actual searches performed

Figure 3