National Nuclear Data Center Activity Report

M. R. Bhat, T. W. Burrows, V. McLane
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Abstract

This report reviews the activities of the National Nuclear Data Center (NNDC) for the period April 1998 to March 1999, for the second meeting of the U.S. Nuclear Data Program (USNDP), April 26-29, 1999. The activities of the Center in this period included 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 acting 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.

Nuclear Structure Data and Related Activities

Nuclear Structure Data Evaluations

(M. R. Bhat, T. W. Burrows, J. K. Tuli)

Evaluations submitted for updating the ENSDF: A=148, ^{143}Nd, ^{143}Eu, ^{145}Sm
Evaluations in Progress: 69, 139, 142
Number of evaluations reviewed: 10 A-chains, and 17 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 20 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. Superdeformed bands and high-spin evaluations submitted by network evaluators are also part of the ENSDF. The evaluation of A=16-20 published by the TUNL group in *Nuclear Physics **A*** was added to the ENSDF. Work is in progress to have a Y2K compliant ENSDF; it is expected to be ready for distribution in the period of May to June 1999.

Nuclear Wallet Cards and NuDat databases are also updated periodically to include additions to the ENSDF. NuDat is distributed along with ENSDF. NuDat was converted from DEC Datatrieve to an ISAM database and both PCNuDat and NuDat use the same database.

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 M^{c}Master 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 15th, there were 136 data sets for 118 nuclides 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 the calendar year 1998, more than 5500 entries were added to the NSR. The list of journals scanned regularly for the NSR is given in the Recent References issue of the *Nuclear Data Sheets*. In addition, relevant secondary references which 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. The four-monthly distributions are sent via the Internet.

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.

Initial development of a relational database version of NSR is complete. It is expected that public access to this database via the Web will be made available in May or June 1999.

Plans are underway to update the author provided keyword preparation packages distributed by *Physical Review* ***C***. User surveys concerning the scope and usability of the NSR will be carried out in 1999.

ENSDF Related Codes

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

The ENSDF analysis and checking codes continue to be maintained and improved. The current status of these codes will be presented at the USNDP meeting. The COMTRANS and ENSDAT programs continue to be maintained and upgraded. The program NDSPUB which produces author proofs and publication output from the ENSDF database continues to be maintained and modified as required.

The NNDC is investigating the possibility of providing a Web page for ENSDF evaluators. This site would allow evaluators to upload ENSDF-formatted files to the NNDC server, run the latest versions of ENSDF-related programs, and receive the results over the Web. In addition to having access to the latest versions of these programs, checking programs requiring databases resident at the NNDC (e.g., XPQCHK which uses the Atomic Masses and Archival ENSDF databases), will also be accessible to users. In the case of ENSDAT, the NSR database would also be available so that the reference listing produced would be complete.

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 with help from the NDP, ORNL for older references.
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 Databank, Paris, and Obninsk on a regular basis.

Nuclear Reaction Data and Related Activities

CSISRS/ENDF/CINDA Related Codes

(C. L. Dunford, V. McLane)

The NNDC databases at the Slavutych Data Center, Ukraine, were updated.

All systems have been upgraded to handle the Y2K problem. The programs have been distributed to those data centers which use the NNDC codes: NDS (IAEA), VNIIEF (Russia), Slavutych, and CNDC (China).

International Cooperations

(S. Mughabghab)

Cooperation with the Korean Atomic Energy Research Institute (KAERI) on the Fission Product Evaluation continues. Two scientists from KAERI have visited the NNDC for extended periods during the year.

- Jonghwa Chang (KAERI, Korea)
- Soo Youl Oh (KAERI, Korea)

Nuclear Reaction Data

(V. McLane, P. Dixon)

The compilation of CPND data continues. As of March 30, the CSISRS library contains more than 3.3K references for CPND data and almost 600K data points. Total for all data is more than 12K references and approaching 5 million data points.

Four scientists have visited the NNDC for periods of six weeks to two months to help with the compilation of data:

- Svetlana Dunaeva (VNIIEF, Russia)
- Sandor Takacs (ATOMKI, Hungary)
- Vladimir Varlamov (Moscow State University, Russia)
- Mercury Vlasov (Kiev, Ukraine)

A contract has been initiated with Oak Ridge National Laboratory to compile the neutron data measured by J. Harvey. The data to be processed has been identified. Data will be averaged and converted to the EXFOR format at ORNL. Several data sets have already been received and processed at NNDC.

An initial design of a new bibliographic data system (CINDA2000) has been done and circulated to the Nuclear Reaction Data Centers. The system will incorporate all nuclear reaction data compiled in the EXFOR format.

Release 5 of ENDF/B-VI was issued.

Compilation of Relativistic Heavy-Ion Data

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

Relativistic heavy-ion data measured at the CERN PS-SPS complex by the NA44 Collaboration, and published in *Physical Review* **C57**, 837 (1998), has been coded in the EXFOR format, checked, and author approval has been obtained. It has yet to be put on the Web as part of the Relativistic Heavy-Ion database.

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, A. Lopez, V. McLane, Y. Sanborn, J. K. Tuli)
3. Anonymous FTP (R. E. Arcilla, T. W. Burrows, C. L. Dunford, R. R. Kinsey)

As shown in Fig. 2, there was no increase in the number of retrievals over the Internet between 1997 and 1998. A 31% increase in retrievals from interactive databases such as NuDat was offset by decreases in retrievals from older Web pages such as the Nuclear Wallet Cards in 1998. NuDat continues to be the most popular database with 24% of the retrievals for the first quarter of 1999 followed by NSR (21%). With the introduction of the nuclear reaction databases (CINDA, CSISRS, ENDF) to the Web, these databases are being accessed more accounting for 18% of the retrievals in the first quarter of 1999 compared to 10% for the same period in 1998. Extrapolation of the first quarter statistics suggest a possible increase in 1999 of 21% over 1998.

Major Additions and Improvements

A. CSISRS (Experimental Nuclear Reaction Data): Originally developed at the IAEA, the Web interface to CINDA was made available on the NNDC site May 11, 1998. Since then, it has been improved to provide ANSAN plots, BNL325-style plots, and links to related EXFOR datasets and to the APS and EDP Sciences Link Managers. The BNL-325 plotting allows overlays, inclusion of ENDF curves, and user-provided data.

B. Client/Server Registry: The database registries for NSR and ENSDF and associated retrieval codes were completed and tested.

C. Database Links [WWW]: Links from HTML retrievals of data resident at the NNDC has expanded over the last year. The current linkages available are:

    1. CINDA: APS and EDP Sciences Link Managers, CSISRS, and ENDF.
    2. CSISRS: APS and EDP Sciences Link Managers and CSISRS.
    3. NSR: APS and EDP Sciences Link Managers, ENSDF, RHID, and XUNDL.
    4. Thermal Neutron Capture Gammas: Links from energy-ordered pages to target-ordered pages.
    5. XUNDL: Uses the NSR Link Manager to redirect to the appropriate journal abstract or to return the NSR entry for the primary reference selected.

D. ENDF [WWW]: Plotting, including overlays, added to Web system.

E. ENDF Preprocessing Codes [WWW,FTP]: The ENDF preprocessing codes were updated to the 1996 versions and the directory structure reorganized. Executables are available for Open-VMS and MS-DOS.

F. Thermal Neutron Capture Gammas [WWW]: The Thermal Neutron Capture Gamma data were updated in February, 1999.
G. USNDP Home Page: The NNDC computer became the home of the U. S. Nuclear Data Program's Web Site in August of 1999. Since then, it has been included in several "Cool Websites" such as the DOE Division of Nuclear Physics. Total monthly accesses of the main USNDP pages have risen from 511 in September 1998 to 5939 in March 1999 (See Fig. 3). Feedback response has been very disappointing with only two received. The two most popular User Views are Nuclear Astrophysics and Archeology (20% and 18% out of a total 461 accesses).
H. XUNDL [TELNET,WWW]: The Experimental Unevaluated Nuclear Data List was added to the OnLine Data Service in December 1998 and to the Web in January 1999.

Other Improvements

A. ENSDF [WWW]: Added capabilities to retrieve by data set or atomic or neutron number range.
B. MIRD [TELNET,WWW]: PostScript output improved.

Future Plans

Following meetings in San Jose and Berkeley in November 1998, the NNDC will be working on providing the needed database interfaces so Isotope Explorer (IE) may retrieve data either from the Isotope Project or NNDC databases. Work will also be done on producing the necessary Java components to allow Isotope Explorer to display drawings and bands in either the IE or Nuclear Data Sheets style.

Web interfaces still need to be developed for the utility codes QCALC and PHYSCO. Since NIST has made available the Photon Cross Sections and Form Factor, Attenuation, and Scattering Tables databases on the Web, it may not be necessary to provide a Web interface for the XRAY database.

An NSR relational database will be available for public testing on the Web in early summer. This system will use the Standard Query Language (SQL) and Active Server Pages (ASP). The collaboration with San Jose State University and Scientific Digital Visions, Inc., in the development of new Internet technologies, database technologies, and scientific data management tools will continue.

There have been preliminary discussions between the NNDC and editorial and technical staff of Physical Review C (PR/C) to provide links from their journal Web pages to the databases of experimental data resident at the Center. This would consist of several components:

1. Physical Review C encouraging authors to submit their experimental data to the NNDC.
2. Development of any easy-to-use Web site for authors to use and expeditious compilation of the contributions received. Ideally, the contributors would receive author proofs while their manuscripts are still under review.

3. Development of a database link manager which would be as transparent and easy-to-use as the APS or EDPS Link Managers.

Hard Copy and CD-ROM

(M. Blennau, P. Dixon, R. R. Kinsey, 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 the 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 the 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 being investigated.

Copies of the Nuclear Wallet Cards were distributed in the last year. A new edition of the Wallet Cards is in preparation and should go to press in early summer. The NNDC satisfied 22 requests for Nuclear Data and References on CD-ROM between April 1998 and March 1999, inclusive.

User Outreach

In addition to developing and hosting the USNDP Web site described above, NNDC staff gave talks on the USNDP in coordination with other centers at the Santa Fe APS/DNP meeting and the Atlanta APS centennial meeting. A poster paper was presented at the recent Nuclei in the Cosmos conference and a talk given at the ANS meeting in Islandia.

ENSDF STATUS (A>44)

6-APR-1999

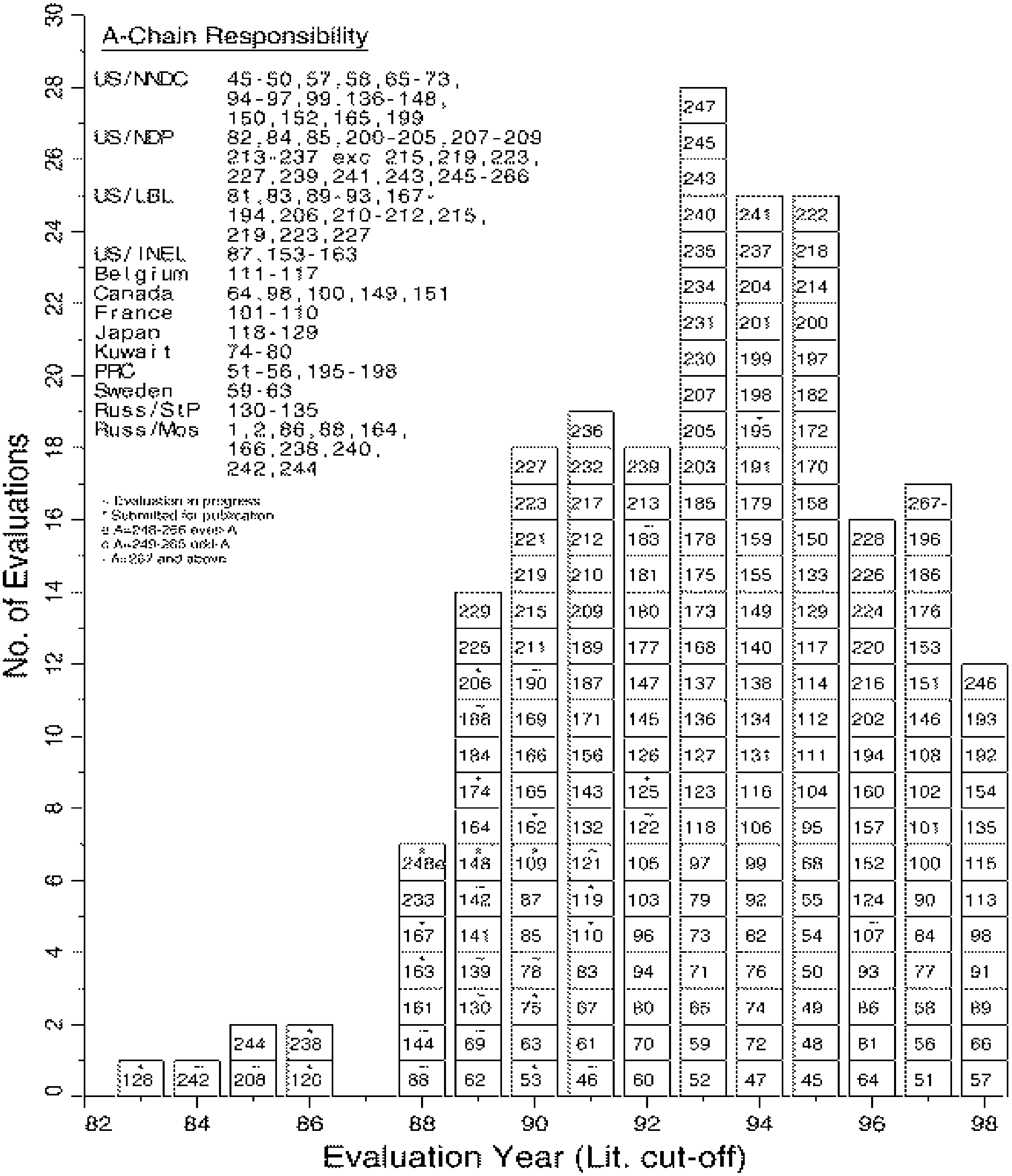
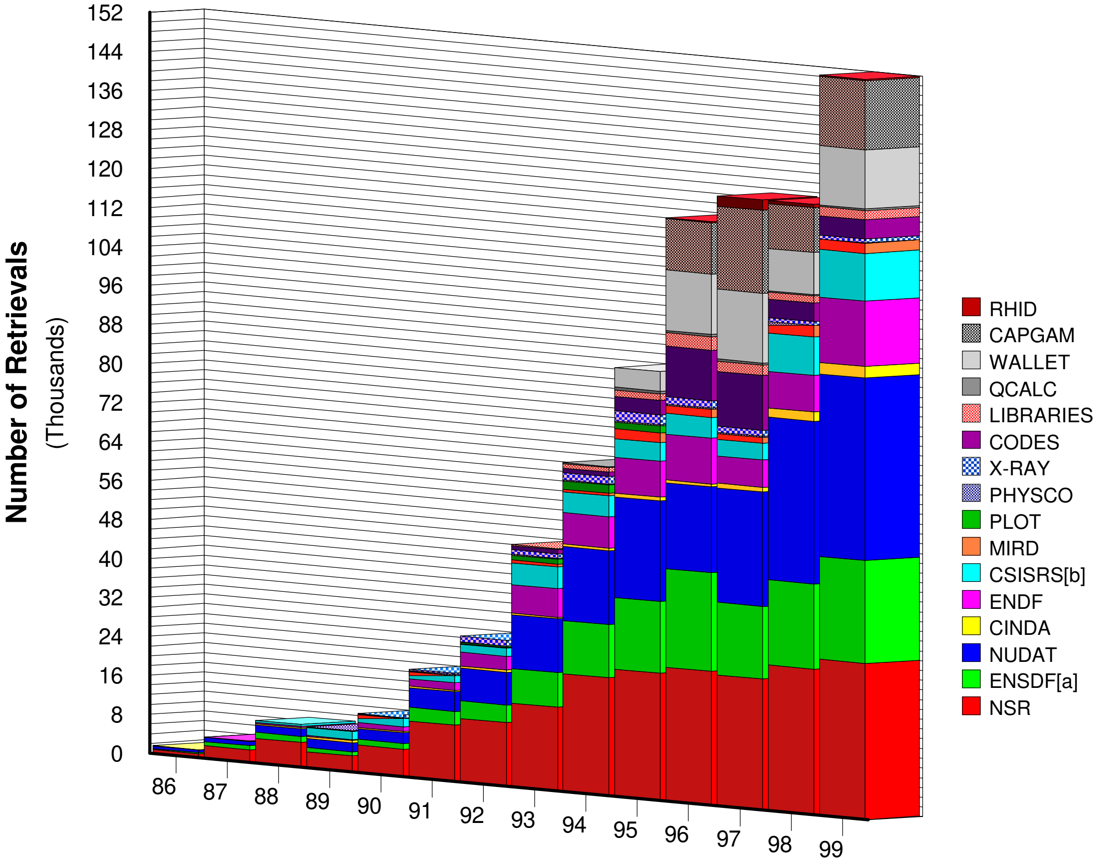


Figure 1

NNDC On-Line Data Service, World Wide Web (W3) and FTP Retrievals 1986-1999*



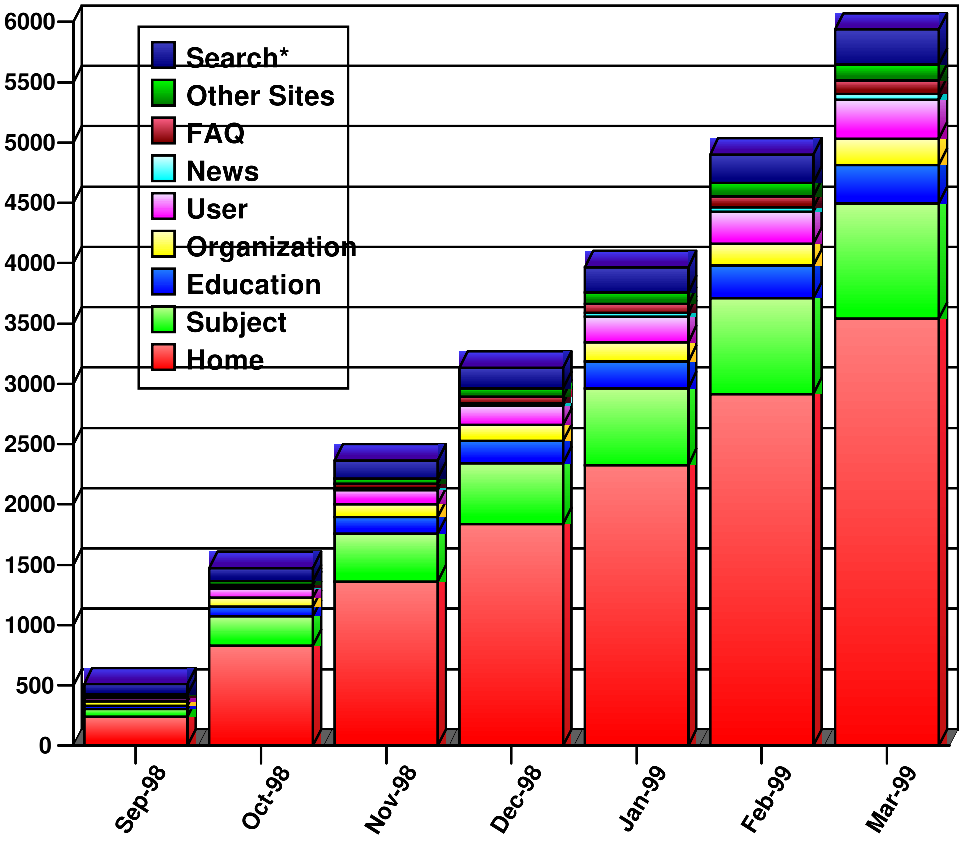
* Extrapolated as of March 31, 1999.

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

[b] Added to Web May 11, 1998.

Figure 2

U.S. Nuclear Data Program Accesses
(September 1998 through March 31, 1999)



*Actual searches performed.

Figure 3