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I N D C INTERNATIONAL NUCLEAR DATA COMMITTEE

Co-ordination of the International Network of Nuclear Structure and Decay Data Evaluators

Summary Report of an IAEA Advisory Group Meeting

IAEA Headquarters
4 - 7 December 2000

Prepared by
V.G. Pronyaev

February 2001

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Abstract

The IAEA Nuclear Data Section convened the fourteenth meeting of the International Nuclear Structure and Decay Data Evaluators Network at the IAEA Headquarters, Vienna, 4 - 7 December 2000. The meeting was attended by 22 scientists from 7 Member States and 1 international organization concerned with compilation, evaluation, and dissemination of nuclear structure and decay data. The present document contains a meeting summary, the recommendations, the data center reports and proposals considered by the participants.

LIST OF ABBREVIATIONS

AGM	IAEA Advisory Group Meeting.
CAJaD, KUR	Centre for Data on the Structure of the Atomic Nucleus and Nuclear Reactions, Kurchatov Institute, Moscow, Russia.
CBNM CEC	Central Bureau for Nuclear Measurements, located at Geel, Belgium. Now : Institute of Reference Materials and Measurements.
CD-ROM	Compact disk with read-only memory.
CEC	Commission of the European Communities.
CNDC	China Nuclear Data Center, Institute of Atomic Energy (IAE), Beijing.
CPND	Charged-particle nuclear reaction data.
DBMS	Database Management System.
ENSDF	Computer-based Evaluated Nuclear Structure Data File.
Evaluation	• Mass-chain evaluation: to obtain best data for the structure and decay of all nuclides with the same mass. • Horizontal evaluation: to obtain best values of one or a few selected nuclear parameters for many nuclides irrespective of their mass.
EXFOR	Computer-based system for the compilation and international exchange of experimental nuclear reaction data.
FIZ	Fachinformationszentrum Energie, Physik, Mathematik GmbH, Eggenstein-Leopoldshafen, Germany.
IAEA/NDS	Nuclear Data Section, International Atomic Energy Agency.
ICRM	International Committee for Radionuclide Metrology.
INDC	International Nuclear Data Committee.
INEEL	Idaho Nuclear Engineering and Environmental Laboratory, USA.
INIS	International Nuclear Information System, operated by the IAEA.
IP	Isotopes Project at LBNL.
IRMM	CEC Institute of Reference Materials and Measurements, Geel, Belgium.
JAERI	Japan Atomic Energy Research Institute.
KUW	Kuwait National University.
LBNL	Lawrence Berkeley National Laboratory, USA.
LIYaF	Lenigrad Institut Yadernoy Fiziki: Data Centre of the Petersburg Nuclear Physics Institute of the Russian Academy of Sciences.
NDP	Nuclear Data Project, the Oak Ridge National Laboratory.
NDS	Nuclear Data Sheets, a journal devoted to ENSDF data.
NDS, IAEA/NDS	IAEA Nuclear Data Section.
NNDC, BNL/NNDC	National Nuclear Data Center, Brookhaven National Laboratory, USA.
NSDD	Nuclear Structure and Decay Data.
NSR	Nuclear Science References, a bibliographic file related to ENSDF.
ORNL	Oak Ridge National Laboratory, USA.
PC	Personal Computer.
USDOE	U.S. Department of Energy.
USNDN	U.S. Nuclear Data Network.
TUNL	Triangle Universities Nuclear Laboratory, USA.
XUNDL	Experimental Unevaluated Nuclear Data List.

CONTENTS

Foreword

Nuclear data are essential to the development, implementation and maintenance of all nuclear technologies. 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. This network has the objective of providing up-to-date nuclear structure and decay data for all known nuclides by evaluating existing experimental data.

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 on-line computer services, PC diskettes and compact disks, wall-charts of nuclides, handbooks, nuclear wallet cards, and others.

The international NSDD network has evolved from the pioneering work in the late forties and early fifties by physicists from the Berkeley Radiation Laboratory and the California Institute of Technology (USA) the Rijksuniversiteit at Utrecht (Netherlands), the Nuclear Data Group (Washington and Oak Ridge) and the Brookhaven National Laboratory (USA). The United States effort is presently coordinated by the Coordinating Committee of the U.S. Nuclear Data Program. 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 sponsored 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.

List of NSDD Meetings

Place		Date	Report
1.	Vienna, Austria	29.04. - 03.05.1974	INDC(NDS)-60
2.	Vienna, Austria	03. - 07.05.1976	INDC(NDS)-79
3.	Oak Ridge, USA	14. - 18.11.1977	INDC(NDS)-92
4.	Vienna, Austria	21. - 25.04.1980	INDC(NDS)-115
5.	Zeist, Netherlands	11. - 14.05.1982	INDC(NDS)-133
6.	Karlsruhe, Germany	03. - 06.04.1984	INDC(NDS)-157
7.	Grenoble, France	02. - 05.06.1986	INDC(NDS)-182
8.	Ghent, Belgium	16. - 20.05.1988	INDC(NDS)-206
9.	Kuwait, Kuwait	10. - 14.03.1990	INDC(NDS)-250
10.	Geel, Belgium	09. - 13.11.1992	INDC(NDS)-296
11.	Berkeley, USA	16. - 20.05.1994	INDC(NDS)-307
12.	Budapest, Hungary	14. - 18.10.1996	INDC(NDS)-363
13.	Vienna, Austria	14. - 17.12.1998	INDC(NDS)-399
14.	Vienna, Austria	04. - 07.12.2000	INDC(NDS)-422

Introduction

The fourteenth meeting on the Co-ordination of the International Network of Nuclear Structure and Decay Data (NSDD) Evaluators was held in the IAEA Headquarters, Vienna, 4 - 7 December 2000. Twenty-two participants attended the meeting from seven countries and one international organization representing all major data evaluation and data dissemination centres. The list of participants is given in **Annex 1**.

V. Pronyaev, Scientific Secretary of the NSDD network co-ordination meetings, opened the meeting. D.D. Sood, Director of the Division of Physical and Chemical Sciences welcomed all participants on behalf of the IAEA and paid attention to the urgent tasks to be considered by the network: maintaining or even raising current manpower levels, by preference with younger people, keeping abreast of the quality of NSDD evaluations and creating a mechanism for proper referencing to the network products when they are used in basic nuclear research and in the creation of databases for different applications.

D. De Frenne was confirmed as Chairman of the meeting. The Goals of the meeting are given in **Annex 2** and the Agenda approved by the participants in **Annex 3**.

The meeting considered the work done by the different ENSDF evaluation and dissemination centres over the last two years and their activity planned for the next two years. A list of all ENSDF evaluation groups with mass-chain evaluation responsibilities assigned for the years 2001 – 2002 is given in **Annex 4**.

The participants discussed the technical matters and problems of quality improvement of the NSDD evaluations and prepared a list of actions to be implemented during the next two years (See **Annex 5**).

The meeting prepared recommendations to the IAEA, which are aimed at larger support by the Nuclear Data Section to the NSDD network activity. This should include the use of technical and research contracts for support of evaluation work and holding workshops at the IAEA (Vienna) and at the ICTP (Trieste) for training of the NSDD evaluators. A free distribution of all nuclear databases was agreed upon but with the requirement from the users of proper reference to the network products (See **Annex 6**).

Brief Minutes of the Meeting

After some discussions and with minor changes the Goals of the Meeting (**Annex 2**) and the Agenda (**Annex 3**) were adopted. The List of Actions set up by the previous Meeting was reviewed. Actions, which have the status “continuing”, were included in the updated list of the present Meeting (**Annex 5**).

The Centre Heads presented status reports of the different ENSDF evaluation centres. The current evaluation efforts provide the re-evaluation per year, of about 12 long mass-chains and a number of short mass-chains and nuclide evaluations. The participants noted with satisfaction the resuming of the activity of the Data Centre at the Saint Petersburg Nuclear Physics Institute, Russia. The finalizing of the A=238 mass-chain evaluation by the Russian Nuclear Structure and Reaction Data Centre was considered as an urgent task and agreed upon for March 2001.

Reports on horizontal evaluation activities were considered. Results of the inter-laboratory Decay Data Evaluation Project and the IAEA Co-ordinated Research Project on X- and Gamma-Ray Decay Data Standards are being introduced in ENSDF in a timely manner. The publication of the new tables of Internal Conversion Coefficients is foreseen for September 2001. The re-evaluated table of Nuclear Moments will be regularly updated and recommended values added to the publication. The B(E0)’s resulting from the horizontal evaluation of those transition probabilities are also introduced in ENSDF.

NSDD application-oriented activities were presented. The database for Prompt Gamma Activation Analysis prepared under the IAEA CRP is nearing completion. There are still some issues, related to the form of data presentation, which should be solved. The development of Nuclear Astrophysics Project is in the stage of planning and consideration for the next 5-year term. The registry system can be very important for data dissemination and database synchronisation in the multi-platform environment. The new technology of data processing based on XML pages linked with the appropriate database solutions looks very promising. There should be no problems with Nuclear Data Sheets publication when ENSDF and NSR are converted into a relational database format.

Data centre reports concerning the dissemination and organization of on-line and off-line access to ENSDF and NSR were presented.

In the session on NSDD Administrative and Technical Items the long-term policy with respect to the NSDD was discussed and possible changes in the policy of the different NSDD program managers were considered. No important changes are to be expected in the policy of the major contributors to the NSDD Network activities. The NSDD evaluation work in some groups is not always fully supported.

The plans of NDS on holding workshops on the training of NSDD evaluators were discussed. Participants agreed that an IAEA consultant should do preliminary work on the preparation of a Manual for ENSDF Evaluators. The mini-Workshop on the training of a limited number of future ENSDF evaluators should be held during one week in 2002 at the IAEA/NDS. The full-scale three weeks Workshop will be proposed by NDS for inclusion in the ICTP (Trieste) plans for 2003. This was strongly endorsed by the participants (See Recommendations in the **Annex 6**).

The NSDD Network document was presented and discussed. The schedule for its updating and publication as INDC report was agreed (See action 22 in **Annex 5**). The chapter with copyright issues should include the results of discussions under Agenda item D.3.

The participants discussed results of the evaluation work carried out for ENSDF during the last two years. Priorities in future ENSDF evaluations and the estimated manpower for this work at each centre were considered. Full network efforts in the ENSDF evaluation work will continue to be at the level of 10 FTE. The responsibilities of the different groups for all mass-chain evaluations, including the final assignment for A=21-44 mass chains, were discussed and the results are given in **Annex 4**. The problems of bringing in new young nuclear scientists in NSDD data evaluation are increasing. For the moment, it is very difficult to find suitable candidates as well for PhD Fellowships as for Post Doctoral positions in the field of experimental nuclear physics and evaluation work. New horizontal evaluations proposed by participants will include the evaluation of measured B(E2)'s in even-even nuclei, the evaluation of all experimentally determined nuclear moments and radii, the evaluation of the half-lives and decay radiation properties for some seventy nuclei most important for different applications and the re-evaluation of nuclear masses.

The result of the work on the unification of the Web access to the NSR and ENSDF/XUNDL databases was reported. The new NSR system should combine the functional possibilities of all developed presentations.

A number of technical items regarding ENSDF were considered. The progress in development of the data processing and checking codes was reported and proposals for further improvement were discussed. Multi-platform versions of the codes should be prepared using available resources at the network centres. The need for the improvement of the calculation of mean beta energies, continuum spectra and log *ft* values for second forbidden non-unique transitions was considered and experts will be consulted. Discussions on rules for isospin assignments were started and will be continued during the next AGM Meeting. The participants adopted a proposal on Revised History Record and a proposal on the Designation of Reactions will need further discussion and clarification. The technical implementation of the XUNDL file with a semi-automated procedure of introducing data into the file, which allowed in short period to prepare a complete library, was met by participants with great interest. A simple way to avoid underestimation of uncertainties of the evaluated values for sets of consistent data was discussed. E. B. Norman presented two reports. The first one treated the high accuracy decay data obtained for ^{66}Ga that will allow the use of ^{66}Ga as a source for high-energy gamma detector efficiency calibration. In the second one, a search for the decay of the low-lying isomer state in ^{229}Th was described.

ENSDF evaluation tools and their development were discussed. Latest versions of the ENSDF evaluation codes reported at the meeting can be found at the Web page:
http://www.nndc.bnl.gov/nndcscr/ensdf_pgm/code_status.html (See also Status Reports).

The problems of quality and completeness of ENSDF, dissemination of ENSDF data and user-oriented databases were briefly discussed. In some cases the delay with final publication of the evaluations was caused by excessive long process of review. To avoid this, all reviews should be asked to be completed in a three months term.

The copyright issues related with the distribution of ENSDF, NSR and other NSDD network products caused long and contradictory discussions. All participants fully agreed that there could not be any limitation on the free distribution of the data. To avoid their following misuse, as *e.g.* their sale after simple repackaging, the participants agreed that all NSDD network products distributed by the Nuclear Data Section of the IAEA should contain a disclaimer with a requirement from the user of a proper reference to the data (See Recommendations in the **Annex 6**).

The list of Actions and Recommendations collected during the Meeting was discussed and approved by the participants (See **Annexes 5** and **6**).

The next Advisory Group Meeting on Co-ordination of the International Network of Nuclear Structure and Decay Data Evaluators will be held in the second half of April, 2003 at McMaster University, Hamilton, Ontario, Canada.

For co-ordination of the network activity through the next NSDD meetings, Denis De Frenne was elected as chairman/coordinator and Pavel Oblozinsky as deputy chairman/coordinator.

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Annex 2. Goals of the Meeting

The goals of the meeting are the following:

- Co-ordination of the activity of all centres of NSDD network participating in the data evaluation, compilation and dissemination: to prepare the co-ordinated plan of activity with priorities of the work for the next two years.

- Review of the activity in the database program development work: to discuss the future NSR, ENSDF and XUNDL database solutions, which will provide better user services and wide co-operation between the centres.

- Consideration of the nuclear databases copyright issues: to discuss the policy for database distribution when it is requested in the form of complete master file or its part for further repackaging or processing.

- Preparation of co-ordinated plan of NSDD evaluators training at seminars, schools and workshops held by the network centres: to find the ways of maintaining or raising current manpower levels and improving quality of NSDD evaluations.

Annex 3. Agenda

A. Introductory Items
  1. Opening statements
  2. Confirmation of meeting chairman
  3. Adoption of the agenda
  4. Review of meeting goals
  5. Accomplishment of action items set at the previous meeting

B. Presentation of Activity Reports
  1. Status reports on mass chain evaluations, horizontal evaluations and application oriented NSDD activities
    a. NSDD activities and ENSDF evaluators reports
    b. Reports on horizontal evaluations
      - Decay Data Evaluation Project
      - Electric Monopole Strength
      - ICC Tables
      - Nuclear Moments
    c. Reports on application oriented NSDD activity
      - PGAA project
      - Nuclear Astrophysics Project
      - Registry System
      - Study of XML technologies
  2. Data centre reports concerning dissemination and organization of on-line and off-line access to the ENSDF and NSR
      - Nuclear Data Sheets publications if NSR and ENSDF are Relational Data Bases

C. NSDD Administrative and Technical Items
  1. Long Term Policy with respect to the NSDD
    a. Reports of program managers
    b. IAEA/ICTP workshop on NSDD
  2. NSDD network document
  3. Administrative items
    a. Evaluation review
      - Summary of the ENSDF evaluation activity for 1999 - 2000
      - Priorities in future evaluations
      - Estimated manpower for future ENSDF evaluations for each center
      - How can we bring in young scientists into the system?
    b. Redefinition responsibility of the groups
    c. Final assignment for A=21-44 region
    d. Needs and plans for horizontal evaluations
    e. Improvements of the NSR database and unification of Web access to the NSR in different centers
  4. Technical items regarding ENSDF
    a. Processing and checking codes, their upgrading
    b. Internal conversion coefficients

c. Weighted averaging
d. Thermal neutron capture
e. Beta-shapes for second forbidden non-unique transitions
f. J^{π} rules
g. Revised history records
h. Designation of reactions
i. Integration of horizontal evaluations into ENSDF
j. XUNDL
k. Evaluation of decay data - Astrophysics. Ga-66 and Th-229 - two Puzzles in Nuclear Data
l. Conclusion of AGM on Long-Term Needs in Nuclear Data

5. ENSDF evaluation tools
6. Standardization of the ENSDF character set
7. Quality and completeness of ENSDF

D. ENSDF Customer Services

1. Dissemination of ENSDF data, including publications and electronic services
2. Outreach, including user oriented databases
3. Reference to ENSDF and NSDD network products and copy right issues

E. Concluding Items

1. Adoption of recommendations and actions
2. Next meeting

F. Demonstration Session

1. New chart of the nuclides
2. LEADER - computer code for analysis of multipolarities of the gamma transitions

Annex 4. Evaluation Responsibility (2001 – 2002) and Effort Table (new assignment is shown by bold)

Nuclear Mass	Responsible Center	FTE 1998	FTE 1999	FTE 2000
45-50, 57,58, 60-63, 65-73, 86, 88, 94-97, 99, 136-148, 150, 152, 165, 199, **82, 84, 85, 200-205, 207-209**	National Nuclear Data Center Brookhaven National Laboratory, USA	1.5	1.9	1.55
213-236 (except 215,219, 223, 227), 237-243 (odd), ≥245, **242 (temporarily, from KUR, Russia)**	Nuclear Data Project, Oak Ridge National Laboratory, USA	1.0	0.5	0.5
59, 81, 83, 90-93, 166, 167-187, 189, 191-193, 206, 210-212, 215, 219, 223, 227, **235, 239 (temporarily, from ORNL, USA)**	Isotope Project, Lawrence Berkeley National Laboratory, USA	2.1	2.5 - 2.75	2.8
87, 153-163	Idaho National Engineering and Environmental Laboratory, USA	0.4	0.35	0.5
2-20 **21-30 (pending)**	Triangle University Nuclear Laboratory, USA	1.2	0.7	1.25
1, 238-244 (even)	Center for Nuclear Structure and Reaction Data, Kurchatov Institute of Atomic Energy, Russia	0.25	0.25	0.3
130-135	Nuclear Data Center, Petersburg Nuclear Physics Institute, Academy of Sciences of Russia, Russia	0.5	0.5	0.5
51-56, 195-198	Institute of Atomic Energy + Jilin University People's Republic of China	0.3 0.3	0.1 0.2	0.2 0.25
101, 104, 107-109, 111, 113-117	CEA, SPN, Bruyeres Le Chatel, France	0.2	0.0 - 0.2	0.3
118-129	Nuclear Data Center, Japan Atomic Energy Research Institute, Japan	1.5	1.5	0.8
74-80	Nuclear Data Center, Physics Department, Kuwait University, Kuwait	0.6	0.3	0.1
102, 103, 105, 106, 110, 112	Laboratorium voor Kernfysica, Gent, Belgium	0.35	0.3	0.3
64, 89, 98, 100, 149, 151, 164, 188, 190, 194, **31 - 44**	Department of Physics and Astronomy, McMaster University, Canada	0.75	0.75	0.8
Total		10.95	10.05	10.15

Annex 5. List of Actions

No.	Responsible	Reason	Action
1	J. Tuli, BNL/NNDC	Quality assurance test	Advise evaluators to run RADLIST and comment on agreement of Q-value and sum of decay energies and X-ray intensities measured and calculated. Action continuing from 1998
2	J. Tuli, BNL/NNDC	Priority list evaluations has to be updated	Send priority list for nuclide and mass chain ENSDF evaluations yearly. Action continuing from 1998
3	J. Tuli, BNL/NNDC	Format and consistency problems could arise for certain horizontal evaluations	Co-ordinate between horizontal evaluators and A-chain evaluators the procedures for inserting horizontal evaluations into ENSDF. Action continuing from 1998
4	J. Wood, GEORGIA TECH	Procedures for calculations of characteristics of E0 transitions should be explained	To prepare manual on handling E0 transitions in ENSDF
5	E. Browne, LBNL R. Helmer, INEEL	Integration of DDEP results into ENSDF	Co-ordinate with file manager the entry of DDEP results into ENSDF. Action continuing from 1998
6	BNL/NNDC	ENSDF analysis and checking codes need to remain current as to formats, physics requirements, and the needs of the community	Update codes for approved format changes. Action continuing from 1998
7	All network participants	Results of large activity in horizontal evaluations is not always or timely incorporated into ENSDF	Keep abreast of and solicit activities in other areas where horizontal evaluations may be appropriate for incorporation into ENSDF. Action continuing from 1996
8	All network participants	Materials of some conferences, meetings and laboratory reports related to NSDD are not always available to NSR compilers in NNDC	Assist the NNDC in obtaining conference proceedings, meeting and lab reports for NSR. One copy of unpublished conference reports containing significant NSDD contribution should be sent to D. Winchell. Revised action continuing from 1998
9	V. Pronyaev, IAEA/NDS	Characteristics and parameters of NSDD evaluators network has to be regularly updated	To update regularly NSDD network document as INDC(NDS) report published electronically according to the latest changes in the network fixed by the AGMs
10	BNL/NNDC	Published versions of ENSDF are needed	Continue a journal "publication" for the mass chain evaluations. Action continuing from 1998

11	IAEA/NDS	Co-ordination of network activity between NSDD meetings and preparation to the next meeting	To nominate a chairman and deputy chairman for next NSDD meeting at the current NSDD meeting. Action continuing from 1998
12	Network	Misprints and errors may be found in NSR and ENSDF	Report all errors detected in NSR and ENSDF, as soon as they are found, to NNDC. Action continuing from 1998
13	ENSDF evaluators	To accelerate the review process	Each ENSDF evaluator should be willing to do 2 mass-chains equivalent reviews per FTE-year. Reviewing process for one mass chain should be not longer than 3 months. Revised action continuing from 1998
14	BNL/NNDC	Researchers are not familiar with ENSDF format	Promote the concept that researchers should supply data to network in complete, tabular form. Action continuing from 1998
15	N. Stone, Oxford Univ., D. De Frenne, DSRP, J. Blachot, CEA S.P.N.	Decrease of NSDD manpower in Europe	Write an information article about nuclear data evaluation in NUPECC news. Action continuing from 1998
16	J. Kelley, TUNL, E. Norman, LBNL/IP	To bring attention of nuclear community to the NSDD evaluation work	Write a brochure about nuclear data evaluation. Revised action continuing from 1998
17	BNL/NNDC, LBNL/IP, SJSU/CNIT	To simplify the data input into ENSDF and the editing of ENSDF files	Research expeditious methods of producing an ENSDF input/checking (editor) program with due recognition of the limited resources of the network. Action continuing from 1998
18	IAEA/NDS	To avoid duplication of the work	To solicit from non-US centres information about software development activities and to inform US NDP about these activities. Revised action continuing from 1998
19	All evaluators	Encourage specific new measurements	Indicate in the abstract of an evaluation, gaps in data, or discrepancies that could be resolved by new measurements. Action continuing from 1998
20	Data center managers	To attract young scientists to data evaluations	Encourage evaluators to participate in nuclear research and evaluation of structure data. Action continuing from 1998

21	NSDD network	To choose the date for next meeting	To send to D. De Frenne by 15 February, 2001 dates most convenient for holding the NSDD 2003 AGM
22	V. Pronyaev IAEA/NDS	Information on NSDD activity should be presented in the network document	Correspond on network document in PDF and MS Word (97) format to all network/meeting participants. To incorporate all corrections sent by participants and publish network document in January 2001
23	NSDD network	To improve NSR	To send comments and suggestions on NSR improvement to David Winchell. Continuing action from 1998
24	BNL/NNDC	NSDD codes should be available on different platforms	To use the network resources for preparation of different versions of NSDD programs for different platforms
25	BNL/NNDC	Increase the accuracy of Auger electron and continuum beta-spectra presentation	Improve ENSDF codes to provide more detailed Auger-electron and continuum beta-spectra presentation
26	J. Tuli BNL/NNDC	General Policy Pages (GPP) in the NDS should be improved	To leave in GPP only information related to presentations in NDS (information of explanatory characters and definitions).
27	Y. Akovali ORNL, B. Singh, McMaster Univ.	Rules of classifications of beta transitions should be clarified	Solicit expert opinion and prepare new input in the “Introductory Material”
28	All network evaluators	Check validity of the rules	Inform NNDC when experimental results appear to contradict the rules
29	All network evaluators	Improve quality of evaluation	Solicit potential non-network evaluation reserves and send to ENSDF manager (NNDC) the names
30	F. Chukreev, KUR	Rule for the lowest energy of the state with $T_>$ can be established	Prepare rule for isospin assignment
31	IAEA/NDS	Improve communication among NSDD members	Create “list” server for NSDD network communication

Annex 6. Recommendations

1. The AGM considers training of new NSDD evaluators as high priority activity of critical importance for the NSDD Network. The AGM appreciates and strongly supports inclusion of two NSDD Workshops into the IAEA nuclear data program for 2002-2003.

2. The AGM recommends that the IAEA Nuclear Data Section support NSDD oriented projects and activities, in particular in developing countries, by award of Research and Technical Contracts. This should be facilitated by the inclusion of appropriate tasks into the IAEA nuclear data program.

3. The AGM recommends that the IAEA Nuclear Data Section include the following disclaimer to each of its databases distributed via Web, CD-ROM, or published reports:

- One may use or reproduce material from this site.

- One may not charge any fee for the data or their use.

- If the data are used, proper reference to their source should be given.

Annex 7. Status Reports: Evaluation Centers

1 Status Report of Nuclear Structure and Decay Data Evaluation for A-Chain in China
Zhou Chunmei, China Nuclear Data Center, China
Huo Junde, Jilin University, China

2 Status Report: Nuclear Data Project at McMaster University
B. Singh, McMaster University, Canada

3 Nuclear Data Section Status Report
D.W. Muir, V.G. Pronyaev, Nuclear Data Section, IAEA, Austria

4 Status Report on NSDD Activities at JAERI
J. Katakura, Nuclear Data Center, JAERI, Japan

5 Nuclear Data Project Evaluation Activity Report
Y.A. Akovali, J.C. Blackmon, D. Radford and M.S. Smith
ORNL, USA

6 France Group Status Report
Jean Blachot, S.P.N., Bruyeres le Chatel, France

7 Belgian Group Status Report
D. De Frenne, E. Jacobs, University Gent, Belgium

8 Nuclear Structure and Decay Data Evaluations and Related Activities of Idaho Group
R.G. Helmer and C.W. Reich, INEEL, USA

9 TUNL Nuclear Data Evaluation Project
J.H. Kelley[1,2], D.R. Tilley[1,2], H.R. Weller[1,3], C.D. Nesaraja[1,3], J.L Godwin[1,3], G. Sheu[1,3], J. Purcell[1,4]
[1]TUNL,Durham, NC, USA
[2]Dept. of Physics, North Carolina State University, Raleigh, NC, USA
[3]Dept. of Physics, Duke University, Durham, NC, USA
[4]Dept. of Physics and Astronomy, Georgia State University, Atlanta, Georgia, USA

10 National Nuclear Data Center Activity Report
J.K. Tuli, D.F. Winchell, T.W. Burrow and V. McLane
NNDC, BNL, USA

11 Isotopes Project
E.B. Norman, C.M. Baglin, E. Browne, S.Y. Chu, R.B. Firestone
LBNL, USA

12 CAJAD activity related with ENSDF in 1999 - 2000.
F.E. Chukreev, CAJaD, “Kurchatov Institute”, Russia

13 Status Report of the Data Center of the Petersburg Nuclear Physics Institute of the RAS.
I.A. Mitropolsky, Data Center of Petersburg Nuclear Physics Institute, Gatchina, Leningrad reg., Russia

Status Report of Nuclear Structure and Decay Data Evaluation for A-Chain in China

Zhou Chunmei
China Nuclear Data Center China Institute of Atomic Energy
P.O.Box 275 (41), Beijing 102413, China
Huo Junde
Department of Physics, Jilin University
Changchun 130023, China

The nuclear structure and decay data evaluation in China has permanent responsibility for evaluating and updating NSDD for A=51-56, and 195-198; temporary for A=61, 62, 63, 170, and 172. The status is as follows:

Updated-A	Status	Evaluators
51	NDS,81,183(1997)	Zhou Chunmei
	NDS,62,229(1994)	Zhou Chunmei
	NDS,48,111(1986)	Zhou Chunmei, Zhou Enchen, et al.
52	NDS,90,1(2000)	Huo Junde
	NDS,71,659(1994)	Huo Junde
	NDS,58,677(1989)	Huo Junde
53	NDS,87,517(1999)	Huo Junde
	NDS,61,47(1990)	Huo Junde
54	Being evaluated	Huo Junde
	NDS,68,887(1993)	Huo Junde
	NDS,50,255(1987)	Huo Junde
55	Being evaluated	Huo Junde
	NDS,64,723(1991)	Huo Junde
	NDS,44,463(1985)	Zhou Enchen, Huo Junde, et al.
56	NDS,86,315(1999)	Huo Junde
	NDS,67,523(1991)	Huo Junde
	NDS,51,1(1987)	Huo Junde, Zhou Chunmei, et al
195	NDS,86,645(1999)	Zhou Chunmei
	NDS,71,367(1994)	Zhou Chunmei
	NDS,57,1(1989)	Zhou Chunmei
196	NDS,83,145(1998)	Zhou Chunmei, Wang Gongqing, et al.
	NDS,76,1(1995)	Wang Gongqing ,et al.
197	NDS,76,399(1995)	Zhou Chunmei
	NDS,62,433(1991)	Zhou Chunmei
198	NDS,74,259(1995)	Zhou Chunmei
	submitted(in review)	Zhou Chunmei
	NDS,60,527(1990)	Zhou Chunmei
61	NDS,67,271(1992)	Zhou Chunmei
62	submitted(reviewed)	Huo Junde
63	Submitted(reviewed)	Huo Junde
170	NDS,50,351(1987)	Zhou Chunmei
172	NDS,51,577(1987)	Wang Gongqing
174	NDS,87,15(1999)	E. Browne,Huo Junde

The evaluations of data sets of (n,g) E=thermal for A=1-35 by Zhou Chunmei have been done.

Status Report of the Nuclear Data Project at McMaster University

(December 1998 - present)
(Report prepared by B. Singh; October 15, 2000)

Status of mass chains in ENSDF for which McMaster data group has permanent responsibility:

A=64, NDS 78, 395-546 (1996).
A=89, NDS 85, 1-179 (1998).
A=98, NDS 84, 565-716 (1998).
A=100, NDS 81, 1-181 (1997).
A=149 (Update), NDS 73, 351-556 (1994). (*)
A=151, NDS 80, 263-565 (1997). (*)
A=164, Submitted December 1999; In review. (*)
A=188, NDS 59, 133 (1990): High-spin update in 1995.
A=190, NDS 61, 243 (1990): High-spin update in 1995. (*)
A=194, NDS 79, 277 (1996) (*)

(*): SD-band data updated in ENSDF in Fall 1999.

Mass-chain/Nuclide Evaluations published/submitted since the 1998 NSDD meeting:

A=130, B. Singh, NDS (Submitted July 2000). In review.
A=42, B. Singh and J.A. Cameron, NDS (Submitted July 2000). In review.
A=164, B. Singh, NDS (Submitted December 1999). In review.
A=43, J.A. Cameron and B. Singh, NDS (Submitted December 1999). In review.
A=163, B. Singh and A. Farhan, NDS 89, 1-211 (2000).
A=44, J.A. Cameron and B. Singh, NDS 88, 299-416 (1999).
A=75, A. Farhan and B. Singh, NDS 86, 785-954 (1999).
A=89, B. Singh, NDS 85, 1-179 (1998).
165Lu, B. Singh and J. Chenkin, NDS 88, 1-78 (1999).
165W, B. Singh NDS 87, 635-644 (1999).
58Cu: B. Singh, NDS 87, 177-190 (1999).
62Ga: B. Singh, NDS 87, 191-196 (1999).
A=1, B. Singh, Updated and included in ENSDF in February 2000.
A=40, 41, 42: B. Singh, Coding of Endt's 1998 update (Nucl. Phys. A633, 1 (1998)) was completed and included in ENSDF in May 2000.
58Zn, 60Zn, 61Zn, 62Zn, 65Zn, 165Gd, 165Re, 165Os, 165Ir nuclides: B. Singh, All these nuclides were updated and included in ENSDF in 1999-2000.

Superdeformed Bands:

B. Singh, complete update of all SD band data published between 1997 and 1999; and included in ENSDF in Fall 1999.

Review work (Dec. 1998-2000):

A=125, A=128, A=148 by B. Singh and A=92 by J.A. Cameron.

New Activities:

1. A=31-44 region:

   In January 1999, John A Cameron (Emeritus-Professor in Physics at McMaster) took the initiative to work on A-chains in 31-44 region in the regular ENSDF style by including all the reaction and decay data sets together with updating to present literature. His interest in this mass region coincides with his current research activities in nuclear spectroscopy of low-mass nuclides with large gamma-detector arrays. John Cameron and B. Singh started work in this mass region in early 1999. Three mass chains (A=44, 43, 42) have already been completed in ENSDF format. Work is now in progress on A=41.

2. Compilation of data from recent publications:
   (B. Singh and summer students):

   At the 1998 NSDD meeting, the McMaster group proposed the creation of XUNDL database to archive compiled, unevaluated (but checked for level-scheme consistency and other data-related problems) data sets prepared from recent (primarily high-spin) nuclear structure publications. Following the acceptance of such a database at the 1998 NSDD meeting, the compilation work at McMaster has been active since January 1999 with the participation of trained undergraduate students, working part-time. Data from journal web pages are routinely transcribed to computer files and later to ENSDF format using semi-automated procedures and computer codes. The compiled data sets in ENSDF format are submitted to BNL for inclusion in XUNDL database, which is managed at BNL.

   From January 1999 to October 2000, about 560 compiled data sets from about 490 recent (mainly from 1995 onwards) publications have been prepared and included in XUNDL database. These data sets cover about 460 nuclides amongst 172 mass chains from A=39 to 254. About 430 data sets have been prepared at McMaster., about 90 at LBNL and about 40 at Grenoble. The data sets from LBNL and Grenoble were checked and edited at McMaster prior to inclusion in XUNDL.

3. Revision of rules for JPI, bands and multipolarity assignments:
   In a presentation by the McMaster group at the 1998 NSDD meeting, it was pointed out that the present rules for the assignment of JPI's, bands, multipolarities, etc. need to be re-examined and updated. The McMaster group has actively participated during 1999-2000 in the discussion and formulation of revised rules for spin-parity assignments, in particular, the rules that are based on particle-transfer reactions, high-spin studies and logft values in beta decay.

Work in progress:

A=41 and A=86: Full mass-chain updates.

Superdeformed Bands: Continuous update of SD band data for all the nuclides from current publication.

Compilation of recent data for XUNDL: Continued work on the compilation of, primarily, high-spin data in ENSDF format from current publications.

Other (data related) publications since the 1998 NSDD meeting:

1. Magnetic-rotational bands:

   About 120 experimentally observed magnetic-rotational bands in 56 (weakly-deformed) nuclei were compiled, covering literature up to August 1999. Proposed and guided by the McMaster group, this project was carried out in collaboration with a Nuclear Theory research group in India.

   Table of Magnetic Dipole Rotational Bands: Amita, A.K. Jain and B. Singh, Atomic Data and Nuclear Data Tables 74, 283-331 (2000)

2. E4 transition strengths:

   The following paper contains all the known E4 transition probabilities from the first 4+ states in even-even nuclides.

   Systematic Investigation of Hexadecapole Collectivity in Even-even Nuclei: R.K. Sheline, B. Singh, P.C. Sood and S.Y. Chu, Czech. Journal of Physics, 49, 1047-1066 (1999).

Support:

The financial support for the project at McMaster is provided partly by NSERC of Canada and partly by the Department of Energy, USA.

Nuclear Data Section Status Report

D. Muir, V.G. Pronyaev
Nuclear Data Section, IAEA
Austria

This report summarises the Nuclear Structure and Decay Data (NSDD) related activity of the IAEA Nuclear Data Section (NDS) for the period October 1998 to September 2000.

1. Online NSDD user service.

NDS uses main services (Telnet/NDIS and Web) developed by the National Nuclear Data Center, BNL, for the online retrievals from NSDD. Since opening of the Web access to the NSDD, the number of NSDD retrievals through Telnet/NDIS was decreased up to about one thousand per year. Many users, especially beginners, prefer now to use friendly Web access to more complex but sometimes more reliable Telnet access. The major databases, NSR and ENSDF, were regularly updated. The table below shows the statistics of the user's online retrievals through Telnet/NDIS and Web for ENSDF, NSR, Nuclear Wallet Cards, NUDAT, MIRD and XRAY databases, libraries computer packages. For preparation of the statistics of the Web retrievals in the same definitions as for existing statistics of Telnet/NDIS, a new program was developed. This program allows also the analysis of the geographical distribution of retrievals. This analysis shows that the relative number of retrievals from users of developing countries, NDS service area, is continue to increase from 7.2% in 1998 to 23.4% in 1999 and 47.4% in 2000 for NUDAT, for example.

	NSR	Nuclear Wallet Cards	ENSDF	NUDAT	MIRD	XRAY	Sum
Telnet/NDIS retrievals (Oct1998-Sep1999)	304	-	211	383	23	29	950
Telnet/NDIS retrievals (Oct1999-24 Sep2000)	268	-	180	324	20	11	803
Web Retrievals (Oct1998-Sep1999)	-	3427	-	2735	553	-	6715
Web Retrievals (Oct1999-24 Sep2000)	-	3279	399	3052	550	-	7280

2. Offline NSDD user service.

For the last two years NDS distributed to the users 87 copies of the Nuclide Wall Charts (Knolls, Karlsruhe or JAERI), 108 copies of Nuclear Wallet Cards by J. Tuli (Sixth edition) and 51 copies of PC NUDAT on CD-ROM by R. Kinsey with updated data.

3. NSDD development programs and projects.

3.1 NDS contribution to the IAEA Analytical Quality Control Services program (Report AQCS 2000-2001).

Half-life decay data for 30 nuclides included in the AQCS list (1998) have been analysed taking into account the experimental and evaluated data obtained since 1990. Half-lives for 16 decay modes were updated to maintain consistency and according to the latest evaluations included in ENSDF or obtained in the framework of the international project on decay data (M.M. Bé, E. Browne, V. Chechev, R. Helmer, E. Schönfeld, J. Lamé, F. Piton, C. Morillon, NUCLÉIDE, Table de Radionucléides vol. 5, ISBN 2 7272 0200 8, CEA/LNHB, 91191 Gif-sur-Yvette, France).

A Web version of the Report AQCS 2000–2001 is in preparation now. It should contain full information (half-lives and decay radiation data) needed for Analytical Control Quality measurements. The preliminary version of these Web pages was prepared. For this, pages prepared by NUDAT in HTML format were taken as a base. In cases if revision of ENSDF decay data was needed for particular radionuclide, according to the latest recommendations of the groups of international experts, these pages were easily edited and the references were added. If users should need data for radionuclides not included in the AQCS, they can retrieve them from NUDAT through a given hyperlink.

3.2 Co-ordinated Research Project on Nuclear Model Parameter Testing for Nuclear Data Evaluation (Reference Input Parameter Library: Phase II).

The Reference Input Parameter Library (RIPL) is a collection of reference input parameters for theoretical calculations of nuclear reaction cross sections. The second phase of the project was initiated in 1999 in order to test and improve recommended RIPL data and to create interfaces between RIPL and commonly used nuclear reaction codes. The files include such nuclear structure and decay data as nuclear masses, Q-reaction values and nucleus ground state deformations, energies, spins and parities of the excited levels and characteristics of gamma transitions between these levels, mean square deformation parameters for levels of vibrational nature. Overall five Research Co-ordination Meetings have been held by the NDS on this subject.

3.3 Co-ordinated Research Project on Updating of X- and Gamma-ray Decay Data Standards for Detector Calibration.

The project includes the evaluation of the half-lives, x-ray and gamma-ray energies and emission probabilities for 68 radionuclides selected as reference standards for gamma-ray spectroscopy or gamma-ray calibrations for environmental monitoring, safeguards, medical applications and material analysis. Two Research Co-ordination Meetings have been held by the NDS. 24 evaluations are completed (May 2000) with other evaluations underway. The project will be finished in 2001.

3.4 Co-ordinated Research Project on Development of Database for Prompt-Gamma Neutron Activation Analysis.

The project was started in 1999 with a first Research Co-ordination Meeting held by the NDS in November 1999. It includes the evaluation of data needed in cold and thermal neutron induced Prompt Gamma Activation Analysis (PGAA) of materials in chemistry, geology, mining, archaeology, environment, food analysis, medicine and other areas. The CRP will produce recommended database for thermal and sub-thermal neutron capture cross sections at dominant isotopes of each chemical element, correction factors to account for cross-section deviations from the 1/v law, energy of gamma-ray transitions and their absolute intensities.

3.5 Workshop on Evaluation of Nuclear Structure and Decay Data.

The Workshop was recommended by the IAEA AGM on International Network of NSDD Evaluators, 14 – 17 December 1998. The proposal to hold this three weeks Workshop in 2001 at ICTP, Trieste, was prepared in January 2000 and submitted for inclusion in the ICTP programme for 2001. The Workshop topics included nuclear structure physics, methods of nuclear structure data evaluation and also the training of 30 participants in retrievals, analysis and applications of the NSDD. After long process of selection, the Workshop on Evaluation of NSDD was not included in the final ICTP programme for 2001. One of the possible reasons is an extremely strong competition from side of other projects proposed to the ICTP by the IAEA for the calendar year 2001 including own NDS regular Workshop on Nuclear Data for Science and Technology: Accelerator Driven Waste Incineration (approved, 2 weeks in September 2001).

The next opportunity to hold the Workshop on Evaluation of NSDD at the ICTP, Trieste will be in the year 2003. NDS included this workshop in programme for 2003, subject of later bilateral IAEA/ICTP consideration and approval. To avoid a delay NDS has a proposal to organise one-week mini-workshop at the IAEA in 2002. The proposal is included in the NDS/IAEA plans for 2002 – 2003. The subject of this mini-Workshop could be limited only by training of young scientists in the evaluation of the nuclear structure and decay data. Participation of four young scientists from developing countries thoroughly selected by network, having good background in nuclear structure theory and experiment, and in condition that they will continue the work in the NSDD evaluation after the workshop, could be sponsored by the IAEA. Four participants from developed countries for no cost to the IAEA could be also invited. Two lecturers with large practical experience in the NSDD evaluation could provide training with a technical assistance of NDS programmers and physicists. For exercises, the real well formulated evaluation tasks could be prepared. The experience accumulated during this mini-workshop can be later used in the organization of the larger scale ICTP workshop planned for 2003.

The NDS is planning to invite in 2001 a consultant for preparation of a manual of ENSDF Evaluators. This manual should contain all information needed to the ENSDF evaluator, including definitions and constants, rules for values assignment and evaluation, description of the formats and computer codes used for theoretical model calculations, data treatment, data analysis, data normalisation, data checking and data visualisation. This manual could be distributed between participants of the workshops and help them later in the NSDD evaluation work. Most parts of this manual exist now as separate documents prepared by different groups of evaluators (methods of half-life evaluation, J^{π} assignment rules, introduction to Table of Radionuclides, report CEA-ISBN 2-7272-02010-6 with definitions and major relations and so on).

Status Report on NSDD Activities at JAERI

J. Katakura
Nuclear Data Center
Japan Atomic Energy Research Institute

1 Mass chain evaluation

The evaluation of Japanese group covers masses from A=118 through 129. After the previous meeting, the evaluations of A=119, 121 and 125 have been published. The evaluation status of the other masses is following:

Mass	NDS publication	Evaluators	Status
118	NDS 75, 99 (1995)	Kitao	Preparing Evaluation (Kanbe)
119	NDS 89, 345 (2000)	Ohya, Kitao	-
120	NDS 52, 641 (1987)	Hashizume, Tendow, Oshima	Post Review (Kitao)
121	NDS 90, 107 (2000)	Tamura	-
122	NDS 71,461 (1994)	Tamura	Evaluating (Tamura)
123	NDS 70, 531 (1993)	Ohya, Tamura	Evaluating (Ohya)
124	NDS 80, 895 (1997)	Iimura, Katakura, Tamura, Kitao	-
125	NDS 86, 955 (1999)	Katakura	-
126	NDS 69, 429 (1993)	Miyano	Evaluating (Kitao, Katakura)
127	NDS 77,1 (1996)	Kitao, Oshima	Preparing Evaluation (Hashizume)
128	NDS 38, 191 (1983)	Kitao, Kanbe, Matumoto	Post Review (Kitao, Kanbe)
129	NDS 77, 631 (1996)	Tendow	Preparing Evaluation (Tendow)

The present evaluators are Iimura, Ohya, Katakura, Kanbe, Kitao, Tamura and Tendow. Most of them are part time evaluators.

2 Other related activities on nuclear structure and decay data evaluation

2.1 Bibliographic data compilation

After retirement of Dr. Tendow, RIKEN has decided to abandon the compilation work. We don’t have clear future plan on the compilation yet. We are searching a way continuing the compilation.

2.2 Revision of the Chart of Nuclides

The Chart of Nuclides are regulary published almost every 4 years from 1977. The current version was published in 1996. We are now planning to publish the new version in early next year.

2.3 Compilation of JENDL FP Decay Data File 2000

JENDL is Japanese Evaluated Nuclear Data Library. As a special purpose file of JENDL, JENDL FP Decay Data File 2000 has been compiled for the use in application fields of nuclear technology. The file contains the decay data of 1229 FP nuclides: 142 stable and 1087 unstable nuclides. The decay data included in the file are half-lives, Q-values, branching ratios, average decay energies of beta-, gamma- and alpha-ray, and the spectral data of radiations. The primary source of the data is ENSDF, but the data not or partly included in ENSDF are estimated with a theoretical calculation. The data derived from the theoretical calculation are half-lives, average decay energies and spectral data of beta- and gamma-ray. The file can be applied to estimation of decay heat in a reactor, radiation source analysis of spent fuel and so on. The report on the file is now being prepared and will be published soon.

NUCLEAR DATA PROJECT
EVALUATION ACTIVITY REPORT *

October 1998 -October 2000
Y. Akovali, J. Blackmon, D. Radford and M. Smith
Physics Division, Oak Ridge National Laboratory
Oak Ridge, Tennessee, 37831-6371, USA

This report summarizes the activities of the ORNL Nuclear Data Project since the IAEA Advisory Group meeting in December 1998. The group's future plans are also included.

The ORNL Nuclear Data Project's responsibility includes the compilation/evaluation of astrophysics data, as well as the evaluation and compilation of nuclear structure data. The Nuclear Data Project, therefore, is composed of two groups. The Nuclear Data Project staff through September 2000 is listed below. Accomplishments for the period of October 1998 through September 2000 of the nuclear structure data group and the nuclear astrophysics group are submitted in this Nuclear Data Project report.

October 1998 October 2000

Nuclear Structure Group Nuclear Astrophysics Group
======================= ============================

Professional Staff:
Yurdanur Akovali (50%) Jeff Blackmon (20%)
David Radford (10%) Michael Smith (20%)

Technical Support:
Mary Ruth Lay (50%)#

Through May 2000.
Effective June 2000, it is reduced to 0%

* This work has been sponsored by the Oak Ridge National Laboratory, managed by UT-Battell for the U.S. Department of Energy under DE-AC05-00OR22725.

NUCLEAR STRUCTURE DATA EVALUATIONS

Completed Work

Evaluations of nuclear structure data pertaining to all nuclei with mass numbers 248, 252, 256, 260, 264, 224, and 249 - 265 odd-mass nuclei have been completed, and adopted data, levels, spin, parity and configuration assignments are presented in the following publications:

Nuclear Data Sheets for A=248 , 252, 256, 260 and 264, Nucl. Data Sheets 87, 249 (1999)

Nuclear Data Sheets for A=249 - 265 (odd), Nucl. Data Sheets 88, 155 (1999)

Evaluations of nuclei with mass numbers 254, 258, 262, and 266 have been completed and submitted to the Brookhaven National Laboratory National Nuclear Data Center for publication. These evaluations have not been reviewed.

About 80% of the evaluations of A=250 nuclei are completed.

The evaluation of A>267 nuclei were reviewed

Work in Progress

It is estimated that evaluations of A=250 nuclei will be finalized before December 2000.

Nuclei with odd-mass numbers 215, 219, 223 and 227 are being reviewed.

Future Plans for Nuclear Structure Evaluations

The nuclear structure and decay data for A=242 nuclei are planned to be evaluated in 2001.

As an integral part of ORNL's forefront research program in nuclear structure physics, the nuclear structure data evaluations will be extended to horizontal evaluation of nuclear states with the purpose of providing a guide to researchers and evaluators and as a means of gaining new insight into nuclear structure.

Nuclear-structure information for nuclei important to current research programs, in particular for nuclei in the far-from-beta-stability regions on both the neutron- and the proton-rich sides, will be evaluated.

DATABASE AND WEB INTERFACE DEVELOPMENT AND EXPERIMENTAL NUCLEAR STRUCTURE DATA COMPILATION (XUNDF)

Our programs for nuclear structure database development and dissemination provide a modern and efficient user access to the nuclear data, and for semi-automatic conversion of journal articles and other data sources into ENSDF-format data bases.

Accomplishments

A FTP/www server site on the ORNL Physics Division local area-network was set up for compilation and distribution of nuclear-structure data. The data on this site are in the "Graphical Level Scheme" format. Members of experimental nuclear structure community are encouraged to contribute their own data by anonymous FTP. Contributed data use the same format, accompanied by additional information describing the experiment(s) that generated the level scheme, the names and institutions of the researchers involved, and references to any publications of the data. Contributed data are checked for internal consistency.

Software for semi-automatic extraction of tabular level-scheme data contained in PDF manuscripts into ENSDF-format data sets has been developed, and is now in extensive use as a production tool for data to be included in XUNDL, at ORNL and McMaster. Documentation has been written, and is available at http//radware.phy.ornl.gov/t2e.html.

A selection of RadWare-format level schemes created from ENSDF files, by means of a conversion program, have also been placed on the site with the intent of generating a displayed level scheme. The response of RadWare users (nuclear structure experimentalists) has been very encouraging, with an average of about three file retrievals per day.

On-line conversion of selected data sets from ENSDF-format to RadWare format was developed to replace the present archive of ENSDF-converted schemes.

Future Plans

We will continue to participate in the NNDC Common Web Interface working group. This initiative aims to improve the consistency of the data dissemination web interface at different NNDC sites, to provide more modern, efficient and consistent user access to the nuclear structure data.

Some further development of the software for semi-automatic extraction and conversion of tabular level-scheme data contained in PDF manuscripts into ENSDF-format data sets, will be done to extend its applicability, and to make it more robust and easier to use. During the course of this development, ENSDF-format data sets will be created from published papers for testing purposes, and for the XUNDL database.

The compilation and electronic dissemination of most recent data on reaction gammas will be done continuously as data become available. Upkeep of the RadWare database will be continued.

Other types of data that could be automatically or semi-automatically converted to XUNDL datasets will be investigated; these may include user-contributed level schemes in various formats.

NUCLEAR REACTION EVALUATIONS for ASTROPHYSICS

Evaluations are being made of nuclear reactions and structure properties important to understanding stellar explosions, the interior of our sun, and other phenomena in nuclear astrophysics. Special attention is focused on reactions on radioactive isotopes that will be measured in the near future at facilities such as ORNL's Holifield Radioactive Ion Beam Facility. The results are put into formats requested by astrophysics community and distributed over the WWW.

Accomplishments

A website which disseminates the rates of nuclear reactions important to nuclear astrophysics has been updated. This site includes plots, tabular values, FORTRAN equations, temperature derivatives, downloadable subroutines, and a graphical search engine for 180 reactions and their inverses. Evaluations were made of the 14O(alpha,p)17F and 17F(p,gamma)18Ne nuclear reactions which have been measured at ORNL's HRIBF and are important for stellar explosions.

Work in Progress

We are currently evaluating the 18F(p,gamma) and 18F(p,alpha) reactions, which will also be measured at HRIBF, and the 17O(p,gamma) and 17O(p,alpha) reactions important for understanding the evolution of Red Giant Stars.

Future Plans

Evaluations of the 18F(p,gamma) and 18F(p,alpha) reactions, important for stellar explosions, and 17O(p,gamma) and 17O(p,alpha) reactions, important for understanding the evolution of Red Giant Stars, will be completed. Evaluated cross sections for the 19 reactions important for the solar neutrino problem will be converted into reaction rates, parameterized, and compared to analytical approximations and to other rate evaluations. Additionally, evaluations of capture reactions on radioactive isotopes such as 33Cl, 25Al, and 26Si will be started to help understand stellar explosions and support the HRIBF experimental program.

Recent Papers

M.S. Smith et al., "Recent Nuclear Astrophysics Data Activities in the U.S.", in Proc. 10th Int. Symp. On Capture Gamma-Ray Spectroscopy and Related Topics, ed. S. Wender, American Inst. Physics, New York, p.243, 2000.

M.S. Smith et al., "Nuclear Astrophysics Data at ORNL", in Nuclei in the Cosmos V, eds. N. Prantzos, S. Harissopulos, Editions Frontieres, Paris, p. 497, 1998.

France Group Status Report

Jean BLACHOT
SPN
Bruyères le Chatel France

1.Status of ENSDF, NDS, XUNDL

```
X= XUNDL  E = ENSDF
101  NDS 83, 1 (1998)        980218
    X   Nb 98HW08   PRVCA 58,108
    X   Tc 99HO10   EPJA 4,319
    X   Rh 99TI01   EPJA 4,11
104  NDS 64, 1 (1991) 91NDS+00 200002
    XE  Mo 96Go04   PRVCA 53,119
    XE  Ru 96Po06   ACTA PHY POL B27,179
    X   Ru 00De33   EPJA   8 177
    XE  Cd 99De22   PRVCA 60,1413
107  NDS 89,213 (2000) 2000Bl05 ,NDS 62, 709 (1991)
    XE  Tc 98Hw04   PRVCA 58,108
    X   Ru 00Fo10   PRVCA 61,064326
    X   Rh 99Ve12   EPJA   6 405
    XE  Pd 96PO07   PRVCA 53,2682
    XE  Ag 97Es02   PRVCA 55,1548
    XE  In 98Ta26   PRVCA 58,3738
    X   Sb 00La27   PRVCA 62,014305
108  NDS 81, 599 (1997)  971025, send final Sep 2000
    X   Ru 00De33   EPJA   8 177
    X   Tc 98HW04   PRVCA 57,2250
    X   Cd 00Ke01   PRVCA 61, 011301  (96ZR(16O,4N))
    X   In 98Ch35   EPJA A3,5
    X   Sn 98JE03   PHYS LET 428B,23
    X   Sb 98JE09   PRVCA 58,2682   (HI,XNG)
    X   Sb 95CE01   NUPAB A 581,189 (HI,XNG)
    X   Te 98La03   PRVCA 57,1022
    X   Te 98So24   EPJA 3,209
109  NDS 86, 105 (1999), NDS 64, 913 (1991)
    X   Rh 99Ve12   EPJA   6 405
    X   Pd 99HO25   EPJA A6 ,43
    X   Pd 98Ku22   PRVCA 58,1966
    X   Cd 00Ch04   PRVCA 61,034318
    X   Sn 96CH37   PRVCA 54,2771
    X   Sn 99DA05   NUPAB A646,3
    X   Te 00Bo29   PRVCA 61,064305
    X   I  99YU02   PRVCA 59,R 1834
111  NDS 81, 753 (1997)  (Te)  960408
        Ru  98HW02
    X   Rh  98LH02  EPJA A 1,285     Ru β- decay
    X   Pd  99HO25  EPJA A 6 ,43
    X   Pd  98Ku22  PRVCA 58,1966
    X   In  98VA03  PRVCA 57,1634
    X   In  97Lo09  Phys. At. Nuc. 60,1591
    X   Sn  95LA11  PRVCA 51,R 2876
    X   Te  00St03  PRVCA 61,034308
    X   I   00Pa38  PRVCA 61,064320
```

113 NDS 83, 847 (1998) 980424

```
    X   Pd  99KR17  PRVCA 60,031302
    X   Pd  99HO25  EPJA A6 ,43
    X   Pd  00ZH04  PRVCA 61,014305
    X   Cd  00Bu06  EPJA A7 ,347
    X   Cd  00Fo10  PRVCA 61,064326
    X   Sn  98SE14  PRVCA 58,1430
    X   Sn  98CH39  EPJA A2 ,323
    X   Sb  98MO22  PRVCA 58,1833
    X   Te  98SE05  PRVCA 57,1656
    X   Xe  00Sc23  PRVCA 61,064316
```

114 NDS 75, 81 (1994) 951026

```
    X   Pd  99BU32   J. Phys. G 25,2253
    X   Cd  00Bu06  EPJA A7 ,347
    X   Sn  95Wi15  NUPAB A586,427
    X   Xe  98De29  PRVCA 58 164
    X   Xe  00Pa31  NUPAB A673,31
```

115 NDS 86,151 (1999) NDS 67, 1 (1992)

```
    X   Pd  99KR17  PRVCA 60,031302
    X   Pd  99HO25  EPJA A6 ,43
    X   Pd  00ZH04  PRVCA 61,014305
    X   Cd  00Bu06  EPJA A7 ,347
    X   Cd  00Fo10  PRVCA 61,064326
    X   Sn  99Lo04  PRVCA 59,1975
    X   Xe  00Pa33  EPJA  7,449
```

116 NDS 73, 81 (1994) 971209, submitted Oct 2000

```
    X   Pd 99BU32   J. Phys. G 25,2253
    X   Sn 98Sa30   NUPAB A637,491
    X   Te 97Se04   PRVCA 57,2290
    X   Te 97Mo23   ZPAD A358,373
    X   Xe 98SE08   PRVCA 57,2991
    X   Xe 95PA21   PRVCA 51,R 2857
    X   Xe 98DE29   PRVCA 58 164
```

117 NDS 84, 115 (1998) (Sb) 920826-

```
    X   Pd 00Zh04   PRVCA 61,014305
    X   Cd 00Fo10   PRVCA 61,064326
    X   Te 99MO30   NUPAB A657,251
    X   I  99PA13   PRVCA 59,1984
    X   I  99Mo17   EPJA A5 ,13
    X   Xe 98PA38   NUPAB A644 ,3
    X   Xe 95PA21   PRVCA 51,R 2857
    X   Xe 98Li06   EPJA A1 ,125
```

2.NUBASE

During these last two years the updating of NUBASE has been continued. A new version could be published within a year. Some information on NUBASE can be found in the recent paper of G. Audi presented for APAC 2000 Cargèse Sep. 2000.

3.DECAY DATA

O. BERSILLON has significantly modified the RADLIST program (version 5.5, October 1988) : a lot of recoding (double precision, Fortran90 compatibility), new numerical integration method, several internal cross-checks, new outputs for easier checking…

Two contributions have been made to the JEFF3 project. The first one is the translation of the NUBASE database into an ENDF/B file. The second one is an ENDF/B file for those of the ENSDF fission products leading to a satisfactory energy balance. These reports will be published as NEA JEFF/DOC reports.

Belgian Group Status Report

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During the last two years the mass chain A=110 was evaluated and published while the evaluation of mass chain A=103 was just finished. For the next future we plan to reevaluate mass chain A=105. If time permits some nuclides for those mass chains for which we have permanent responsibility will be reevaluated.

Our fundamental research program was based, over the last two years, on two different kind of nuclear structure experiments. We finished our (γ,γ') experiments with polarized and unpolarized bremsstrahlung in Ghent and Stuttgart on different Fe, Ni, Mo, Sn, and Sb targets and are since last year very much involved in experiments with polarized protons and deuterons at the AGOR accelerator of the KVI in Groningen (The Netherlands). We performed (p,p')experiments with polarized protons (E_p=150 MeV) on ^{12}C and ^{124}Sn and (d,^{2}He) (E_d=150 MeV) on ^{12}C, ^{24}Mg and ^{58}Ni. We would like to obtain the M1 strength for the studied nuclei via polarized proton scattering. We obtained a very high resolution for the ^{2}He spectra of about 140 keV, which has never been obtained before. The aim of the latter experiments is to determine the strength of the spin-flip transitions in those reactions.

Nuclear Structure and Decay Data Evaluations
and Related Activities of Idaho Group

R. G. Helmer and C. W. Reich

1. Mass-Chain and Nuclide Evaluations

Within this Network, the Idaho Group has the evaluation responsibility for the twelve mass chains 87 and 153-163. The participants in this work are C. W. Reich and R. G. Helmer. Since the last Network meeting in December 1998, we have submitted complete evaluations for A = 161 and 162, and these have been added to ENSDF and published in Nuclear Data Sheets. The evaluation for A = 163 was submitted by B. Singh and A. R. Farhan and it has been published.

We are currently working on A = 87 and 156.

The current status of our twelve mass chains is as follows:

A	last date of publication	Comments
87	2/91	in progress
153	2/98	
154	9/98	
155	4/94	
156	1/92	in progress, 156Er submitted as a priority nuclide (9/00)
157	6/96	
158	3/96	
159	5/94	
160	8/96	
161	8/00	
162	7/99	
163	1/00	

2. Decay Data Evaluation Project, DDEP

R. G. Helmer is the co-ordinator of an international group that is carrying out evaluations of decay data for a group of nuclides that are important for applications. This Project was approved as part of the activities of this Network in 1994. This Project includes evaluators from France, Germany, Russia, Spain, and the United Kingdom that are not a part of the ENSDF Network . The participants from the Network are E. Browne, Lawrence Berkeley National Laboratory, J. K. Tuli, Brookhaven National Laboratory, and the co-ordinator.

The members of this Project have completed and published the evaluations for 29 radionuclides. These results appear in two reports from Laboratoire National Henri

Becquerel, LNHB (formerly Laboratoire Primaire des Rayonnements Ionisants, LPRI) France. All of these results have been converted to ENSDF data sets by R. G. Helmer and E. Browne, and submitted to the National Nuclear Data Center or the appropriate ENSDF evaluators. More evaluations are being carried out by the Project members.

The International Atomic Energy Agency, IAEA, has created a Coordinated Research Program, CRP, to prepare an update of their earlier report on X-and γ-ray Decay Data Standards for Detector Calibration and Other Applications. R. G. Helmer is a member of this CRP and most of the other members were chosen because they are members of the DDEP. The CRP has adopted the methodologies of the DDEP. Therefore, the decay data recommended by the IAEA will generally by the same as published by the DDEP and submitted for inclusion in ENSDF. This CRP has met twice and will conclude its work in late 2001.

3. Related Activities

C. W. Reich has co-ordinated the efforts of the sub-committe appointed at the 1998 International Network meeting to revise the rules for J^{π} assignments as they appear in the Nuclear Data Sheets. This subcommittee has produced a set of proposed modifications. These were presented to the US Nuclear Data program at its meeting at LBNL in April 2000. They were agreed to by the participants at this meeting.

R. G. Helmer has participated in the subcommittee appointed at the 1998 Network meeting to monitor the progress on the transfer of assignments of the A=21-44 mass chains formerly done by the Utrecht group.

The paper by R. G. Helmer and C. van der Leun entitled "Recommended standards for gamma-ray energy calibration (1999)" has been published in Nuclear Instruments and Methods, **A450** (2000) 35.

Contact has been maintained with S. Raman, Oak Ridge National Laboratory, concerning the progress in completing a new computer code to compute internal-conversion coefficients.

TUNL NUCLEAR DATA EVALUATION PROJECT

October 2000

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I. Status of A=3-20 data evaluation

TUNL is responsible for data evaluations in the mass range A=3-20. The current status of these evaluations is summarized below. Since the last NSDD/IAEA meeting in 1998, reviews of the A = 6 & 7 nuclides have been completed in collaboration with G.M. Hale of Los Alamos National Laboratory and H.M. Hoffman of Universität Erlangen-Nürnberg. An "Energy Levels of Light Nuclei, A = 5,6,7" review is planned for submission to Nuclear Physics A in 2000, and an evaluation of A = 8 and A=9 nuclei is underway.

Nuclear Mass	Publication/Status	Comments
A=3	Nucl. Phys. A474, 1 (1987)	TUNL
A=4	Nucl. Phys. A541, 1 (1992)	TUNL
A=5-10	Nucl. Phys. A490, 1 (1988)	Penn*
A =5-7	To be submitted to Nucl. Phys. A (2000)	TUNL
A=11-12	Nucl. Phys. A506, 1 (1990)	Penn*
A=13-15	Nucl. Phys. A523, 1 (1991)	Penn*
A=16-17	Nucl. Phys. A564, 1 (1993)	TUNL
A=18-19	Nucl. Phys. A595, 1 (1995)	TUNL
A = 20	Nucl. Phys A636, 247 (1998)	TUNL

*Professor Fay Ajzenberg-Selove, University of Pennsylvania

II. ENSDF

ENSDF files consisting of adopted levels, decay data, and reaction data are presently prepared at TUNL for A=3-20. Since 1998 the A= 7-13 ENSDF files have been updated to include data from the past reviews of Fay Ajzenberg-Selove. ENSDF files which reflect information from the "Energy Levels of Light Nuclei, A = 5-7" review will be submitted shortly after publication in Nuclear Physics A.

III. World Wide Web Services

TUNL continues to develop new WWW services for the nuclear science and applications communities. The most recent evaluations are available online in pdf format, and Energy Level Diagrams are provided for A=4-20 nuclei. A new initiative has begun to provide the "Energy Level" series in HTML format with direct links to the NSR. We have recently developed a website dedicated to the distribution of nuclear physics related applications for PalmOS devices. Efforts are underway to provide all previous FAS and TUNL evaluations (since 1959) in pdf format via the Nuclear Physics A (Elsevier) website.

IV. Related Activities

TUNL continuously scans the literature and maintains a substantial reference database. We also make extensive use of the Nuclear Science References services at NNDC, resources of the Triangle Area Libraries, Monthly Updates from NNDC, Current Contents Connect, and Physics Abstracts.

Supported by the U.S. Department of Energy Director of Energy Research, Office of High Energy and Nuclear Physics, Contract Nos. DE-FG02-97ER41042, DE-FG02-97ER41033.

National Nuclear Data Center

National Nuclear Data Center Activity Report
October 31, 2000

This report reviews the evaluation of nuclear structure, decay data and related activities of the National Nuclear Data Center (NNDC) for the period October 1998 to October 2000. The name of the person with lead responsibility for each of the sections is underlined.

I. New Evaluations for ENSDF:

(T.W. Burrows, A. Sonzogni, J.K. Tuli, D.F. Winchell)

Evaluations submitted for updating ENSDF:

- In 1998: 57, ^{141}Eu, ^{143}Nd
- In 1999: 61, ^{145}Sm, ^{145}Eu
- In 2000: 69, 139, 141, 142, 144, 148

Number of evaluations reviewed:

- In 1998: 8 A-chains, 7 nuclides
- In 1999: 4 A-chains, 11 nuclides
- In 2000: 7 A-chains, 2 nuclides

II. Database Maintenance:

1. The Evaluated Nuclear Structure Data File (ENSDF):

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

The ENSDF is continuously updated on the basis of new evaluations submitted; details of processing these are given in Section III.1. The current status of mass- chains for A > 20 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 in which only those data sets that have been modified since the last distribution are included. Users may also update their local databases easily by using the WWW ENSDF access. In August 1999, Y2K compliant version of ENSDF was distributed. Superdeformed bands and high-spin evaluations submitted by network evaluators have also been added to the ENSDF and are available to users via the online system and WWW access. The evaluations of A<=20 published by the TUNL group in *Nuclear Physics A* were added to the ENSDF.

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.

2. The Nuclear Science References (NSR):

(A. Sonzogni, J. Tallarine, D.F. Winchell)

Compilation of nuclear science articles has continued, with keywords being assigned when appropriate. All articles from *Physical Review C*, *Nuclear Physics A*, and *The European Physical Journal A* are assigned keynumbers and entered into the database. About 70 other journals are regularly scanned. Monthly distributions continue to be sent to various data centers. Distributions previously done on four-monthly basis were changed to monthly in 1999. Secondary source entries prepared by groups at RIKEN Data Center, Japan and Gatchina, Russia were received and merged into the database.

A new staff member, who will spend part of his time on NSR keyword preparation, was hired in 1999.

In late 1998, NSR began using the recently assigned chemical symbols for elements 104-109. Keyword and selector fields for old entries were updated with the symbols.

Development of a relational version of NSR has continued. A public version of this database was made available on the web in June 1999.

The author keyword preparation package distributed by *Physical Review C*, was updated in 1999. Authors are now encouraged to submit their keywords electronically.

Since the beginning of 1999, over 12,000 incomplete NSR entries from the 1960s, 70s, and 80s have been updated to include missing author, title, and reference information.

III. Data Dissemination:

(T.W. Burrows, C.L. Dunford, R.R. Kinsey, V. McLane, D.F. Winchell)

The data available from the NNDC are disseminated in hard copy and magnetic media and through online access via TELNET, the World Wide Web (WWW), and anonymous FTP.

1. **Processing New Evaluations (Hard copy, TELNET, WWW):**

   New evaluations submitted to the NNDC are checked by the format and physics checking codes and errors are corrected. A hard copy of the evaluation is sent for review and for final checking by the editor. The final corrected evaluations are published as the *Nuclear Data Sheets* by Academic Press in eleven issues per year. The December issue is devoted to Recent References which are the yearly updates to the NSR. Academic Press is continuing to make available the contents of each NDS issue on the web as Adobe Portable Document Format (PDF) files.

2. **Nuclear Wallet Cards (Hard copy, FTP, WWW):**

   The 2000 Edition of the Nuclear Wallet Cards was published with a literature cut-off date of July 31, 1999. The contents of the Wallet Cards have been available on the WWW and FTP sites since September 1, 1995 and are updated every six months coinciding with the ENSDF distribution.

3. **Online Data Services (FTP, TELNET, WWW):**

   The total number of retrievals in 1999 was 165,881 compared to 125,272 in 1998 and 125,149 in 1997 for an average yearly increase of 16%; retrievals through September 2000 have already exceeded the 1999 total. NSR and NuDat are the two most popular systems with each contributing about 22% of the total retrievals through September 2000. The Web continues to be the most popular method of accessing the NNDC systems with 81% of the retrievals through

September 2000 compared to 74% and 57% in the same periods for 1999 and 1998.

Improvements and additions to the Online Services since the last NSDD meeting include the following:

a. FTP, TELNET, or WWW:
    i. Measurement and Basic Physics Committee of the U.S. Cross-Section Evaluation Working Group Annual Report 1997 added [FTP, WWW]
    ii. CINDA and ENSDF were brought up to Y2K compliance [TELNET, WWW]
    iii. ENDF and ENSDF program distribution directory structures were reorganized [FTP, TELNET, WWW] and OpenVMS and MS-DOS (32 bit) executables added [FTP, WWW]
    iv. The Experimental Unevaluated Nuclear Data List (XUNDL) added [TELNET, WWW]
b. World Wide Web:
    i. CINDA: Links to journal abstracts expanded to include EDP Science and NP Electronic
    ii. CSISRS/EXFOR:
        - Links to journal abstracts expanded to include EDP Science and NP Electronic
        - Overlay plotting of experimental and evaluated data, including the ability for user to enter energy-cross section pairs to add to the plot
        - Database registry system implemented
    iii. ENSDF:
        - HTML table and PostScript level schemes and band drawings retrieval options added
        - Ability to specify "evenness" in retrievals by atomic number
        - Access to the basic ENSDF datasets (*i.e.*, not ComTransed)
        - Links from ENSDF pages to NSR to obtain NSR entries added since the ENSDF mass or nuclide cutoff date
        - Database registry system implemented
    iv. MIRD:
        - HTML/GIF option
        - Links to parent and daughter information in the MIRD format
        - Links to CSISRS/EXFOR, ENSDF, NSR, and the NuDat Decay Radiations and Wallet Card modules
    v. NSR:
        - Links to journal abstracts expanded to include EDP Science and NP Electronic
        - Links to RHID and XUNDL added
        - Alternate NSR site using Microsoft SQL Server and Active Server Pages added
        - Database registry system implemented. Demonstrations available at http://trinity.digitalcre ativity.com/NSRstats and http://trinity.digital creativity.com/NSRprofiler.
    vi. PhysCo: Interface added to the ENSDF analysis codes LOGFT and HSICC.
    vii. Thermal Neutron Capture Gammas: Updated in February 1999.
    viii. XUNDL: Database registry system implemented

The NSR Link Manager described in the 1998 Center report to the NSDD is currently being used on pages at the NNDC, TUNL, the IAEA Nuclear Data Section and its Brazilian mirror, and others and the ENSDF Link Manager is still in use on pages at Lund University, TUNL, and others.

The NNDC continues to host the USNDP Web site. Since the 1998 NSDD meeting, Tom Burrows has visited the IAEA Nuclear Data Section twice and Bob Kinsey, once, to consult on Web dissemination of nuclear data.

4. **Current Activities:** With the exception of the activities noted above, the TELNET service is basically in a maintenance mode and all current activities and future plans are focused on the World Wide Web. Current activities include:
    a. APS link to databases: The NNDC is working with the editors of Physical Review C to establish links from their journal articals to the CSISRS/EXFOR and XUNDL databases.
    b. Cooperative Development:
        i. Members of the NNDC are involved in a USNDP Task Group to develop unified Web servers for ENSDF and NSR. The current emphasis is on ENSDF.
        ii. The NNDC is participating with Scientific Digital Visions, Inc. (SDV) in Small Business Innovative Research grants to develop tools useful for the ENSDF Editor and investigate XML technology.
        iii. The NNDC is continuing its collaboration with SDV and San Jose State University in delveloping interfaces between client applications and the databases resident at the NNDC.
    c. CSISRS/EXFOR, ENDF: In cooperation with the IAEA Nuclear Data Section an interface to CSISRS/EXFOR and ENDF has been developed which allows the program ZVVIEW to be used as a helper application. This still needs to be integrated into the CSISRS/EXFOR retrieval system.
    d. Database Investigations: Several relational database systems and their connectivity through the Web have been investigated and a final selection of a system should be made by the end of the year.
    e. ENSDF:
        i. In support of the Task Group described above, an interface to LBNL's Isotope Explorer 3.0 Java applet from the ENSDF and XUNDL databases at the NNDC has been prototyped.
        ii. Improved HTML presentation of ENSDF data, possibly using UNICODE (UTF-8) for X11-based browsers, is still being investigated.
    f. NSR: In support of the Task Group described above, an interface to LBNL's Isotope Explorer 3.0 Java applet from the NSR database at the NNDC has been prototyped.
5. **Future Plans:**
    a. One small database (X-RAY) and the utility module QCALC still remain to be ported to the Web from the TELNET Online Data Service.
    b. Upgrade, where necessary, current Web interfaces to provide the full capabilities of their TELNET counterparts.
    c. For MIRD, develop methods to retrieve the data by decay chain (e.g., ^{232}Th and all its daughters).
    d. For the Thermal Capture Gammas, add tables of absolute intensities ordered by target.
    e. Work on merging the NSR Web and SQL servers at the NNDC.
    f. Begin transfering the databases at the NNDC and their associated interfaces to the new relational database system.

IV. User Services & Network Support:

(T.W. Burrows, M.T. Blennau, V. McLane, J. Tallarine)

The ENSDF analysis and checking codes continue to be maintained and improved; recent improvements made in them and their current status is given in a separate report accompanying this contribution.

The NNDC provides many services to the international Nuclear Structure and Decay Data (NSDD) network evaluators and others on a routine basis. At present they are:

i. Monthly NSR updates are sent to those evaluation centers that still request them, for the A-chains assigned to them.
ii. Complete NSR and ENSDF retrievals are sent at the start of an evaluation to those who cannot access online the NSR or the ENSDF from the NNDC, the NEA Data Bank, Saclay, or the NDS, IAEA; others have to do their own retrievals.
iii. Copies of hard-to-get references are sent to evaluators (with help from the NDP for older references).
iv. ENSDF updates are sent twice a year.
v. NSR updates are sent once in every four months.
vi. The ENSDF physics processing codes are maintained; and corrections and updates are sent periodically.
vii. Special retrievals are made from the NSR and the ENSDF. Requests for these specialized retrievals are satisfied on a case-by-case basis. Users are encouraged to take advantage of the full potential of the NNDC online system; only if their needs cannot be met by the system then their requests are processed in-house.
viii. ENSDF, NSR, NUDAT updates are sent to the IAEA Nuclear Data Section, the NEA Databank, the Obninsk Data Center, RFNC, Sarov and Slavutych, Ukraine on a regular basis.

V. <u>Publicity for Network Activities & User Outreach</u>:

The following is a list of items done to publicize the network activities, and its products & services:

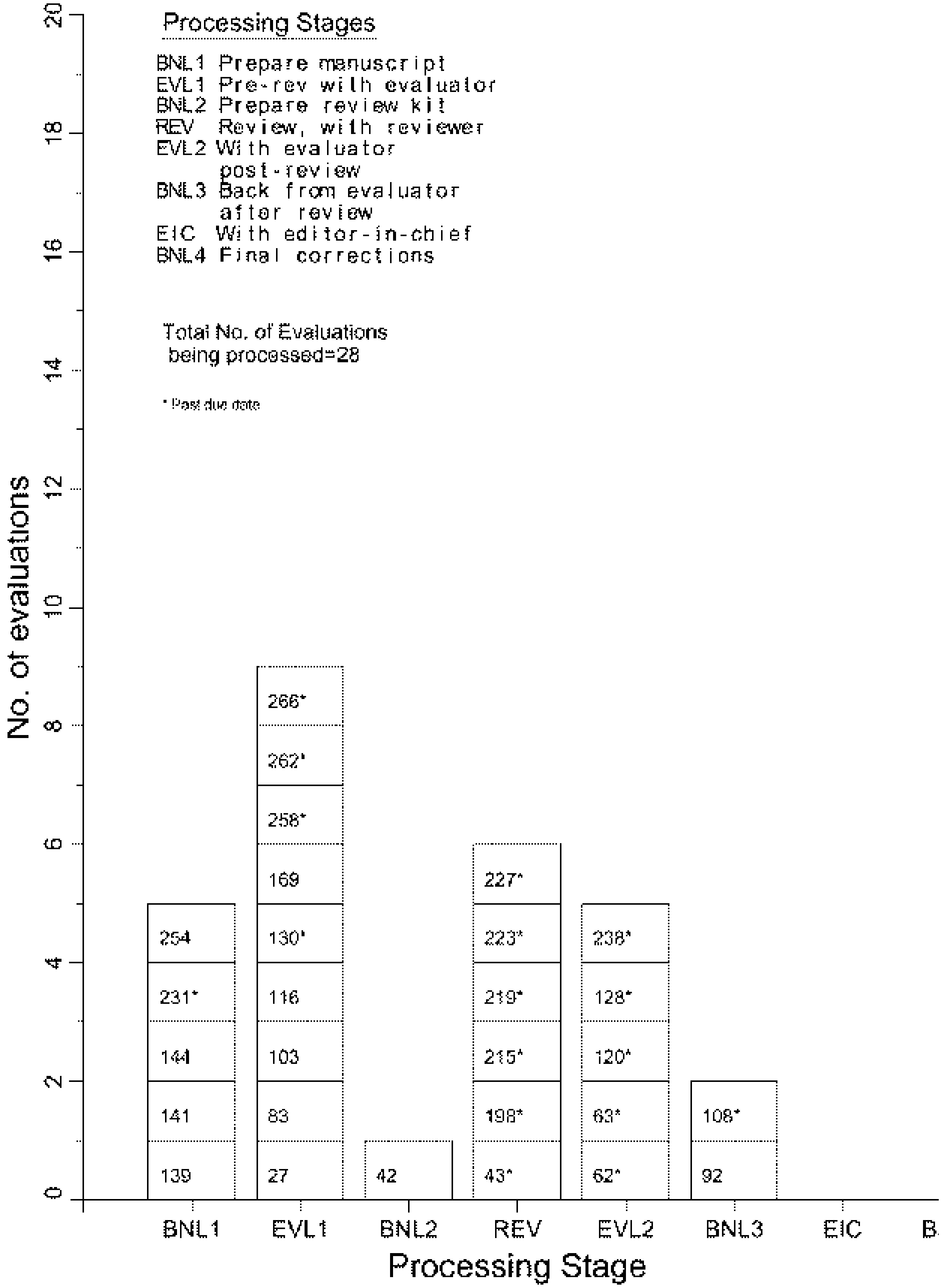
- Information on the products and services available from the NNDC and other members of the U.S. Nuclear Data Program (USNDP) is given on their WWW homepages with cross-links amongst them.

- Every issue of the NDS contains a brief description of the databases maintained at the NNDC and how to access them.

- The NNDC online system was installed at the nuclear data center at Obninsk, Russia. Mirror sites of the NNDC web pages for ENSDF, the Nuclear Wallet Cards, etc., were established at the Slavutych Data Center, Ukraine in 1997.

- The NNDC personnel gave the following talks to improve user awareness of the online data services:
  - THE NUCLEAR STRUCTURE DATA RESOURCE AND REPOSITORY, J.K. Tuli, Nuclear Structure 2000, Michigan State University, East Lansing, MI, August 15-19, 2000.
  - U.S. NUCLEAR DATA PROGRAM, C.L. Dunford, KAERI, CNDJ and Beijing University, June 2000.
  - THE NSR DATABASE, D.F. Winchell, DNP Meeting, Asilomar, CA, October 1999.
  - EVALUATED NUCLEAR STRUCTURE DATA FILE AND NUCLEAR DATA PROGRAM, J.K. Tuli, American Physical Society Centennial Meeting, Atlanta, GA, 1999.

Evaluation Processing Status
24-OCT-00



Status of ENSDF Analysis and Utility Codes

(November 11, 1998 to October 24, 2000)

Previous Status Reports

Nov. 10, 1998: Status report for the 1998 meeting of the IAEA-sponsored Nuclear Structure and Decay Data (NSDD) Network.

April 21, 1999: Status report for the 1999 USNDP Coordination Meeting

April 14, 2000: Status report for the 2000 USNDP Coordination Meeting

Current Status

A. With the exception of RadList and two minor revisions in FMTCHK, all ANSI, Open-VMS, and MS Windows versions are current with those maintained in-house at the NNDC.
B. With the exception of ENSDAT, 1998 NSDD meeting format proposals have been implemented in all the codes.
C. All time/date stamps in the ENSDF analysis and utility codes maintained by the NNDC have been checked for Y2K compliance and corrected as necessary.
D. The Web and anonymous FTP directories have been restructured and OpenVMS and MS Windows executables added. ZIP files have been added for the ANSI-standard versions and self-extracting executables for OpenVMS and Windows. These files contain all necessary sources, data, documentation and executables for the program package.
   The old MS-DOS distribution has been removed.
E. Code Revisions (See the relevant "Read Me's" for additional corrections):

ENSDAT	All 1998 NSDD meeting format proposals implemented except for Ionized Atom datasets Emulation of RadWare-style band drawings
FMTCHK	Added check on validity of parents in DSID Allow multiple parents if SF decay Updated H record checks to include proposed revisions discussed but not adopted at 1999 USNDP meeting Allow COMMENTS datasets for Nuclides Split errors (<E>) into errors (<E>) and fatal errors (<F>) and added option to only report fatal errors Added check for duplicate X records Give non-numeric calculated final levels if parent is non-numeric Added warning if level member of more than one band Added a check for duplicate DSID's Changed from to message on long records with non-blanks past 80 Implemented format changes approved at the 2000 USNDP meeting 1. Allow FL=? 2. Allow lowercase second letter for Author code 3. `%xx=?` was allowed in version 8.9e 4. Allow ENSDF as a citation on H record 5. Remove warning for H record changes proposed at USNDP1999 and adopted in 2000
GTOL	Do not include GAMMA records with "`FL=?` in the least-squares fit or the intensity balance calculations. Added estimates of upper limits of the calculated net feeding using the methods of Lyon
LOGFT	Modified to output a warning to the report file and terminal and add a comment to the B or E record when an allowed spectrum is assumed in the calculations (*i.e.*, when the type is not allowed or first- or second-forbidden unique).
NSDFLIB	The ZSYM/IZEL subroutine in NSDFLIB now recognizes "`NN`" instead of "`N  `" as the neutron chemical symbol. Corrected fatal error in CNVS2U when the single character "E" was passed
PANDORA	Do not check A,Z on P card for SF decay
RadList	The auxiliary atomic and atomic mass data files used by RadList have been updated to use the data in 1996Sc06 and 1995Au04, respectively.
TREND	Y2K Updates and expansion of PRINTS codes Attempt to distinguish between pre- and post-Y2K datasets (For additional corrections made, see READTREN.ME.)

F. The program PREND has been removed from the distribution.

G. Codes from other Centers: GABS has been updated to current formats and checked for Y2K compliance. No updates have been received for the codes GAMUT and SPINOZA.

Future Plans

A. GAMUT and SPINOZA: These programs need to be updated for the format changes since their last revision dates of September 1988 and August 1993, respectively. They will be **removed** from the distribution unless upgrades are received by the NNDC by January 1, 2001 or the NNDC is notified that they are Y2K compliant and compatible with the current ENSDF formats by this date.
   LOGFT:

   LBNL has provided their version of the code. Upgrading to calculate 3^{rd}- and 4^{th}-forbidden unique Log *ft*'s will begin after January 1, 2001.
   The program currently assumes that the theoretical values used in calculating the electron-capture fractions have no uncertainties, resulting in an underestimate of the electron-capture fractions uncertainty. This will be corrected using the data of Schönfeld.

B. RadList: Calculation of subshell conversion- and Auger-electron and X-ray intensities will be added and the calculation of continua spectra inproved. During this process, the relevant portions of the French version of the program will be included.

Tables

Analysis Codes						
Code	Function	Version No./Date	FORTRAN			Documentation
			ANS[a]	DVF[b]	VMS[c]	
ALPHAD	Calculates α R_0's, HF's and theoretical $T_{1/2}(\alpha)$'s	1.5a 19990409	X	X	X	No (See "Read Me" file)
DELTA	Analyzes angular correlation data.	1.01 19930415	X	X	X	LUNFD/(NFFR-3048) 1-27
GABS	Calculates absolute ΔI_γ's.	9 200005	X	X	X	Yes
GAMUT	Creates adopted levels, gammas from source data sets.	[d,e] 198809			X	LBL-26024
GTOL	Determines level energies from a least-squares fit to E_γ's & feedings.	6.3 20000523	X	X	X	BNL-NCS-23375/R LUNFD/(NFFR-3049) 1-27
HSICC	Interpolates internal conversion coefficients	11.13b 19990412	X	X	X	Nucl. Data **A4**, 1 Nucl. Data Tables **A6**, 235 (1969) Nucl. Data Tables **A9**, 119 BNL-NCS-23375/R (1977)
LOGFT	Calculates log *ft*.	7.15a 19990414	X	X	X	Nucl. Data Tables **A10**, 206 BNL-NCS-23375/R (1977)
NSDFLIB	Support subprograms for many codes	1.5d 19990628	X			Yes
PANDORA	Physics check of ENSDF data sets. Aids with adopted gammas & XREF.	6.5b 19990913	X	X	X	Yes
RadList	Calculates atomic & nuclear radiations. Checks energy balance.	5.5 19881005	X	X	X	BNL-NCS-52142
RULER	Calculates reduced transition probabilities.	1.20b 19990921	X	X	X	Yes
SPINOZA	Physics check of an ENSDF data set.	1(4)[d,e] 19930809		X	X	Unknown

a ANSI-standard FORTRAN 77
b Compaq/Digital Visual Fortran (WIN95/98)
c OpenVMS Fortran
d Program as received from the author.
e Program contains Open-VMS extensions of ANSI FORTRAN 77.

Utility Codes						
Code	Function	Version No./Date	FORTRAN ANS[a]	DVF[b]	VMS[c]	Documentation
ADDGAM	Adds gammas to adopted data set.	1(3) 19930414	X	X	X	No (See "Read Me" file)
COMTRANS	Converts the text comments of an ENSDF dataset to a "rich text format"	6.0 19991013		X[d]	X[d]	No (See "Read Me" file)
ENSDAT	Produces tables and drawings	9.7 20000911		X[d]	X[d]	No (See "Read Me" file)
FMTCHK	ENSDF format checking	8.9i 20000522	X	X	X	No (See "Read Me" file or "Read Me" in HTML)
NSDFLIB	Support subprograms for many codes	1.5d 19990628	X			Yes
TREND	Tabular display of ENSDF data.	8.20 20000412	X	X	X	No (See "Read Me" file)

a ANSI-standard FORTRAN 77
b Compaq/Digital Visual Fortran (WIN95/98)
c OpenVMS Fortran
d Only the executables are available

Thomas W. Burrows.

The latest version of this report is maintained at
http://www.nndc.bnl.gov/nndcscr/ensdf_pgm/code_status.html.

Isotopes Project

LAWRENCE BERKELEY NATIONAL LABORATORY

E.B. Norman (Project Leader)
C.M. Baglin, E. Browne, S.Y. Chu (to 5/00), R.B. Firestone.

Report prepared for the December 2000 IAEA Advisory Group Meeting on Coordination of the International Network of Nuclear Structure and Decay Data Evaluators. This report covers the period from December 1998 to November 2000.

A. NUCLEAR STRUCTURE AND DECAY EVALUATION

Mass Chain Responsibility:

A = 59, 81, 83, 90-93, 166-187, 189, 191-193, 206, 210-212, 215, 219, 223, 227, >266

PERSONNEL

The group's data evaluation effort has ranged from 2.0 to 2.5 FTE during the period covered by this report.

In addition, two guests spent leave with the Isotopes Project: Professor Shiu-Chin (Alice) Wu (Taiwan) (to August '99 and Jul.–Sept. 2000) and Dr. Jean Blachot (October '99). Dr. Wu evaluated A=46 and A=83, and Dr. Blachot assisted with the preparation of ENSDF files for A=21-29 based on the 1998 update evaluation of A=21-44 by Peter Endt.

Ongoing international collaborations exist with Gabor Molnar (Hungary) and Zhou Chunmei (China) (preparation of evaluated (n,γ) data), and with French, German, British, US, Spanish and Russian scientists participating in a radioactive decay data evaluation project.

The group is indebted to Jean Zipkin (also a guest of LBNL) for data entry of many (n,γ) and A=21-39 datasets.

EVALUATION/COMPILATION ACCOMPLISHMENTS

- **Mass Chains**

  Submitted: 46, 83, 92, 167, 169, 174, 215, 219, 223, 227, 231, A>266

  Published: 91, 167, 174, 206, A=267-293

- **Complete Nuclide Evaluations**

  The nuclide evaluations (listed below) were undertaken because of their ‘priority’ status (those marked with *), the existence of significant, newly-published information which could be expeditiously included in ENSDF (thus improving the timeliness of the file), the need to revise α-decay parent or daughter information (for internal consistency of the file), or the absence of a published evaluation for the nuclide.

  - Published in Nuclear Data Sheets:
    ^{170}Pt, ^{181}Pt, ^{181}Au, ^{181}Hg, ^{186}W, ^{187}Tl*, ^{183}Hg*.
  - Unpublished; reviewed and added to ENSDF:
    ^{81}Zr, ^{166}W*, ^{168}Tb/Dy, ^{170}Os, ^{170}W, ^{170}Yb, ^{171}Os, ^{171}Ir, ^{171}Pt, ^{171}Au, ^{179}Ta, ^{183}Au, ^{186}Hf, ^{186}Ta, ^{187}Pb, ^{191}Po, ^{191}Bi.
  - Submitted: ^{91}Kr, ^{91}Sr, ^{91}Zr.

    * Priority nuclide

- **Decay Data Evaluation Project (DDEP) Participation**

  DDEP Nuclides Evaluated:
  ^{44}Sc, ^{60}Fe.

  DDEP Evaluator Training:
  LBNL organized (with INEEL) a special two-week training session at LBNL for non-US evaluators who had recently joined the Decay Data Evaluation Project.

  ENSDF-Coding of non-US DDEP Evaluations:
  “Decay” and “Adopted” datasets were prepared for inclusion in ENSDF for ^{68}Ge, ^{68}Ga, ^{125}I, ^{141}Ce.

- **Continuation of IAEA CRP to develop an (n,γ) Database:**

  This 3-year IAEA-sponsored Coordinated Research Project is to be completed in 2002. It aims to produce a database for use in neutron-induced prompt gamma-ray activation (PGAA) analysis. Thermal and cold neutron capture isotopic data are being evaluated in China and the US to obtain best values for gamma-ray yields per 100 neutron captures. CRP participants in Hungary and the US will then combine those data (in ENSDF format) with measured elemental data (from Hungary and elsewhere) to produce recommended values for prompt-gamma energies and intensities and other useful information. The database will be tested at several neutron facilities.

  Evaluated (thermal n,γ) data sets not already in ENSDF will be made available to NNDC for inclusion in ENSDF.

- **ENSDF Coding of non-US Evaluation:**
  (1998 Update for A=21-44 by P. Endt)

  All chains from A=21 to A=39 have been submitted for inclusion in ENSDF and are currently in review. For each chain:

  - The updated information from Endt (1998) was added to the “Adopted Levels, Gammas” datasets.

- The existing decay datasets in ENSDF were updated from the literature and new datasets were created as needed.
- Reaction datasets were created from material given in Endt's evaluation (this information had not been in ENSDF).
- Evaluated (n,γ) datasets (from the IAEA CRP activity) were added.

- **Reviews of Evaluations**

  Mass Chains: A=52, 107, 109, 121

  DDEP Nuclides: ^{85}Sr, ^{166}Ho, ^{166m}Ho, ^{241}Am.

- **Compilation**

Approximately 7 datasets were prepared and included in the XUNDL database.

B. NUCLEAR DATA DISSEMINATION

PERSONNEL

The group's data dissemination effort has ranged from 1.5 to 0.5 FTE during the period covered by this report.
Approximately 1.0 FTE additional effort has been provided by students visiting from EVITech, Finland and Lund University, Sweden.

DISSEMINATION ACTIVITIES

1. Isotope Explorer

Isotope Explorer 3.0 was released for Internet use in 1999 and can be accessed at http://ie.lbl.gov/ensdf/. This platform-independent version of the program can download ENSDF data from the Isotopes Project Server. The ENSDF format data can be displayed as level scheme drawings and Nuclear Data Sheet style tables. The data can be selected by level properties (E, JPI, half-life), gamma-ray coincidence relationships, or nuclear structure and band assignments. Tables can be displayed with comments included. Isotope Explorer 3.0 can also retrieve the keyword abstracts for the references from the WWW.

Most ENSDF retrieval is still done using the more versatile Isotope Explorer 2.0. A tour of its capabilities, and the user manual can be downloaded from the WWW at http://ie.lbl.gov/isoexpl/isoexpl.htm. In addition, it is available on the *Table of Isotopes* CD-ROM complete with the ENSDF and NSR databases. There are over 3200 registered users, and about 1600 users express interest in this program each month. Isotope Explorer users downloaded ENSDF datasets for about 450,000 isotopes during the past year. Month-to-month usage fluctuates substantially, possibly coinciding with preparation for major meetings. Usage since 1996 is summarized in Figure 1.

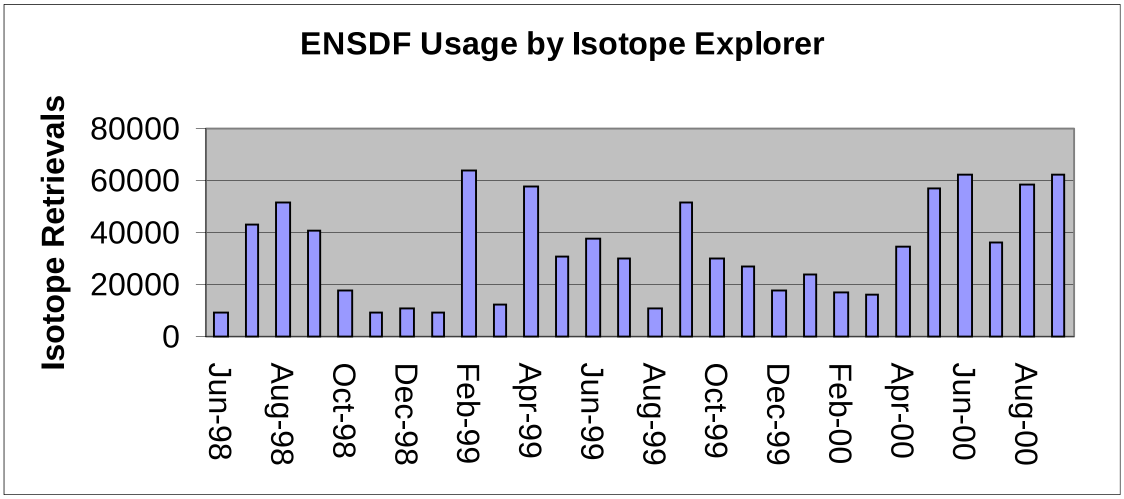


Figure 1. Usage of Isotope Explorer 6/98 – 9/00

2. LBNL/Lund WWW Table of Radioactive Isotopes

The LBNL/Lund Table of Radioactive Isotopes on the WWW may be accessed at http://nucleardata.nuclear.lu.se/Database/toi. Gamma-ray and alpha-particle data from ENSDF and the *Table of Isotopes* can be searched by combination of energy and nuclide range. Additional information, including x-ray, Auger, and continuous radiations, was added in 1999. This service has been provided for about 6 months with usage rising rapidly. Nearly 220,000 data requests were received by the Table of Radioactive Isotopes web site in 1999.

3. LBNL/Lund Isotope Explorer NSR Server

The LBNL/Lund Isotope Explorer NSR Server on the WWW supersedes the 1996 Nuclear Data and References CD-ROM. This information can be accessed from the LBNL server at http://128.3.5.61:6023/welcome.htm. References from the Nuclear Science Reference file can be selected using any combination of author, nuclide, keynumber, publication date, reaction, keyword, and data type. The Isotopes Project or Lund server selects references satisfying the selection criteria and the keyword abstracts are returned to the user and displayed. Currently about 3000 reference requests are processed each month.

4. World Wide Web

The Isotopes Project has continued to update and improve its WWW home pages. Linked home pages for access to data from the *Table of Isotopes*, nuclear astrophysics, high-spin nuclear structure, radioactive decay, atomic masses, neutron capture gammas, fission, and other topics have been developed. These home pages can be accessed from the WWW at http://ie.lbl.gov/toi.html. Data are provided in text, Postscript, and Portable Document Format. About 10,000 separate users per month submitted over 2.5 million data requests last year. The usage since 1998 is summarized in Figure 2.

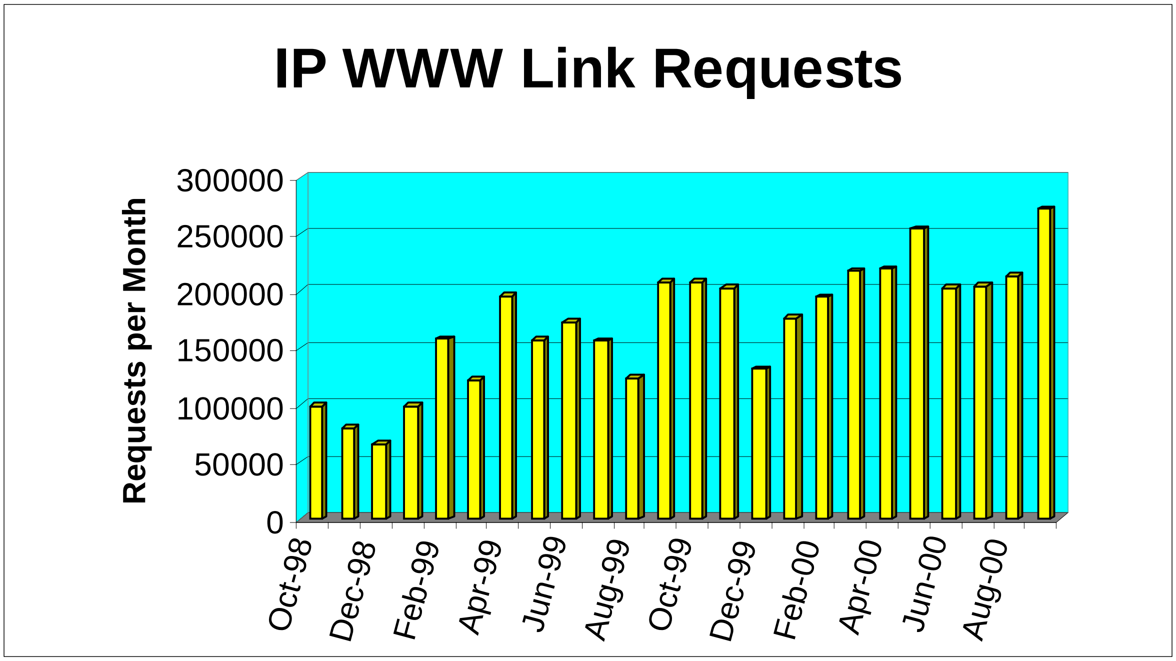


Figure 2. Usage of Isotopes Project WWW sites 10/98 – 9/00

- **Nuclear Astrophysics Home Page** (~750 users/mo.)

The Nuclear Astrophysics home page at http://ie.lbl.gov/astro.html includes a comprehensive bibliography of interest to researchers in the nuclear astrophysics community. Links are provided to those references or data that are available in electronic form. Stellar nucleosynthesis data from Hoffman and Woosley, Thielemann *et al*., and others, are made available from this home page in both text and Postscript format.

- **High-Spin and Nuclear Structure Home Page** (~500 users/mo.)

An electronic edition of the *Table of Superdeformed Nuclear Bands and Fission Isomers* is available from the High-Spin and Nuclear Structure home page at http://ie.lbl.gov/hspin.html. This home page also provides reference lists and links to information of interest to nuclear structure researchers.

- **Decay Data Home Page** (~800 users/mo.)

The decay data home page at http://ie.lbl.gov/decay.html provides summary mass-chain decay schemes and nuclear charts from the *Table of Isotopes*; energy-ordered tables of gamma rays from radioactive decay; alpha and gamma energy and intensity standards; data from the 1986 edition of the *Table of Radioactive Isotopes*; and links to information of interest to users of decay data.

- **Atomic Masses Home Page** (~1100 users/mo.)

The atomic mass home page at http://ie.lbl.gov/toimass.html provides access to the experimental atomic mass tables of Audi et al and 14 calculated mass tables.

- **Thermal Neutron Capture Home Page** (~700 users/mo.)

The Thermal Neutron Capture home page at http://ie.lbl.gov/ng.html was developed jointly by the Isotopes Project and the Institute for Isotope and Surface Chemistry, Hungary. Lone *et al*. gamma-ray yield data, ENSDF (n,γ) E=thermal data for A>44, LBNL/Hungary (n,γ) compilation for A<45, isotopic abundances, and thermal neutron cross sections are available from this site.

- **Fission Home Page** (~700 users/mo.)

The Fission home page at http://ie.lbl.gov/fission.html contains fission yields compiled by England and Rider and spontaneous fission data from ENSDF.

- **Education Home Page** (~3600 users/mo.)

The Education home page at http://ie.lbl.gov/education/isotopes.htm serves students of all ages from around the world with information on isotopes and an animated glossary of nuclear and astrophysical terms. This page is incorporated into the science curriculum of many schools and we receive considerable feedback from young people.

- **Other Data Pages** (~2600 users/mo.)

Additional home pages for atomic data, elemental data, education, nuclear moments, interaction of radiation with matter and other topics are available.

5. Other Dissemination Activities

The Isotopes Project is a participant in the USNDP Dissemination Collaboration effort to produce a single web interface to the ENSDF, XUNDL, NSR, and other databases. The group is also developing the web interface to the Prompt Gamma-ray Activation Analysis database in collaboration with the IAEA Coordinated Research Project for the Development of a Database for Prompt Gamma-ray Activation Analysis.

C. PUBLICATIONS and INVITED TALKS

Mass Chain or Nuclide Evaluations

Nuclear Data Sheets for ^{170}Lu, Coral M. Baglin, Nuclear Data Sheets **85**, 575 (1998).

Nuclear Data Sheets for ^{179}Ir, Coral M. Baglin, Nuclear Data Sheets **85**, 595 (1998).

Nuclear Data Sheets for A=91, Coral M. Baglin, Nuclear Data Sheets **86**, 1 (1999).

Nuclear Data Sheets for ^{170}Pt, Coral M. Baglin, Nuclear Data Sheets **86**, 449 (1999).

Nuclear Data Sheets for ^{186}W, Coral M. Baglin, Nuclear Data Sheets **86**, 455 (1999).

Nuclear Data Sheets for ^{187}Tl, Coral M. Baglin, Nuclear Data Sheets **86**, 487 (1999).

“Table de Radionucléides”, M.-M. Bé, N. Coursol, B. Duchemin, J. Lamé, C. Morillon, F. Piton, E. Browne, V. Chechev, R. Helmer and E. Schönfeld, Document CEA-ISBN 2 7272 0200 8 (1999); CD-ROM “Nucléide”, the computerized form of “Table de Radionucléides”, version: 1-98, 19/12/98, CEA Laboratoire Primaire des Rayonnements Ionisants.

“Table of Radionuclides: Comments on Evaluations”, M.-M. Bé, B. Duchemin, E. Browne, S.-C. Wu, V. Chechev, R. Helmer and E. Schönfeld, Document CEA-ISBN 2 7272 0211 3 (1999).

Nuclear Data Sheets for A=174, E. Browne and J. Huo, Nuclear Data Sheets **87**, 15 (1999).

Nuclear Data Sheets for ^{181}Pt, Coral M. Baglin, Nuclear Data Sheets **87**, 197 (1999).

Nuclear Data Sheets for ^{181}Au, Coral M. Baglin, Nuclear Data Sheets **87**, 225 (1999).

Nuclear Data Sheets for ^{181}Hg, Coral M. Baglin, Nuclear Data Sheets **87**, 239 (1999).

Nuclear Data Sheets for A=206, E. Browne, Nuclear Data Sheets **88**, 29 (1999).

Nuclear Data Sheets for A=267-293, R.B. Firestone and J. Gilat, Nuclear Data Sheets **90**, 293 (2000).

Nuclear Data Sheets for A=167, Coral M. Baglin, Nuclear Data Sheets **90**, 431 (2000).

Nuclear Data Sheets for ^{183}Hg, Coral M. Baglin, Nuclear Data Sheets **91**, 117 (2000).

Outreach Talks on Nuclear Data

“Data Dissemination Activities of the U.S. Nuclear Data Program”, Richard B. Firestone, Bull. Am. Phys. Soc. **44**, 263, FB11.3 (Atlanta, 1999).

“The Decay Data Evaluation Project”, E. Browne, Bull. Am. Phys. Soc. **44,** Paper CE.14 (Asilomar, 1999).

“WWW Table of Radioactive Isotopes”, R.B. Firestone, L.P. Ekstrom, S.Y.F. Chu, Bull. Am. Phys. Soc. **44**, Paper CE.13 (Asilomar, 1999).

“Update on the U.S. Nuclear Structure and Decay Data Evaluation Program”, Coral M. Baglin, Bull. Am. Phys. Soc. **45**, No. 2, 30, B14.7 (Long Beach, 2000).

Other Talks/Publications Related to Nuclear Data

“A New Gamma-Ray Spectrum Catalog for PGAA”, Z. Rezavy, G.L. Molnar, T. Belgya and R.B. Firestone, Proc. 10th International Conference on Modern Trends in Activation Analysis (MTAA-10), 19-23 April 1999, Bethesda MD (invited paper).

Table of Isotopes, 8th Edition, 1999 CD-ROM Update, John Wiley & Sons, Inc., NY, R.B. Firestone, Coral M. Baglin, S.Y. Frank Chu (July 1999).

"IAEA Coordinated Research Project on the Development of a Database for Prompt Gamma-Ray Neutron Activation Analysis: Progress Report", Richard B. Firestone in **INDC(NDS)-411**, 45 (2000).

"The New Prompt Gamma-ray Catalog for PGAA", G.L. Molnar, Zs. Revay, T. Belgya and R. B. Firestone, Proc. 4th Topical Meeting on Industrial Radiation and Radioisotope Measurement Applications (IRMMA'99), 3-7 October 1999, Raleigh NC; Appl. Radiat. Isot. **53**, 527 (2000)

"Nuclear Structure and Decay Data in the Electronic Age", R.B. Firestone, J. Radioanal. Nucl. Chem. **243**, 77 (2000).

"Application of Prompt Gamma Activation Analysis (PGAA) to Inorganic Photochromic Host Materials", D.L. Perry, R. Gatti, R.B. Firestone, G.L. Molnar, Z. Rezavy and Z. Kasztovszky, Am. Chem. Soc. National Meeting, 26-30 March 2000, San Francisco CA, Paper INOR590.

"Application of Prompt Gamma Activation Analysis (PGAA) to Ocean Floor Geothermal Vent-Produced Metal Sulphides", D.L. Perry, R. Gatti, R.B. Firestone, P. Wilde, G.L. Molnar, Z. Rezavy and Z. Kasztovszky, Am. Chem. Soc. National Meeting, 26-30 March 2000, San Francisco CA, Paper GEOC83.

"The Nuclear Science Database: 60 Years of Community Experience", keynote address to the HUGO Mutation Database Initiative Meeting, 9 April 2000, Vancouver, Canada.

"Databases: Science's Neglected Legacy", S.M. Maurer, R.B. Firestone and C.R. Scriver, Nature **405**, 116 (2000).

Other Nuclear Science Publications Involving Isotopes Project Personnel:

Collective Band Structures in Neutron-Rich ^{107,109}Ru Nuclei, S.-Z. Zhu, C.-Y. Gan, …, S.Y. Chu, *et al.*, Chin. Phys. Lett. **15**, 793 (1998).

Octupole Correlations in Neutron-Rich ^{145,147}La Nuclei: Coriolis-limit-coupling bands with aligned h11/2 Proton, S.Z. Zhu, J.H. Hamilton, …, J. Gilat, …, S.Y. Chu, *et al.*, Phys. Rev. **C59**, 1316 (1999).

Octupole Deformation Bands of $\pi h_{11/2}$ in Neutron-Rich ^{145,147}La Nuclei, …. , S.Y. Chu, *et al*., Chin. Phys. Lett. **16**, 169 (1999).

Cosmic Ray Half-Life of ^{56}Ni, K. Zaerpoor, Y.D. Chan, M.R. Dragowsky, M.C.P. Isaac, K.S. Krane, R.-M, Larimer, A.O. Macchiavelli, R.W. MacLeod and E.B. Norman, Phys. Rev. **C59**, 3393 (1999).

Octupole Correlations in Neutron-Rich ^{143,145}Ba and a Type of Superdeformed Band in ^{145}Ba, S.J. Zhu, …, S.Y. Chu, *et al.*, Phys. Rev. **C60**, 051304 (1999).

Octupole Deformation and Signature Inversion in ^{145}Ba, S.J. Zhu, …, S.Y. Chu, Chin. Phys. Lett. **16**, 715 (1999).

Systematic Investigation of Hexadecapole Collectivity in Even-even Nuclei, R.K. Sheline, B. Singh, P.C. Sood, S.Y. Chu, Czech. J. Phys. **49**, 1047 (1999).

Identification of Levels in Neutron-Rich ^{145,147}Ce Nuclei, M. Sakhaee, …, S.Y. Chu, *et al.*, Phys. Rev. **C60**, 067303 (1999).

High-Spin States in Neutron-Rich Even-Even Pd Isotopes, K. Butler-Moore, …, S.Y. Chu, *et al.*, J. Phys. (London) **G25**, 2253 (1999).

Quadrupole-Octupole Coupled States in ^{144}Nd, S.J. Robinson, M.M. Hindi …E.B. Norman, *et al.*, Phys. Lett. **465B**, 61 (1999).

Internal Bremsstrahlung Endpoint of ^{54}Mn, M.M. Hindi, R.-M. Larimer, E.B. Norman and G.R. Rech, Phys. Rev. **C61**, 55501 (2000).

Measurement of Excitation Functions in the Reaction ^{197}Au(^{11}C,xn)$^{208-x}$At Using a Radioactive ^{11}C Beam, R. Joosten, J. Powell, F.Q. Guo, P.E. Haustein, R.-M. Larimer, M.A. McMahon, E.B. Norman, et al., Phys. Rev. Lett. **84**, 5066 (2000).

CAJaD activity related with ENSDF in 1999-2000

F.E.Chukreev
CAJaD, "Kurchatov's Institute", Russian Federation

Data Evaluation. Sorry, but I has been forced to stop my activity for ENSDF in January 1999 and I could return to the activity in October 2000 only.

Now we update A=238 as after 1996 year, when the evaluation was prepared, some new interesting papers were published. The new publication request serious corrections in 1996 version. We hope to finish it before March 2000.

It is very hard to find new evaluators. Dr. V. Makarenko, which helped me to prepare A=238, stopped his activity in 1999. New attempts to find new evaluators are continuing constantly. One volunteer is found now. He begin A=240 evaluation. However, real manpower now is 0.5*Chukreev.

Data Dissemination. We decided to refuse from creating separate CAJaD Web site. Very good cooperation with CDFE (Moscow State University) permits to include ENSDF data on http://depni.npi.msu.su/cdfe. The Web site is supported by computer power of Moscow State University, similar support in Kurchatov's Institute is impossible now.

Our plan for nearest future to include results of A.A.Soldatov and D.P.Grechukhin regarding to probabilities of isomer transitions with very low energies (< 2 KeV) and table of isotopic compositions.

Support. Our ENSDF activity has not any financial support.

Status of the Data Center
of the Petersburg Nuclear Physics Institute of the RAS

From the beginning of 2000 the Data Center of the Petersburg Nuclear Physics Institute of the Russian Academy of Sciences has restored its activity. Now there are 8 persons in its structure: four nuclear physicists, a mathematician and three programmers. The group is supplied with the necessary equipment and is integrated in an infrastructure of the Institute.

The Data Center continues refereeing of Russian publications on nuclear physics in the format NSR. Among them are the theses of the reports presented on Annual Conferences on Nuclear Spectroscopy and Structure of Atomic Nuclei, preprints of Joint Institute for Nuclear Research and Petersburg Nuclear Physics Institute. These activities can be extended, if we receive other editions.

In Data Center the original publications containing experimental data on properties of low-lying states of nuclei with A=132 are assembled. The new data are presented in the format ENSDF. The level schemes are constructed and the estimation of these data is carried out according to the requirements of "Procedures Manual for the ENSDF". This operation is carried out with positive acceleration, and we hope, that in the beginning of the next year we can present the first version of the review in the format ENSDF with our comments.

The group has plans on creation of data samples from ENSDF and their systematics on the basis of appropriate nuclear models. In our opinion, such an approach is completely necessary for successful development of ENSDF and should be additional to the estimation of data.

In particular, «Atlas of rotational bands in odd nuclei» has been created on the basis of ENSDF. Now it is in practice being prepared for publication. Our Atlas contains more than the two thousands rotational bands. The description of energies of rotational levels is carried out using the model of a variable moment of inertia. Much attention was given to graphical presentation of the information. As a result, the association of observable fragments of bands is offered, the extra levels are eliminated. The found global behaviours of model parameters are of interest for the nuclear theory.

The compilation of properties of monopole states (spin-parity is 0+) of even-even nuclei is completed. The database obtained on the basis of ENSDF includes energies, lifetimes, multipolarities, intensities and reduced probabilities of transitions. The analysis of these data will be carried out on the basis of macroscopic nuclear models.

The systematics on rotation of odd nuclei and on monopole states together with appropriate retrieval systems facilitating search for information will be placed on the Web-site of our Data Center.

The Data Center of Petersburg Nuclear Physics Institute makes a request to Advisory Group to support our activities. We are sure that the results of these activities do not only represent independent interest for the experts, but are also the powerful tool for improvement of an estimation of new nuclear data.

I.A.Mitropolsky,
Head of the Data Center
of Petersburg Nuclear Physics Institute
of Russian Academy of Sciences.
Gatchina, Leningrad region
188300, Russia

December 1, 2000

Annex 8. Status Reports: Projects and Other Activities

1. High-spin Task-Force / XUNDL Status Report (Dec. 1998 – Dec. 2000)
   B. Singh, McMaster University, Canada
2. Decay Data Evaluations and Related Activities of the Radionuclide Data Center (1998 – 2000 Progress Report)
   V.P. Chechev, Khlopin Radium Institute, Russia
3. Report to the International Nuclear Structure and Decay Data Network on the Georgia Tech Group Activity
   J. Wood, Georgia Institute of Technology, Atlanta, Georgia, USA
4. Decay Data Evaluation Project Report
   R. Helmer, Idaho Group, USA

High-spin Task-Force / XUNDL Status Report (Dec. 1998- Dec. 2000)
(Prepared by B. Singh, McMaster, Dec, 1, 2000)

XUNDL database

Provides prompt Internet access to recently published or completed (fully analyzed but not published) primarily high-spin level-scheme data that are not yet available in ENSDF database. (The database is not limited to high-spin papers, there are some low-spin compilations also.)

Convenient access to different viewers (LBNL's Isotope explorer, Oak Ridge's RADWARE, BNL's on-line retrieval) and, to the published article on journal Web page (if the user has valid internet access to the journal). Database is indexed by mass number, nuclide and reference keynumber.

The XUNDL database is organized and managed by David Winchell and Tom Burrows at NNDC, BNL.

STATUS

Since Jan. 1999, 585 data sets have been added to XUNDL, mostly from papers published in 1998-2000. (Almost all the high-spin papers in 1998-2000 are included (2001: 1; 2000: 115; 1999: 108; 1998: 115; 1997: 41; 1996: 64; 1995: 42; 1994-1990: 31).

About 455 data sets were compiled at McMaster, using semi-automated translation procedures. About 130 data sets were received by McMaster group from other data centers (about 90 from Berkeley and about 40 from Grenoble). These data sets were checked and edited at McMaster, prior to inclusion in XUNDL.

A lot of actual compilation work is done by undergraduate summer students (Jordan Chenkin: May 1999-April 2000; George Reed: May 2000- present). The students are trained in basic nuclear physics, ENSDF formats, semi-automatic translation codes, consistency checking codes such as FMTCHK, GTOL, etc. The students' work is checked thoroughly by data evaluator before submitting a dataset to BNL. Generally, one undergraduate student works full time during the summer months (May to August) and part-time (7-10 hours/week) during the study semesters.

Data errors found in original published level schemes, based on level-scheme checking codes, are routinely communicated to the original authors for corrections or comments. Most common type of data errors found in the publications are: 1. Quoted gamma-ray energy does not match the level-energy difference. 2. Spins and parities quoted in tables are different from those in figures.

Presently XUNDL has 585 data sets from 511 papers covering data for 478 nuclides from ^{36}Ar to ^{254}No, amongst 174 A-chains (A=39 to 254, 95% content is high-spin level chemes.)

We are almost up-to-date (as of Dec. 1, 2000) with the coverage of high-spin papers for XUNDL. Only 3 papers remain to be included, which are being worked on at present.

When we run out of current papers to compile, we compile high-spin papers for A-chains, which are quite outdated in ENSDF. During this year we have compiled high-spin data for about 5 mass chains which were more than 10 years old in ENSDF.

Other high-spin updates

Superdeformed structures:

Full update of SD band data for ENSDF was completed at McMaster in September 1999, and another one in Nov. 2000. All published SD band data (as of Dec 1, 2000) are included in ENSDF.

Magnetic rotational bands:

A compilation of all the known dipole bands of this type (about 120 bands) with literature coverage up to August 99 has been published in Atomic and Nuclear Data Tables (March 2000 issue). Since then there are only two more papers on this subject. This work was done in collaboration with a theoretical nuclear physics group in India.

Semi-automated Procedures to Translate Tabular data in journals into ENSDF format

• **Step 1: Create text file of tabular data**.

In the literature the level-scheme data are generally presented in one of the three styles:

1. Complete Tabular data: E_γ, I_γ, $E_{initial}$, $J_{initial}$, A_2, A_4, DCO, Multipolarity, Mixing ratio, Band label, etc. (Almost fully automatic; takes ~ 30 minutes to get a first draft of a dataset in ENSDF format, irrespective of the complexity of level scheme and number of gamma rays and levels involved).

2. Partial Tabular data: No $E_{initial}$, $J_{initial}$, Band label, etc. (Partially automatic).

3. No Tabular data, only the level-scheme figure in paper. (<50% automatic).

For style #1: Create text file by extracting tabular data, using:
Adobe Acrobat for PDF files from web; or Scanner for hard-copy tables from LATEX; or Postscript Files, followed by the use of OCR software.

For style #2: Create text file #1 as above for style #1.Create text file #2, by entering $E_{initial}$ and $E\gamma$'s, as read from the level-scheme figure in a spreadsheet program such as EXCEL. Combine the two text files in EXCEL to get a final text file.

For style #3: Create text file by entering $E_{initial}$ and Eγ's, as read from the level-scheme figure in a spreadsheet program such as EXCEL.

For styles #2 and #3, it may take up to 3-4 hours, depending upon the complexity of the level scheme.

- **Step 2: Edit the text file created in step 1, using a text editor**.

Arrange the data in columns with appropriate headings: (Ei, Eg, Ig, Ji, A2, MR, MU, DCO). At present T1/2 and A4 headings are not allowed in the code. The file must be free of any tabs (i.e. there should be spaces only). Use Radford's **TXT2ENSDF** (PC) code to convert the text file in step #1 to ENSDF format.

- **Step 3: Check the ENSDF formatted data set for level-scheme consistency and possible data problems in publications**:

Use BNL's **GTOL** code to perform a least-squares adjustment of the level-scheme and check for poorly fitted Eγ's. Use BNL's FMTCHK to check the formatting of the data set. (Communicate with original authors if there are data problems in a paper).

- **Step 4: Check the final ENSDF formatted data set using LBNL's viewer 'Isotope Explorer' to verify that the level scheme and the band assignments, correctly, match the publication.**

Decay Data Evaluations and Related Activities of the Radionuclide Data Center (1998-2000 Progress Report)

V.P. Chechev

V.G. Khlopin Radium Institute, St. Petersburg
Russia

1. Decay data evaluations

Since 1998 these evaluations are made within the framework of the international Decay Data Evaluation Project (DDEP) cooperation and also the IAEA CRP on X-, gamma-ray standards. For chosen applied radionuclides the final tables of the evaluated values of decay characteristics are presented in the form adopted by DDEP participants with the purpose of the data publication in Table de Radionucleides (BNM-CEA/DTA/LNHB, France). Also after review of DDEP members results of the evaluations are entered into ENSDF.

For ^{3}H, ^{14}C, ^{35}S, ^{36}Cl, ^{111}In decay data evaluations which I completed in 1998 the ENSDF data sets were created by R.G.Helmer in March-April 1999.

In 1999-2000 an analysis of decay schemes and associated experimental data has been completed and the evaluation results have been obtained for the 11 radionuclides: ^{99}Mo+^{99m}Tc (in cooperation with LNHB, France), ^{57}Co, ^{67}Ga, ^{93m}Nb, ^{129}I, ^{133}Ba, ^{154}Eu, ^{155}Eu, ^{170}Tm and ^{241}Am. At present the final versions of data evaluations, after review, are available for ^{67}Ga, ^{133}Ba, ^{170}Tm and ^{241}Am. Others should be reviewed.

2. Measurements of KX- and gamma-ray absolute emission probabilities

In 1998 within the framework of the international intercomparison EUROMET-410 such measurements were made for photons accompanying the decay of ^{169}Yb. The measurement results have practically coincided with the final average values of the EUROMET-410 (in limits of uncertainties).

In 2000 the measurements have started for making precise definition of the absolute emission probability of KX-rays in the ^{237}Np+^{233}Pa decays (in cooperation with LNHB, France).

3. Dissemination of nuclide data

a) The national standard reference data (SSD) have been worked out for half-lives and gamma-ray energies and emission probabilities for the radionuclides forming parts of the standard spectrometric gamma-ray sources (OSGI): ^{22}Na, ^{54}Mn, ^{57}Co, ^{60}Co, ^{65}Zn, ^{75}Se, ^{88}Y, ^{109}Cd, ^{113}Sn, ^{133}Ba, ^{137}Cs, ^{139}Ce, ^{152}Eu, ^{228}Th, ^{241}Am. The SSD values include mainly the 1999 DDEP evaluation results.
b) The 1999-2000 DDEP and ENSDF evaluated values have been entered into the database of the Radionuclide Data Center, PC system, which contain short information on characteristics of the all the known nuclides, with the purpose updating the NUCLIDE GUIDE(Moscow, 1995) and the wall type NUCLIDE CHART (Moscow, 1998).

4. Radionuclide data for astrophysics

An analysis of radionuclide data and data on meteoritic abundances of daughter nuclides for the extinct natural radionuclides of ^{26}Al, ^{53}Mn, ^{60}Fe, ^{107}Pd, ^{129}I, ^{146}Sm and ^{244}Pu has been fulfilled. Based on the total set of the data mentioned above the parameters of the last nucleosynthesis events in the neighborhood of the nascent solar system have been evaluated.

5. Publications

1. V.P.Chechev. Search for optimum approach to evaluating data with different consistency. INDC(NDS)-399, March 1999, Vienna, p.116-118.
2. V.P.Chechev. Remarks on the LWEIGHT program. INDC(NDS) -399, March 1999, Vienna, p.119-122.
3. V.P.Chechev. Evaluation of the decay characteristics of ^{3}H and ^{36}Cl. INDC(CCP)-419, IAEA, April 1999, p.1-18.
4. M.–M. Be, E.Browne, V.Chechev, R.Helmer, E.Shoenfeld et al. Table de Radionucleides. CEA-ISBN 2-7272-0200-8, France, 1999.
5. M.-M. Be, E.Browne, V.Chechev, R.Helmer, E.Shoenfeld et al. Table de Radionuclides-Comments on evaluations, CEA-ISBN 2-7272-0211-3, France, 1999.
6. V.P.Chechev, N.K.Kuzmenko. The evaluation of decay and radiation characteristics of ^{93m}Nb, ^{111}In and ^{170}Tm in the framework of the international research program “Standards of X- and γ-rays”. In: International Conference on Nuclear Physics “Nuclear Shells – 50 Years” (49th Meeting on Nuclear Spectroscopy and Nuclear Structure), 21-24 April 1999, Dubna, Russia. Editors: Yu.Ts.Oganessian and R.Kalpakchieva, World Scientific, Singapore, 2000, p.534 - 543.
7. V.P.Chechev and A.G.Egorov. Search for an optimum approach to the evaluation of data of varying consistency: half-live evaluations for ^{3}H, ^{35}S, ^{55}Fe, ^{99}Mo and ^{111}In. Appl. Radiat. Isotop. 52(3), 2000, p. 601-608.
8. V.P Chechev and N.K Kuzmenko, The evaluation of decay and radiation characteristics of ^{93m}Nb, ^{111}In and ^{170}Tm. Izmeritelnaya Tekhnika, N 2 (2000) 49-54 (in Russian).
9. V.P Chechev and N.K Kuzmenko. Decay of ^{67}Ga. In: International Conference “Clustering Phenomena in Nuclear Physics” (50th Meeting on Nuclear Spectroscopy and Nuclear Structure), 14-17 June 2000, St.Petersburg, Russia, p.406.

Report to the International Nuclear Structure and Decay Data Network on the Georgia Tech Group activities

J. Wood

In the past two years the Georgia Tech Group has accomplished the following:

Completion of a horizontal survey of electric monopole transition strength. The final form of the survey is embodied in a published article "Electric monopole transitions from low-energy excitations in nuclei", J.L.Wood et al., Nucl. Phys. A, Vol. 651, pp. 323-368 (1999).

Initiation of an on-going project in horizontal nuclear data systematics. This has been launched with the hiring of a postdoctoral research fellow (Ana-Maria Oros-Peusquens). The first topic chosen for the program involves low-energy collective features (excitation energies, electric quadrupole transition probabilities) of double-even nuclei.

Once this has been brought to a "first draft" we plan to develop systematics for far-from-beta-stability regions, especially for neutron-rich nuclei in preparation/anticipation of nuclear structure studies with neutron-rich radioactive beams.

Decay Data Evaluation Project (DDEP)

Richard Helmer (Idaho Group)

The Decay Data Evaluation Project has published the evaluations for the decay of 29 radionuclides including the detailed comments of the evaluators on the methods used in the analysis of the measured data. For all of these data, corresponding decay and adopted data sets have been prepared for inclusion in ENSDF and provided to the National Nuclear Data Centre or the appropriate mass chain evaluators. This Project makes use of non-ENSDF evaluators in France, Germany, Russia, Spain, and the United Kingdom as well as ENSDF evaluators from the United States.

Annex 9. Proposals/Position Papers

1. Spin-parity assignements in high-spin studies
   B. Singh and J.C. Waddington, McMaster University, Canada
2. Simple way to avoid underestimating uncertainties of the evaluated values for sets of cosistent data: a proposal for an improvement of evaluation
   V.P. Chechev, Radionuclide Data Center, V.G. Khlopin Radium Institute, Russia

3 Proposed changes to the NDS introductary material
   C.W. Reich, INEEL, USA

4. New Software Tools for Evaluating and Disseminating Nuclear Data
   T. Langlands[1], E. Miyake[1], C. Stone[2]
   [1]Scientific Digital Visions, Inc. Sacramento, CA, USA
   [2]San Jose State University, San Jose, CA, USA
5. ICC TABLES – Status Report
   S. Raman, ORNL, USA
6. Designation of Reactions
   R. Helmer, Idaho Group, USA
7. Revised History Record
   J. Tuli, NNDC, BNL, USA
8. Mean Beta Energy Values
   M.-M. Be, CEA/LNHB, Sacley, France

Spin-parity assignments in high-spin studies

B. Singh and J.C. Waddington, October 10, 2000

(For details consult the paper: " J^{π} and multipolarity assignments in (HI,xnypzαγ) reactions" by J.C. Waddington and B. Singh, Summary report of 1998 NSDD meeting, p113-115 of INDC(NDS)-399)

Spin assignment:

1. Generally for the states populated in high-spin reactions, spins increase with increasing excitation energy. This is a result of the fact that these reactions tend to populate yrast or near yrast states.

2. In the angular distribution of gamma rays (for a typical value of σ/J=0.3):

   a. If $A_2 \approx +0.3$ and $A_4 \approx -0.1$, the transition is generally ΔJ=2 (stretched quadrupole). (The same A_2 and A_4 values are possible for ΔJ=0, D+Q transitions also, but such transitions are less common. Furthermore, if a ΔJ=0 transition is expected to be dipole, then $A_4 = 0$).
   b. If $A_2 \approx -0.2$ and $A_4 \approx 0$, the transition is generally ΔJ=1 (stretched dipole).
   c. If $A_4 > 0$ (positive), the transition is ΔJ=1, D+Q. ($A_2 \approx +0.5$ to -0.8).

3. In the angular correlation (DCO) of gamma rays (for a typical value of σ/J=0.3):

   For ΔJ=2, stretched quadrupole as a gating transition:

   If R(DCO) ≈ 1.0, the transition is generally ΔJ=2 (stretched quadrupole). (The same value is possible for ΔJ=0, dipole transitions, but such transitions are less common).

   If R(DCO) ≈ 0.5, the transition is generally ΔJ=1 (stretched dipole).

   If R(DCO) differs significantly from ≈ 0.5 or ≈ 1.0, the transition is ΔJ=1 (or 0); D+Q.

   For ΔJ=1, stretched dipole as a gating transition:

   If R(DCO) ≈ 2.0, the transition is generally ΔJ=2 (stretched quadrupole). (The same value is possible for ΔJ=0, dipole transitions, but such transitions are less common).

   If R(DCO) ≈ 1.0, the transition is generally ΔJ=1 (stretched dipole).

If R(DCO) differs significantly from ≈ 2.0 or ≈ 1.0, the transition is ΔJ=1 (or 0); D+Q.

Parity assignment:

1. If the conversion coefficient and/or linear-polarization measurements have been reported, then the multipolarity (electric or magnetic character) of a transition may be uniquely determined.

2. The recommended upper limits (RUL's) may be used to limit the multipolarity (electric or magnetic character) of a transition if the level lifetime is known experimentally or it can be estimated from the coincidence resolving time.

3. For a well-deformed nucleus, when a regular sequence of ΔJ=2 (stretched quadrupole) transitions is observed at high spins as a cascade, then the sequence may be assigned to a common band with E2 multipolarity for all the transitions in the cascade. A similar but somewhat weaker argument holds for less deformed nuclei where a common structure of levels is connected by a regular sequence of ΔJ=2 (stretched transitions) as a cascade.

4. For near-spherical nuclei, when a regular sequence of ΔJ=1 (stretched dipole) transitions is observed at high spins as a cascade, then the sequence may be assigned to a common band with M1 multipolarity for all the transitions in the cascade. (Cascades of ΔJ=1, E1 transitions occur in rare cases of nuclides which show alternating-parity bands or reflection asymmetry.)

5. In the absence of angular distribution/correlation data, a regular sequence of transitions in a cascade may be assigned to a common structure or a band if: 1. The low-lying levels of this structure have well established spin-parity assignments. 2. If there is good evidence that, at higher energies and spins, the band has not changed in its internal structure due to band crossings or other perturbations.

Simple way to avoid underestimating uncertainties of the evaluated values for sets of consistent data : a proposal for an improvement of the evaluations

V.P. Chechev
Radionuclide Data Center
V.G. Khlopin Radium Institute, St. Petersburg, Russia

Previously I considered a danger of overestimating the uncertainty of the evaluated value for a set of discrepant data with $\chi^2>2(n-1)$ if an unweighted average was chosen /1/. The EV1NEW computer program allows to avoid such a risk /2,3/.

Now I would like to point out the risk of assigning too low uncertainty to the evaluated value for a set of consistent data with $\chi^2\leq(n-1)$. It refers to sets of measurement results obtained by the same method, and in particular, to measurements of relative gamma-ray emission probabilities and associated values. In such cases it should be take into account a systematic uncertainty of the measurement method connected with detection efficiency. This uncertainty contributes mainly to the total uncertainty of the best experimental values and it cannot be decreased by means of weighting and averaging data.

To avoid underestimating the uncertainty the following rule is suggested: **if the smallest of the input measurement uncertainties (σ_{min}) is more than the uncertainty obtained from statistical data processing, the σ_{min} should be used as a final uncertainty of the evaluated value**. This rule is justified by the fact that almost any measurement is indirect and the total uncertainty of any precise measurement includes mainly the systematic error of the measurement method. Exceptions can be only for measurement data obtained by essentially different methods (for example, half-life measurements by calorimetry and specific activity determination).

As the example of applying this rule I will consider the recent evaluation of the relative emission probability for the gamma-ray of 181.1 keV in the decay of ^{99}Mo (in units of 100 for the gamma-ray of 739.5 keV). We have the ten agreed (in limits of uncertainties) values obtained with Ge(Li) and HPGe-detectors since 1965: 39(16), 48.7(23), 49.9(34), 49.6(42), 49.1(16), 50.1(7), 49.8(33), 48.7(13), 50.3(17), 49.4(8). The weighted mean (WM) of these 10 measurement results is 49.6 with an internal uncertainty of 0.4 and external uncertainty of 0.2 (χ^2=2.0). If we take formally WM=49.6(4) or 49.6(2) we will decrease unjustifiably the real uncertainty of the measurement method connected with a detection efficiency curve which gives a main contribution to the uncertainties of the two most accurate measurements. Therefore we should use the σ_{min} for the final uncertainty of the evaluated value: 49.6(7).

The other example having already given earlier in /4/ concerns the evaluation of the experimental K internal conversion coefficient for the 84 keV gamma transition in ^{170}Yb. The weighted mean (WM) of the eight measurement results for α_K(84 keV) [1.48(5), 1.41(4), 1.37(4), 1.41(5), 1.46(7), 1.39(3), 1.41(3) and 1.43(4)] is 1.414 with an internal uncertainty of 0.014, a reduced χ^2 of 0.6 and an external uncertainty of 0.011. The third digit in WM cannot be given as none experimentalist declares such an accuracy. Again, if we take formally WM=1.41(1) we will discard a systematic uncertainty of the measurement method connected with detection efficiency and use of K fluorescence yield ω_K which can contribute significantly to the total uncertainty of the best experimental values of α_K. Taking it into account the smallest of the input uncertainties should be chosen as a final uncertainty of the WM: α_K(exp)=1,41(3).

References:

1. V.P. Chechev. INDC(NDS)-399, IAEA, Vienna, March 1999, pp. 119-122.
2. V.P. Chechev. INDC(NDS)-399, IAEA, Vienna, March 1999, pp. 116-118.
3. V.P. Chechev and A.G. Egorov. Appl. Radiat. Isotop. 52(2000)601-608.
4. V.P. Chechev. INDC(NDS)-415, IAEA, Vienna, September 2000, pp. 49-50.

PROPOSED CHANGES TO THE NDS INTRODUCTORY MATERIAL
(for the IAEA Advisory Group Meeting
Vienna, Austria, Dec. 4-7,2000)

Revisions to the earlier version of this document
C.W. Reich (dated 10 November, 2000)

The following version of the previously submitted document of the title shown above includes some of the comments received after it was put on the web. Please read this revised version carefully and compare it with the previous version.

As before, sections unchanged are included with no associated comments. Sections which have modifications have the proposed new comments, along with enough of the pre-existing information to help you see how it fits in. It will be helpful to have a copy of the previous version available to help identify the specific items.
Prepared in the format of the relevant sections of the Introductory Material of the NDS.

It will be helpful to have available a copy of this Material to be referred to as you read the following.
Briefly, the proposed changes are as follows:
In "beta transitions" , sections 7a and 7b have been combined and rewritten. The last log ft comment has been augmented. The delta-pi comments have been changed from +,- to yes, no.
The title "Deformed Regions - -Band structure" has been changed.
The last sentence in item 30 has been modified.
In the "Weak Arguments" section: Item 5 has become item 4; item 6 has been combined with item 5; the small-lettered paragraph in item 4 has been eliminated; item7 has been modified; item 11 has been deleted.

(From page vii) *****

GENERAL POLICIES - THEORY

*

α-Decay Hindrance Factors

The α-hindrance factors (the ratio of the measured partial half-life for α-emission to the
....
(1947Pr17). The nuclear radius parameter for each even-even nucleus is determined by defining,
....
...... For odd-A and odd-odd A nuclei, The radius parameters are chosen to be the average of the radii for the adjacent even-even nuclei (1998Ak06). In the few cases where only one of the adjacent even-even radius parameters is known, the extrapolated/interpolated values are used in calculations. A survey for dependence of α-hindrance factors upon asymptotic quantum numbers and variation of α-hindrance factors within rotational bands is summarized in 1972El21.

References

1947Pr17 ....
1952Bl97 ...
19...
19...
...
...
19...
1979Ah01 ...
1998Ak06   Y. A. Akovali, Nucl. Data Sheets 84, 1 (1998)

(Pages ix,x)

PROPOSITIONS ON WHICH STRONG ARGUMENTS ARE BASED

Ground States

—

Gamma Transitions

---
b From1979En04
c From 1981En06
d Deduced from ENSDF by M. J. Martin
Note: In super-deformed bands, the E2 transitions can have Γ_γ/Γ_W values > 1000.

Beta Transitions

7. If log*ft* < 5.9, the transition is allowed: ΔJ=0 or 1, Δπ=no. Superallowed (ΔT=0) 0+ → 0+ transitions have log*ft* in the range 3.48 to 3.50. Isospin forbidden (ΔT=1) 0+ → 0+ transitions have log*ft* > 6.4.
8........
9........
10......
11. --------values corresponding to a shape factor ($p^2 + q^2$), then the transition is first-forbidden unique (ΔJ=2, Δπ=yes).

See "β-Decay Rate Probabilities" on page vii.
Note that log f1ut = log ft + 1.079.
Note that, for nuclei at, or very near to, closed shells, these values may be smaller. For example, in the mass region around Z=82, the upper limit of 5.9 given in # 7 (i.e., lower limit for logft of a first-forbidden transition) could be 5.1).

$\gamma\gamma$ Directional Correlation
...
$\beta\gamma$ Directional Correlation
....
$\beta\gamma$ Polarization Correlation
....
Reactions
19...
20...
21...
22...
23...
24. If the vector analyzing power for a single-nucleon transfer reaction shows a clear preference between J=L+1/2 and J=L-1/2 and if the L value is known, then the J value is determined. _

Magnetic Moments
....

Regions of Strong Nuclear Deformation

The systematic occurrence of rotational-band structure in the strongly deformed nuclides can be a considerable help in making Jπ assignments, since one can also use the level energy as one of the considerations. This frequently makes it possible to assign a Jπ value to a level with confidence from data which, absent such structure, might yield an ambiguous assignment.

29. Level-energy considerations. If the couplings among the states are not too strong, the energies of the lower members of a band can be expressed by the relatively simple relation (see, e.g., 1971Bu16 and references therein):

$$E(J,K) - Eo = AX + BX^2 + CX^3 + ... + \Pi \text{ etc.(See eq. (12) of 1971Bu16 for this term)} \quad , (1)$$

where $X = J(J+1) - K^2$

The **inertial parameter**, A, exhibits a systematic behavior in the various regions of strongly deformed nuclei, which can be helpful in assigning levels to rotational bands. In some instances (such as strong Coriolis coupling) where the A values depart significantly from systematic trends, this observation can itself can be useful, since it can help establish the presence of such effects and, hence, provide evidence for the relevant nucleonic configurations.

For the case of K = ½ bands, the **decoupling parameter**, a , which is characteristic for each such band, is given by the ratio A_1/A. Establishing a value for the decoupling parameter of a proposed band can be useful in assigning a nucleonic configuration to it - and *vice-versa*.

30. Allowed-unhindered beta transitions. Beta transitions having log*ft* values < 5.0 are classified as

"allowed unhindered" (*au*). Such transitions take place between one-quasiparticle orbitals having the same asymptotic quantum numbers. In the "rare-earth" region ($90 \leq N \leq 112$, $87 \leq Z \leq 76$), four such orbital pairs are known: [532], near the beginning of this region; [523], near the middle of this region; [514], above the middle of this region; and, at the high end, [505]. Observation of an au transition is definitive evidence for the presence of the particular orbital pair, from which reliable Jπ and configuration assignments can frequently be made.

31. Coulomb excitation. If a sequence of levels having "rotational-like" energy spacings is found to be excited with enhanced probabilities, this is evidence that this sequence (at least below the first "backbend") forms the ground-state rotational band for the nuclide involved. If the transition quadrupole moments involved are large (tens of Weisskopf units or larger) and comparable to each other, then this is definitive evidence for both a band structure and the sequence of Jπ values, assuming one of the spins is known.

32. Alpha decay . Observation of a "favored" α transition (HF < 4) indicates that the two states involved have the same nucleonic configuration. If a sequence of levels having "rotational-like" energy spacings is associated with the level fed by this favored transition and these levels have HF's that vary according to the established trend within rotational bands (1972El21), then this sequence can be considered to form a rotational band whose nucleonic configuration is the same as that of the alpha-decaying state. If the Jπ value of this latter state and its configuration are known, then the corresponding quantities can be considered to be known for the band in the daughter nuclide.

33. Single-nucleon-transfer reactions (light-ion-induced). For a single-nucleon transfer reaction induced by light ions (^{4}He and lighter), the characteristic pattern of cross sections among rotational-band members ("fingerprint") can be used to assign a set of levels as specific Jπ members of a band based on a particular Nilsson configuration, if the fingerprint agrees well with that predicted by the Nilsson-model wave functions and is distinct from those expected for other configurations in the mass region. (This method is even stronger if angular distributions giving unique L values, or vector analyzing powers, support the assignments for one or more of the levels.)

34. High-spin states. In the decay of high-spin states, commonly produced in heavy-ion induced compound nuclear reactions or in highly excited nuclides created as products of nuclear fission, the multipolarities of the deexciting γ transitions and the relative spins and parities of the levels are generally determined from angular distributions, angular correlations (DCO ratios), linear polarizations and internal-conversion coefficients. In addition, relative energy-level spacings nd the increase of γ intensity with decreasing excitation energy are important clues. Since the considerations involved in determining Jπ values for the strongly deformed nuclides are not significantly different from those used for nuclides in other regions of the nuclide chart, the reader is referred to the Section on "High-Spin States" (********) for a discussion of these considerations.

Alpha Decay

35. The hindrance factor for an α transition from the ground state of an even-even nucleus to the

ground state of the daughter nucleus is 1.0 by definition. For odd-A and odd-odd nuclei, the hindrance factors are ≤4 for favored α transitions which connect the states having the same spin, parity and configuration.

36. For α decay between two states ......

(Refer to page. x)

PROPOSITIONS ON WHICH WEAK ARGUMENTS ARE BASED

----

4. The spin and parity of a parent state may be inferred from the measured properties of its assumed isobaric-analog resonance, and vice versa.

5. Low-lying states of odd-A nuclei have shell-model spins and parities, except in regions where deformations appear. In regions of nuclear deformation, the Nilsson model can be used to limit the possible spins and parities. These arguments are much stronger when supported by expected cross-section strengths in single-nucleon transfer reactions.

6a. For low-lying states of odd-odd spherical nuclei, the Nordheim rules (1950No10) may be helpful in obtaining the ground-state spins and parities, if there is supporting evidence.

$$J = j_p + j_n, \text{ if } j_p = l_p \pm ½ \text{ and } j_n = l_n \pm ½ ;$$

$$J = | j_p - j_n |, \text{ if } j_p = l_p \pm ½ \text{ and } j_n = l_n \mp ½ .$$

6b. For low-lying states of strongly deformed odd-odd nuclei, the Gallagher-Moszkowski rules (1958Ga27) may be helpful in deducing the relative positions of the two two-quasiparticle states formed by the two different couplings of the quasiparticle constituents, if there is supporting evidence. Here, the state corresponding to the parallel alignment (Σ=1) of the projections (=1/2) of the intrinsic spins (½) of the two odd particles is expected to lie lower than that produced by the antiparallel (Σ=0) alignment. This can be particularly useful in establishing the ground state Jπ values and nucleonic configurations for these nuclei.

(In the strongly deformed even-even nuclei, the opposite is expected to obtain, i.e., the Σ=0 coupling should lie lower than that with Σ=1. In these nuclei, however, this is generally less helpful since the two-quasiparticle excitations occur at or above the pairing gap, where the level densities are high and couplings to vibrational excitations can affect the two two-quasiparticle states differently.)

7. Statements similar to 5 and 6 based on other models.

8. Statements based on interpolation or extrapolation of regional trends, such as shown in 1971Bu16, 1972El21, 1977Ch^^ , 1990Ja^^ and 1998Ja^^for the rare-earth and heavy-mass regions.

9. All statements ......

10. Rules extracted in the survey by 1972El21 for unfavored α transitions can be used to deduce the configuration of the parent or the daughter level, if one of them is known**.**

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New Software Tools for Evaluating and Disseminating Nuclear Data

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Rapid advances in software technology have been a challenge for us in the nuclear data network. New technologies offer different methods of processing and disseminating nuclear data. We can now disseminate data employing applets, beans, servlets, and a bewildering array of other obscure terms and acronyms. To keep pace with the technologies has been a challenge for us and has forced us to make difficult choices between maintaining backwards compatibility, efficiently implementing new services, and migrating to newer technologies that quickly make our recent work outdated.

We have been exploring three new, related technologies that offer real promise for modeling, processing, and disseminating nuclear data. *Extensible Markup Language* (XML) provides a simple method of describing nuclear data. It is an extensible language in that we can create a vocabulary that clearly describes our data. XML is an open standard and it is self-describing. We provide in this report examples of XML-formatted nuclear data that can be understood by any person trained in nuclear science. XML formats are defined by document type definition (dtd) files which specify the structure of the dataset. Software that parses the XML data are freely available and they use a dtd file to determine if the data are well-formed. Within the nuclear data network, we can use the technology as an advanced format checking method. *Extensible Style Language* or XSL is a technology that supports XML data searching, filtering and processing. We show examples of how the technology can be used to transform an XML-formatted ENSDF file into a table similar in form to those found in the Nuclear Data Sheets. It is a powerful technology for disseminating and transforming nuclear data. *Scalable Vector Graphics* (SVG) is a last technology we present here. The technology has been used to convert XML-formatted ENSDF files into interactive level schemes. An advantage of SVG is it relies on a free browser plug-in which is widely available. We have concluded these

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XML technologies provide powerful opportunities for nuclear data evaluation and dissemination.

Extensible Markup Language (XML)

XML is a markup language similar to HTML, but it is designed to support custom vocabularies. XML data is textual and it is gaining acceptance in a wide variety of applications such as databases, web servers, cell phones, personal digital assistants and other devices. We represent data by enclosing it inside tags that describe the data. An alpha particle might be represented by the character string `<particle>alpha</particle>`. The first tag marks the start of the data and the end tag, formed by placing the *slash* character before the tag name, marks the end of the data. A second XML format for this example is `<particle type="alpha"/>`. In the latter example *type* is an attribute of the tag *particle*. Which format is employed depends on the nature of the data being described. More advanced data structures are described by creating a hierarchy of XML data structures. Building on our previous example, we could describe the (p,α) reaction for a 1.2 MeV incident proton energy by listing the projectile, its energy, and the ejectile. Figure 1 provides a sample of the XML for this reaction.

Figure 1. XML description of the (p,α) reaction

```
<reaction>
    <projectile>
      <nuclide a="1" z="1"/>
      <energy>
        <value>1.2</value>
        <units category="energy" type="electron volt" prefix="Mega"/>
      </energy>
   </projectile>
   <ejectile>
     <particle type="alpha"/>
   </ejectile>
</reaction>
```

Note the clarity with which the data are described. XML is an open standard and it is self-describing. We can use XML to exchange data with other users, other programs, and do so in a platform-independent way. Figure 2 shows an example of how an *Evaluated Nuclear Structure Data File* (ENSDF) dataset might look with an XML format. For the purposes of brevity, we have stripped out most of the information from the file and we have simplified some data representations. We have also provided a less-readable format for the 109.440 keV level, stripping out most of the white space (tabs and spaces). The point we are making here is the data does not depend on its exact position in the file, just on its order.

Figure 2. Truncated XML file for ENSDF

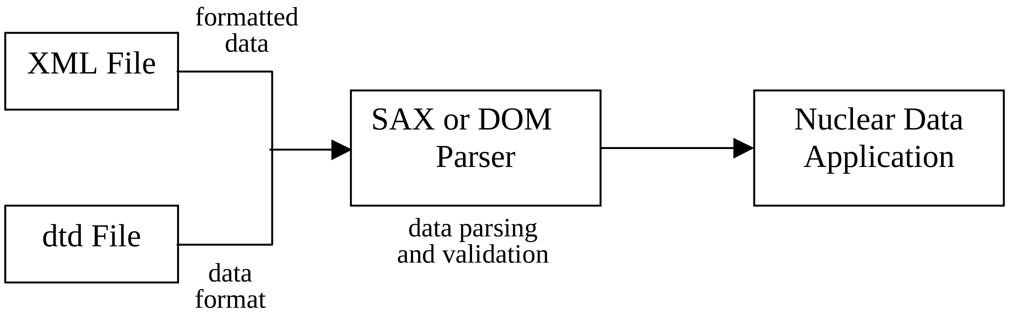
```
<?xml version='1.0' encoding='UTF-8'?>
<!DOCTYPE dataset SYSTEM "File://localhost/disque/ensdf.dtd">
<dataset>
   <nuclide a="108" z="47" />
   <level>
      <energy>
         <value>0</value>
         <units category="energy" type="electron volt" prefix="kilo"/>
      </energy>
      <halflife>
         <value>2.37</value>
         <units category="time" type="minute"/>
      </halflife>
      <spin value = "1+"/>
   </level>
   <level>
      <energy>
         <value>79.13</value>
         <units category="energy" type="electron volt" prefix="kilo"/>
      </energy>
      <halflife>
         <value>1.2</value>
         <units category="time" type="second" prefix="nano"/>
      </halflife>
      <spin value = "2-"/>
   </level>
   <level>
      <energy><value>109.440</value><units category="energy" type="electron volt"
      prefix="kilo"/></energy><halflife><value>418</value><units category="time"
      type="year"/></halflife><spin value = "6+"/>
   </level>
</dataset>
```

Data Parsing and Validation

Two software technologies are used for parsing XML data. Both are available to Java programmers in the form of jar (object) files that can be attached to their software applications. The files are available from www.xml.org. The first is known as a *Simple API for XML* or SAX. It is an event-driven parser that throws events as the XML file is loaded and as tags and attributes are identified. Programmers can implement the SAX parser by adapting example code from reference books or from web pages that promote XML. A limitation with the SAX parser is that it does not retain the hierarchical structure of the XML data. The *Document Object Model* or DOM parser does retain the hierarchical structure of the XML data. This parser loads the entire XML file into memory and it provides methods for searching and modifying the XML tree. Since the DOM parser loads the entire XML file into memory it may not be appropriate for large, complex files. We have found both parser technologies to be easily implemented and we have adopted XML support for all our database applications.

A second technology provides a set of rules for the structure of the XML file. It uses a document type definition or *dtd* file to specify what information must appear in the file and in what order the information is to be found. The schematic for the data loading process is shown in Figure 3. Both the XML and dtd files are passed to the parser which loads the XML data and verifies the data has a format consistent with that described in the dtd file. If the XML data is consistent then it is considered to be well-formed. Otherwise, the parser throws an error. As part of the parsing process, the data are loaded as data objects or arrays as required by the nuclear data application.

Figure 3. The XML Data Parsing Process



A simple document type definition is shown in Figure 4. This dtd describes the proper format for the simple reaction we have shown in Figure 1, one that is defined by a projectile, an ejectile, and a q-value. The first two lines define a nuclide as a tag with a nucleon number attribute and a proton number attribute. It appears in Figure 1 as `<nuclide a="1" z="1"/>`. The entity *EMPTY* states the nuclide tag cannot include character data. We have defined the particle tag as having the attribute *type*, and we have specified the attribute can take on the values of *none*, *alpha*, *beta*, and *positron*. We have also defined *none* as the default value to account for the case where the particle tag appears without the type attribute. Projectiles and ejectiles are each defined as having one of two possible subordinate tags: nuclide or particle. Finally, a reaction is defined as possibly having a projectile, possibly having an ejectile, and possibly having a q-value (whose definition has been omitted). If the XML file is consistent with this format, then it is well-formed.

Figure 4. Document Type Definition for a Simple Reaction

```
<!ELEMENT   nuclide       EMPTY>
<!ATTLIST   nuclide       a       CDATA   #REQUIRED
                          z       CDATA   #REQUIRED>
<!ELEMENT   particle      EMPTY>
<!ATTLIST   particle      type    (none | alpha | beta | positron) "none">
<!ELEMENT   projectile    (nuclide | particle)>
<!ELEMENT   ejectile      (nuclide | particle)>
<!ELEMENT   reaction      (projectile?,ejectile?,qvalue?)>
```

Extensible Style Language (XSL)

A very effective technology has been developed to support XML processing. It is known as *Extensible Style Language* or XSL. As with XML, Java and C++ software packages are available to the programmer for adding XSL to custom applications. The purpose of XSL is to create a method for analyzing and transforming XML files. XSL is a sort of XML-based programming language that includes commands for searching, testing, and string manipulation. Figure 5 shows an example of part of an XSL file for creating an HTML file that displays data with a format similar to the *Nuclear Data Sheets*. This code fragment displays a table of XRefs. Most of the code consists of HTML tags and data that are output to the HTML file. XSL commands are found as tag names that begin with "xsl". The *xsl:for-each* command tells the application to implement the next four lines for every occurrence of the tag name XRefEntry (which is subordinate to other tags). Basically, the command retrieves the contents of the attributes *value* and *parent* from XRefEntry and outputs the information as a row in an HTML table, the value in column one and the parent in column two. The HTML code fragment for this XRef table is shown in Figure 6. Finally, we show in Figure 7 the appearance of the resulting table in a browser.

Figure 5. XSL Code Fragment

```
<table border="1">
  <FONT FACE="Helvetica, arial" SIZE="1">
    <tr ALIGN="CENTER">
      <td><b>ID</b></td>
      <td><b>Parent</b></td>
    </tr>
  </FONT>
  <xsl:for-each select="//XRefIndex/XRefEntry">
    <tr>
      <td><xsl:value-of select="@value"/></td>
      <td><xsl:value-of select="@parent"/></td>
    </tr>
  </xsl:for-each>
</table>
```

Figure 6. HTML Code from an XML-Formatted ENSDF File.

```
<table border="1">
    <FONT SIZE="1" FACE="Helvetica, arial">
       <tr ALIGN="CENTER"><td><b>ID</b></td><td><b>Parent</b></td></tr>
     </FONT>
     <tr><td>A</td><td>108AG IT DECAY (418 Y)</td></tr>
     <tr><td>B</td><td>107AG(N,G) E=TH: SECONDARY</td></tr>
     <tr><td>C</td><td>107AG(N,G) E=THERMAL: PRIMARY</td></tr>
     <tr><td>D</td><td>107AG(N,G) E=16.3 EV</td></tr>
     <tr><td>E</td><td>107AG(N,G) E=2,24 KEV: AV RES</td></tr>
     <tr><td>F</td><td>107AG(D,P)</td></tr>
     <tr><td>G</td><td>108PD(P,NG)</td></tr>
     <tr><td>H</td><td>(HI,XNG)</td>
     </tr>
</table>
```

Figure 7. XRef Viewed in a Table from Netscape Navigator

^{108}Ag

Title: ADOPTED LEVELS, GAMMAS
Evaluator: Jean Blachot
Reference: NDS 81, 599 (1997)

Cross Reference (XREF) Flags

ID	Parent
A	108AG IT DECAY (418 Y)
B	107AG(N,G) E=TH: SECONDARY
C	107AG(N,G) E=THERMAL: PRIMARY
D	107AG(N,G) E=16.3 EV
E	107AG(N,G) E=2,24 KEV: AV RES
F	107AG(D,P)
G	108PD(P,NG)
H	(HI,XNG)

Adopted Levels

E_{level} (keV)	J^{π}	XRef	$T_{1/2}$	Comments
0	1^+	ABCDEG	2.37 m 1	J: atomic beam (1976Fu06). π: E1 γ from 2^-
79.13	2^-	ABCEFG	1.2 ns 4	J: E1 γ to 1^+. M4 γ from 6^+. π from L(d,p)=2
109.440	6^+	AB	418 yr 21	J: optical hyperfine structure pattern (1975Fi07). π from M4 γ to 2^-
155.876	$5^+,6^+$	B		J: see 598 level
193.07	1^+	BCDEG	0.5 ns	J: E1 γ to 2^-. Fed in (n,γ) from 0^-
206.61	2^+	BCEG	0.2 ns	J: M1 γ to 1^+. γ(θ) in (p,nγ)
215.382	3^+	BFGH	45.8 ns 7	J: E1 γ to 2^-. γ(θ) and excitation function in (p,nγ)

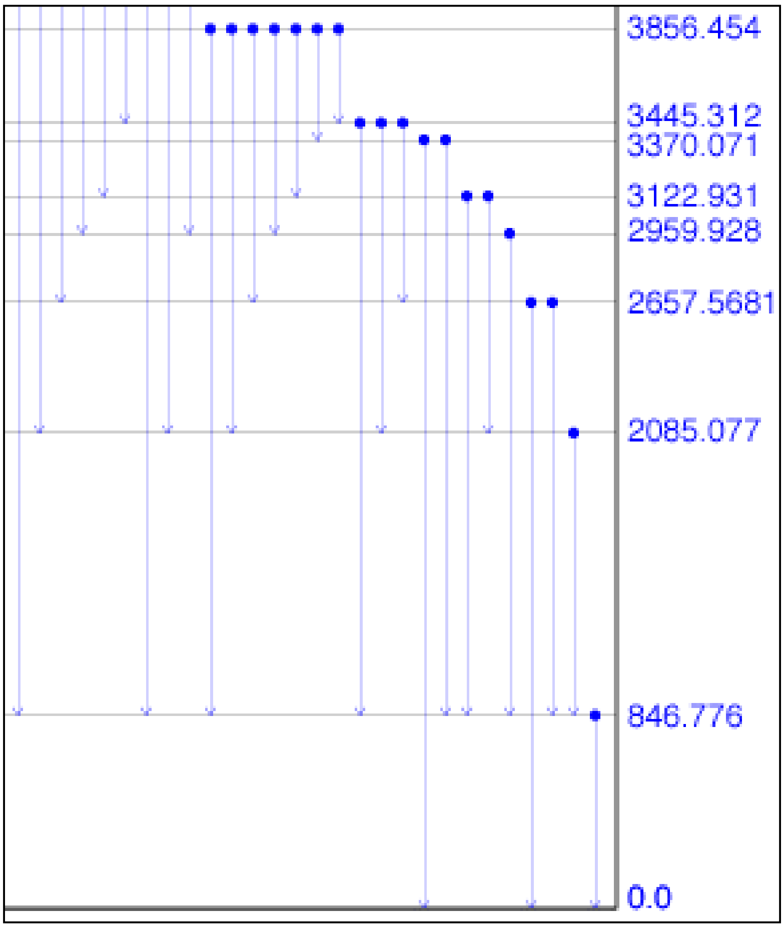
Scalable Vector Graphics

Scalable Vector Graphics or SVG is a graphics language that is based on XML. The SVG vocabulary defines basic drawing commands such as *line*, *circle*, and *text*. Attributes for these tags define coordinates and other necessary information. For example, to draw a blue line between the coordinates (1,3) and (5,4), we would use the command <line style="fill:blue" x1="1 y1="3 x2="5" y2="4"/>. We can combine drawing commands, creating more complex graphical objects. Free SVG plug-ins are available for browsers and this features makes SVG attractive for disseminating nuclear data. An interactive SVG plug-in is available from Adobe at www.adobe.com. Users can zoom and shift images. Objects can be defined as linkable, taking the user to another web page. The technology supports object grouping, allowing, for example, gamma rays in a cascade to be colored differently from other gamma rays, and allowing the entire cascade to be shown or hidden from view. Objects can also be animate and they can be mouse-over sensitive. Figure 8 shows a code fragment from an SVG file that produces an interactive level scheme. A part of the resulting SVG level scheme, as seen in Netscape Navigator with the Adobe SVG plug-in, is shown in Figure 9. We produced the level scheme by loading the XML data through a SAX parser and writing out the SVG commands to a text file. We could also have produced the SVG file using the XML-formatted ENSDF along with an appropriate XSL file.

Figure 8. Code Fragment for an SVG Level Scheme

```
<?xml version = "1.0" encoding="utf-8" ?>
<svg>
   <rect style = "fill:white;stroke:black;"   width = "400"     height = "400" />
   <line style="fill:black"   x1 = "0"       y1 = "400.0"      x2 = "400"       y2 = "400.000"/>
   <text style="fill:blue"    x  = "404"     y  = "400.0">0.0 </text>
   <line style="fill:black"   x1 = "0"       y1 = "400.0"      x2 = "400"       y2 = "400.000"/>
   <text style="fill:blue"    x  = "404"     y  = "400.0">0.0 </text>
   <line style="fill:black"   x1 = "0"       y1 = "327.645"    x2 = "400"       y2 = "327.645"/>
   <text style="fill:blue"    x  = "404"     y  = "332">846.776 </text>
   <circle style="fill:blue"  cx = "392.0"   cy = "327.645"    r  = "2" />
   <line style="fill:blue"    x1 = "392.0"   y1 = "327.645"    x2 = "392.0"     y2 = "400.000"/>
   <line style="fill:blue"    x1 = "390.0"   y1 = "397.000"    x2 = "392.0"     y2 = "400.000"/>
   <line style="fill:blue"    x1 = "394.0"   y1 = "397.000"    x2 = "392.0"     y2 = "400.000"/>
   <line style="fill:black"   x1 = "0"       y1 = "221.836"    x2 = "400"       y2 = "221.836"/>
   <text style="fill:blue"    x  = "404"     y  = "225">2085.077 </text>
   <circle style="fill:blue"  cx = "384.0"   cy = "221.836"    r  = "2" />
   <line style="fill:blue"    x1 = "384.0"   y1 = "221.836"    x2 = "384.0"     y2 = "327.644"/>
   <line style="fill:blue"    x1 = "382.0"   y1 = "324.644"    x2 = "384.0"     y2 = "327.644"/>
```

Figure 9. Partial SVG Level Scheme Displayed in a Browser.



XML Technologies and Data Evaluation

We have identified three general uses for XML technologies in nuclear data evaluation. (1) Development of data entry and data exchange tools. We envision interfaces where users can input nuclear data and transmit XML-formatted information to a web server or an application. Evaluators can also manually create and edit XML-formatted ENSDF data using word processors. The language is simple to make this a practical option. (2) Format checking is probably the most powerful feature of the XML series of technologies. We can create dtd files that fully-describe ENSDF and other data formats. Once an evaluator creates or modifies a data file, it can be passed through an XML parser to verify the file contains a well-formed data set. During our initial studies of creating XML-formatted ENSDF files, we have found the errors thrown by the SAX parser to be particularly effective in identifying formatting and content errors. We acknowledge that additional physics checking will still be needed if this technology is used for data evaluation. (3) Data transformation is another valuable feature of XML. We could, for example, load an XML-formatted ENSDF file, extract the gamma-ray data, determine level energies from this data, and output the data to a data file. Alternately, we can use the XSL technologies to extract key numbers from the ENSDF file and determine if they do in fact represent valid NSR references.

XML and Nuclear Data Services

The XML technologies have important applications in nuclear data dissemination. Many commercial applications, especially database software, provide support for importing and exporting XML. We believe this may in fact provide a good method of migrating our data to a modern database system. Once the XML formats have been established, the technology could then be used to exchange data between databases and custom nuclear data processing and display software. We believe the XML technology is applicable in this way to all of the databases used within the nuclear data community. The XSL technology provides considerable value to us as part of nuclear data web servers and as a mechanism to process the datasets. We have found that the learning curve for XSL is not too large, and believe it may be a practical method of creating new data displays that are presented from the NNDC and other nuclear data servers. Finally, the SVG technology appears to be a reasonable way to serve graphs, level schemes and other graphical representations over the web.

ICC TABLES- Status Report

S.Raman

Oak Ridge National Laboratory

Concerning the ICC Tables, we have completed 80-90% of the work. We have calculated K, L, and M values for Z=12 to Z=112. Unfortunately, we now have a table that exceeds 500 pages. We are thinking of producing two versions: a 200-page version to be submitted to ADNDT, and a 600-page version, which will be available in electronic form in the Academic Press IDEAL Library as a Supplement to the ADNDT article.

Under normal circumstances, this work would have been completed by now. However, our collaborator, Dr. M. B. Trzhaskovskaya (Petersburg Nuclear Physics Institute, Gatchina), was forced to cancel a planned visit this summer for health reasons. We have rescheduled her visit for March and April of next year. We hope to submit a manuscript to ADNDT by September of next year. We are also planning to extend the tables to Z=126.

Designation of Reactions

Richard Helmer (Idaho Group)

In composing a designation, an evaluator should consider the physics involved and assign the reaction designation that best communicates the physics of the experiment. In the past this has been fairly straightforward, but with modern complex reactions this requires some new considerations. In all cases where the reaction designation does not clearly define the reaction and the product that was studies, the evaluator should use a comment to clarify the situation.

It is suggested that in all cases, the first two quantities given will be the target and the projectile. The letter 'X' will be used to represent a group of particles whose makeup is not known.

The following are a few examples of possible reaction designations:

^{153}Sm	^{154}Sm(d,t)
^{153}Sm	^{153}Sm(γ,γ')
^{44}Ar	C(^{46}K,Cpnγ)
^{43}Ar	^{1}H(^{43}Ar,^{43}Ar') or ^{1}H(^{43}Ar,p') where the scattered protons are measured; ^{43}Ar(p,p') may describe the physics more simply, but it violates the target-projectile 'rule'
^{87}Ge	Pb(^{238}U,PbX) or Pb(^{238}U,PbF) where ^{87}Ge is a fragment from the ^{238}U beam, but if one does not know the Pb target survives, then Pb(^{238}U,X) would be more accurate

Revised History record

J. Tuli (NNDC)

a. In all individual data sets in ENSDF (excepting the REFERENCE and COMMENTS data sets) the following information will be presented (the information is required, unless indicated optional) on an "H" record every time changes are made to the data set ("H" record is defined under (b)):

> Change/evaluation TYPe, AUThor's name (the person who makes or responsible for the change, not necessarily the evaluator of the data set), the DATe of change, literature CUToff date (optional when changes do not involve evaluation, CITation (optional, if not published), COMments (optional)

b. The history record will have 'H' in col. 8 and will have various fields and their values in cols 10-80 followed by any number of continuations. Field descriptor is terminated by = and the value by $ ($ not needed if it is the last field on the H record).

c. Current list of evaluation types (can be expanded) are:

FULl (Complete revision of the nuclide based on all information to the cut off date indicated. CUToff date required)
FMT (Reformated a quantity or a record)
ERRata (Fix an error in the dataset-should be accompanied with COM)
MOD (Modified dataset for partial update of nuclide. Kind of modification done should be indicated as comment. CUToff date optional)
UPDate (Update due to scan of new literature. CUToff date required)
EXP (Experimental data sets in XUNDL)

The first three letters must be spelled exactly as given here. There can be only one type specification per history record given.

d. Date and Cutoff date must be given as DD-MMM-YYYY (e.g., 31-MAY-1996)

e. Citation (optional) gives the reference where the evaluation is published.

f. Comments (optional) may give general remarks about evaluation/update.

g. The fields can be in any order on an "H" record.

Note that history records indicate various revisions. These are wiped out at the next FULL evaluation.

For FULL evaluation NNDC will introduce "H" records based on the COMMENTS data set.

h. History record must occur before any formatted record, and immediately follow the DSID record. All history records should be grouped together in descending chronological order, i.e., the most recent one appears first in the data set.

i. Example:

```
156DY H  TYP=MOD$AUT=C. Reich$DAT=15-MAY-1996$CUT=01-MAY-1996$
156DY2H  COM=Updated SDB data beyond B. Singh's evaluation of SD Bands
156DY H  TYP=MOD$AUT=B. Singh$DAT=31-DEC-1995$CUT=15-DEC-1995$
156DY2H  COM=Updated SDB data only$
156DY H  TYP=UPD$AUT=R. Helmer$DAT=31-DEC-1994$CUT=15-DEC-1994$
156DY2H  COM=updated data set for new references since last full evaluation
156DY H  TYP=FMT$AUT=J. Tuli$DAT=1-DEC-1994$COM=FIXED Format$
156DY H  TYP=FUL$AUT=R. Helmer$DAT=20-AUG-1991$CUT=01-May-1991$
156DY2H  CIT=NDS 65, 65 (1992)
```

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Saclay, November, 20

As I proposed during the CRP meeting in Braunschweig, I have tried to compare the mean beta energy value obtained by two programs (see the table below) : in some cases the differences appear not negligible. I have also added the values recommended by the ICRP38, because they are used by the medical circle.

- LOGFT does “special calculations for first and second forbidden”, the others are treated as allowed;
- SPEBETA does special calculations in all cases but it is necessary to know the shape factor of the spectra. We (P. Cassette and me) used those given by Behrens in Physics Data (ZAED 6-1, 1976).
- In the ICRP38 , the first forbidden nonunique are treated as allowed, the second forbidden nonunique as first forbidden unique and the third forbidden nonunique as second forbidden unique.

The table shows :

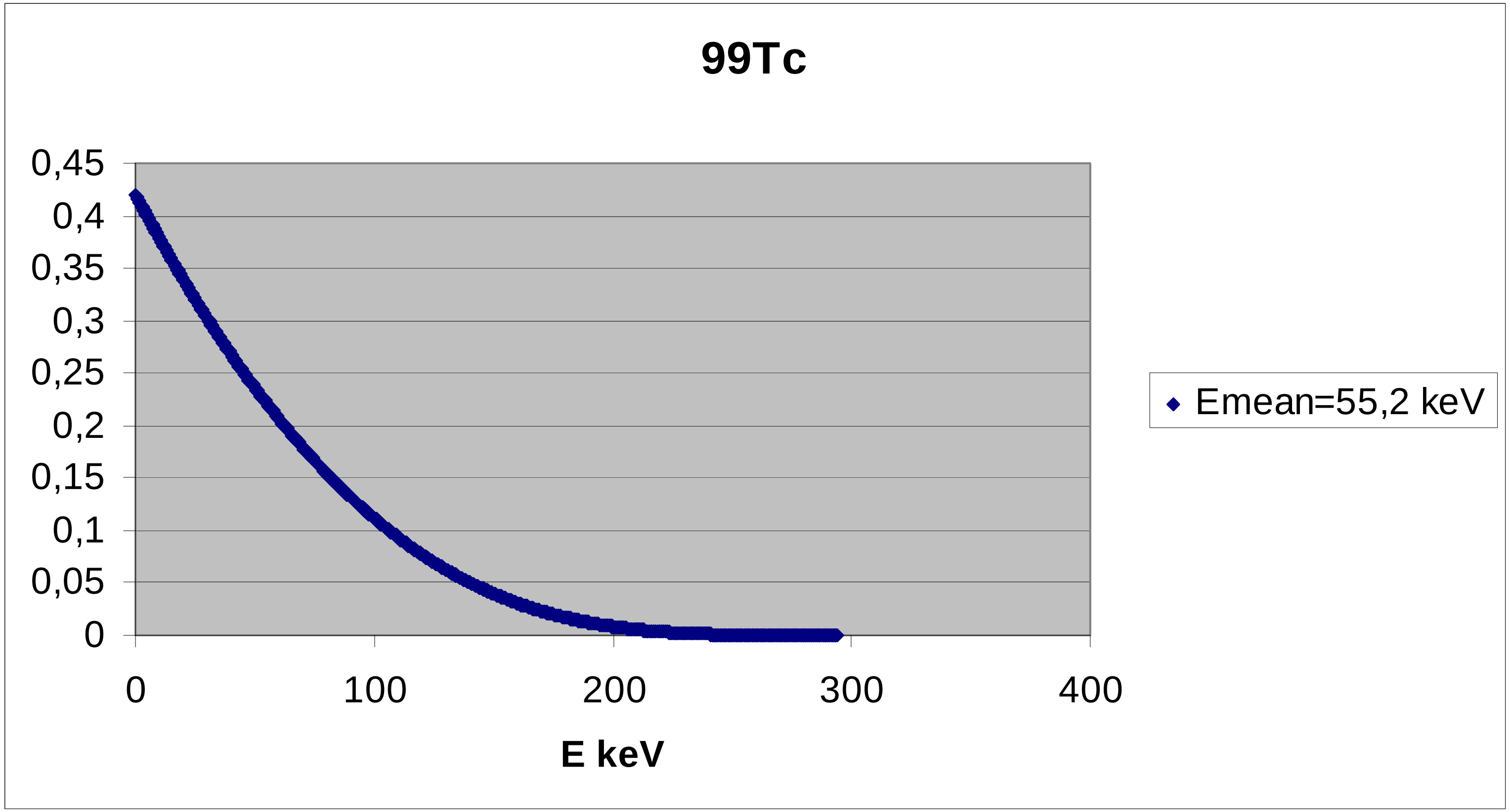
- when the transition is allowed, all the programs are in agreement;
- when they cannot calculate, LOGFT and CIPR38 take the transition as allowed;
- the last column gives the reference used as given in the Behrens paper;
- in some cases, the discrepancy between the results given by SPEBETA and the others is greater than 15%.

To give an example of the SPEBETA calculations, the energy spectrum of 99Tc calculated with the shape factor determined by Reich (Z.Phys. 271 (1974) 107) is also given.

It must be noted, as says Behrens : “In the case of forbidden non unique transitions … a simple calculation of the beta spectrum shape is not possible.”

As this data are of interest for several kind of users (dosimetry calculation, decay heat power, etc.), it could be useful to motivate new experiments.

Parent Nuclide	**Z**	**Ji**	**Jf**	**B+-**	**Nature**	**Emax**	**LOGFT/brc**	**SPEBETA**	**LOGFT/SPE**	**SPEBETA If allowed**	**CIPR38**	**Behrens references Physics Data 6-1 (1976)**
22Na	11	3+	2+	+	Allowed	545,6	215,54	216,4	0,996		215	
24Na	11	4+	4+	-	Allowed	1390	554	554,3	0,999		554	
47Ca	20	7/2-	7/2-	-	Allowed	1991,9	818,9	820	0,999		817	
131I	53	7/2+	5/2+	-	Allowed	606,3	191,58	191,8	0,999			
86Rb	37	2-	2+		1st forbidden	697	232	234	0,991		233	
99Mo	42	½+	3/2-	-	1st forbidden	848,1	289,7	299	0,969	289,6		
144Pr	59	0-	0+	-	1st forbidden	2997	1221,8	1226,5	0,996	1229	1222	
170Tm	69	1-	0+	-	1st forbidden	968	323,1	**306**	1,056	323,4	323	der Werf
170Tm		1-	2+	-	1st forbidden	883,7	290,5	**321**	0,905	290,9	298	(321= Greverie; 275=Werf)
188Re	75	1-	0+	-	1st forbidden	2120,4	795,4	**740**	1,075	801,4	795	(740=Werf)
188Re		1-	2+	-	1st forbidden	1965,3	728,89	**752**	0,969	733,9	728	(751=André; 691=Werf)
198Au	79	2-	2+		1st forbidden	962	314,6	310,4	1,014		315	
90Y	39	2-	0+	-	1st forb.unique	2280,1	933	932	1,001		935	
115Cdm	48	11/2-	7/2+		1st forb.unique	679	244	**136**	1,794	221	242	(Bosch)
204Tl	81	2-	0+	-	1st forb.unique	763,7	244	**271,8**	0,898	240,9	244	(Flothmann)
36Cl	17	2+	0+	-	2nd forbidden	709,23	251,2	**303**	0,829	251,3	279	(Reich)
59Fe	26	3/2-	7/2-	-	2nd forbidden	1564,7	614,3	**584**	1,052	615	635	(Raman)
99Tc	43	9/2+	5/2+	-	2nd forbidden	293,7	84,6	**55,2**	1,533	84,5	101	(Reich)
129I	53	7/2+	3/2+	-	2nd forbidden	154,4	41,5	**37**	1,122	41,5	48,9	(Mateosian)
137Cs	55	7/2+	3/2+	-	2nd forbidden	1175,6	416,2	**273**	1,525	416	425	(Lidovsky, id. L2 = 0,004)
10Be	4	0+	3+	-	2nd forb.unique	556,2	252,4			203	252	
60Co	27	5+	2+	-	2nd forb.unique	1491,4	625,87			580,6	626	
87Rb	37	3/2-	9/2+	-	3rd forbidden	282,3	81,7			81,7	111	
40K	19	4-	0+	-	3rd forb.unique	1312,1	488	**589**	0,829	509,2	585	Logft modified for 3U
Logft/brc = calculations did with Logft by O. Bersillon												
SPEBETA = calculations did with the LNHB program												
CIPR38 = values given in Annals of the ICRP 38												


99Tc
0,45
0,4
0,35
0,3
0,25
0,2
0,15
0,1
0,05
0
0
100
200
300
400
E keV
Emean=55,2 keV

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RIPL for FTP file transfer of RIPL;
NDSONL for FTP access to files saved in “NDIS” Telnet session.
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