Isotopes Project

LAWRENCE BERKELEY NATIONAL LABORATORY

E.B. Norman (Project Leader)

NUCLEAR DATA EVALUATION ACTIVITIES
April 1999 - April 2000

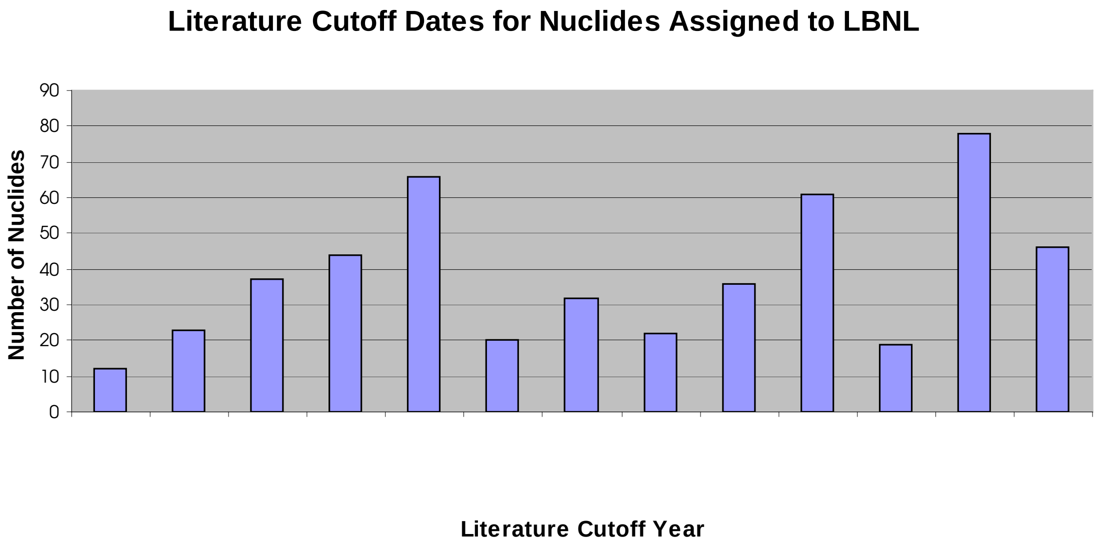
Report prepared for the Nuclear Structure and Decay Working Group, USNDP Annual Meeting, April 26-28, 2000 at Lawrence Berkeley National Laboratory.

This report refers exclusively to the data evaluation/compilation component of the Isotopes Project's activities; for the group's Data Dissemination activities, please see the Isotopes Project's report to the Dissemination Working Group.

MASS CHAIN RESPONSIBILITY, STATUS (~500 nuclides)

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

The average time elapsed since the most recent full evaluations of the ~500 nuclides in the above chains is 4.7 years (based on literature cutoff dates for those evaluations). Three of these nuclides have received high-spin data updates subsequent to their last full evaluation.



PERSONNEL

Isotopes Project personnel involved in data evaluation/compilation are as follows:

C. Baglin	0.5 FTE (0.6 FTE, effective 3/10/00)
E. Browne	1.0 FTE
R. Firestone	0.5 FTE

In addition, two guests spent leave with the Isotopes Project: Professor Shiu Chin (Alice) Wu (Taiwan) (April - August '99) and Dr. Jean Blachot (October '99). Dr. Wu evaluated A=46, 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 ACCOMPLISHMENTS (since April 1999 Meeting)

- **Mass Chain Evaluations**

Submitted:	46, 92, 215, 219, 223
Published:	174, 206

- **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:
    ^{181}Pt, ^{181}Au, ^{181}Hg, ^{187}Tl*.
  - Unpublished (reviewed and added to ENSDF):
    ^{81}Zr, ^{168}(Tb, Dy), ^{179}Ta, ^{183}Au.
  - Submitted:
    ^{166}W*.

- **Data Sets**

  Submitted alpha-decay chain datasets for the seven nuclides in the newly-identified ^{293}118 to ^{265}Rf chain.

- **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 ultimately be submitted to NNDC for inclusion in ENSDF.

- **Reviews of Evaluations**
  Mass Chains:
  A = 52, 107, 121.

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

Six chains (A=21-26) have been completed and included in ENSDF. For each chain:

- The updated information from Endt (1998) was added to the Adopted Levels, Gammas datasets previously existing in ENSDF.
- The existing decay datasets in ENSDF were updated from the literature and new datasets were created when necessary.
- 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) have been added.

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

COMPILATION

Datasets for XUNDL:

Four datasets prepared in collaboration with Andrew Davies, a student from Westmont College (CA), have been included in the XUNDL database, along with datasets for ^{81}Zr, ^{168}Dy and ^{186}Os.

REMAINING EVALUATION/COMPILATION PLANS FOR FY2000

Specific plans for the remaining half of FY2000 are as follows:

- **Mass Chain Evaluation:**
  A = 83, 169, 210, 227, begin 170.

- **Individual Nuclide Evaluation:**
  ^{168}Er$^{\#}$, ^{191}Bi, ^{183}Hg$^{\#}$, one additional nuclide as yet undetermined.
  \# Priority nuclide

- **Continuation of IAEA CRP to develop an (n,γ) Database:**
  See description above for this project. (n,γ) datasets for $Z \leq 21$ will be submitted by the end of FY2000 for inclusion in ENSDF.

- **Continuation of DDEP Nuclide Evaluation:**
  ^{81}Kr, ^{91}Nb, ^{92g}Nb, ^{92m}Nb, ^{223}Ra, ^{227}Ac, ^{227}Th

(These include four nuclide decays that are of astrophysical interest.)

- **ENSDF Coding of non-US Evaluations:**
  - **DDEP Nuclides:**
    ^{68}Ge, ^{68}Ga, ^{125}I, ^{141}Ce
    (Decay and Adopted data sets are being prepared for inclusion in ENSDF.)
  - **A=27-39 (Endt; 1998 Update):**
    Complete preparation of A=27-39 (as for A=21-26 above) and submit to NNDC for inclusion in ENSDF.

PUBLICATIONS (since April ‘99 Meeting)

Nuclear Data Evaluation

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).

“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).

Nuclear Structure and Nuclear Astrophysics Research:

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).

Data Evaluation Talks:

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