

Status of the ENDF Project

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Pavel Oblozinsky

National Nuclear Data Center
Brookhaven National Laboratory, Upton, NY 11973

Abstract

The present status of the United States ENDF project is given. We focus on highlights of the last CSEWG meeting along with a brief summary of development of the ENDF/B-VII library. The current version of the library, ENDF/B-VI, release 8 is frozen since October 2001.

1. CSEWG Organization

The current organization of the Cross Section Evaluation Working Group, CSEWG, is as follows:

- Chair P. Oblozinsky, BNL
- Committee chairs
 - Measurements & Basic Physics D. Smith, ANL
 - Evaluations M. Chadwick, LANL
 - Formats & Processing M. Greene, ORNL
 - Data Validation R. McKnight, ANL
- ENDF manager M. Herman, BNL

Mike Herman joined the National Nuclear Data Center, BNL on March 1, 2003. He took over the management of the ENDF library from Vicki McLane.

The current version of the library, ENDF/B-VI, release 8 is frozen since October 2001. Activities of CSEWG are focusing on the development of a new version of the library, ENDF/B-VII.

2. Highlights of the CSEWG Meeting, November 2002

The 52nd meeting of the Cross Section Evaluation Working Group was held at Brookhaven National Laboratory, November 5-7, 2002. A total of 44 participants attended the meeting. This included 39 individuals from 13 U.S. organizations, one representative from the DOE Office of Science, Division of Nuclear Physics, and 4 foreign participants, from JAERI (Japan), KAERI (S. Korea), NEA Data Bank (Paris) and IAEA Nuclear Data Section (Vienna).

The Agenda included an extra session devoted to nuclear data for homeland security. The remaining part of the Agenda followed traditional pattern of 4 working committees, dominating topic being creation of the ENDF/B-VII library.

Nuclear Data for Homeland Security

The basis for discussion was provided by the recent Workshop on the Role of the Nuclear Physics Research Community in Combating Terrorism, July 11-12, 2002, Washington, DC. It was proposed to create Homeland Security Task Force as a part of the CSEWG and the US Nuclear Data Program.

Evaluations

Reports on evaluation activities focused on contributions to ENDF/B-VII. Impressive contribution was reported by LANL, including actinides, charged-particle reactions for astrophysics and 160 photonuclear reactions. Other contributions were reported by ORNL, BNL and also LLNL.

Standards are expected to be completed in 2004, with reasonably close results available by the end of 2003.

Remaining gaps and deficiencies in ENDF/B-VII were addressed.

Formats and processing

Status of 4 processing codes was reported. New features are available in NJOY99 (LANL), code AMPX-2000 (ORNL) was used to process 340 ENDF/B-VI evaluations, LLNL code can fully handle ENDF/B-VI data files, and ANL focused on the needs of the VIM code.

A format for the ENDF/B-VII library was approved. Adopted was evolutionary approach using the current ENDF-6 format without any major changes. Although long-term future is in favor of advocates of revolutionary approach based on entirely new technologies, a common sense determined that ENDF-6 should remain to be the format for ENDF/B-VII.

Proposals for new and revised ENDF-6 formats were discussed. It appeared that WPEC proposals were not given sufficient attention, and an auxiliary session was held to rectify this situation. Established procedures and timetable for submittals must be observed in future.

Data Testing

Progress and status of several data validation and testing activities were reported. Of most interest was a report on benchmark testing for ^{235}U and ^{238}U of JENDL-3.3 in view of its relevance for the ENDF/B-VII library.

Time did not allow discuss planning of data testing activities for the ENDF/B-VII library. This topic will be addressed at the next meeting with the understanding that thorough testing is an extremely

important aspect of the new library.

Measurements and Basic Physics

Laboratory presentations on experimental work were provided by LANL, RPI, ANL, NIST and also Ohio. The status of standards measurements was reviewed, including IAEA project to update standards cross sections for light nuclei. Timely output of this project, in particular methodology for combining light- and heavy-element evaluations, is of top importance for the development of the ENDF/B-VII library.

The United States will host the ND'2004 Conference, September 26 – October 1, 2004 in Santa Fe, New Mexico, the hosting laboratory will be LANL.

ENDF/B-VII

The decision to develop the ENDF/B-VII library was taken in 2000, followed by planning in 2001. The present meeting focused on progress in evaluation activities, formats and standards. Substantial progress in evaluation was reported by LANL, with smaller contributions coming from ORNL and BNL. An important decision on a new format was reached, to proceed with the current ENDF-6 format. A good progress was reported on new standards, an important role of the IAEA in this process was appreciated.

Next Meeting

The next CSEWG meeting will be held at BNL on November 4-6, 2003 (Tuesday – Thursday).

3. Development of the ENDF/B-VII Library

CSEWG activities are focusing on the development of a new version of the ENDF/B library, ENDF/B-VII. A brief summary is given below.

Timetable

The current timetable for development of the ENDF/B-VII library is as follows:

- 2002: Formats, Evaluations
- 2003: Evaluations, Standards, Validation
- 2004: Standards, Validation
- 2005: Release

New features

The ENDF/B-VII library is expected to have the following new features:

- New version of standard cross sections
- Energies up to 150 MeV for selected materials
- Photonuclear data
- Improved evaluations for major actinides
- Improved evaluations for materials important for criticality safety and fission products
- New and improved charged particle evaluations relevant to astrophysics
- Evaluations relevant to RIA, ADS and next generation reactors (Gen-IV).

New evaluations

So far, the following new/improved evaluations have been submitted for inclusion into the ENDF/B-VII library. In addition, we indicate new evaluations that are expected to be submitted in future.

- a) LANL: actinides, Hg and Pb, and photonuclear data, major contributor of new evaluations
- Actinides
 - 232, 233, 234, 235, 237, 238, 239, 241U
 - 239Pu
 - Mercury and Lead
 - 196, 198, 199, 200, 201, 202, 204Hg neutron and proton evaluations up to 150 MeV
 - 208Pb (inelastic scattering improved)
 - 160 materials for the photonuclear data library, mostly up to 150 MeV, includes considerable international input (IAEA CRP project)
 - Light charged-particle thermonuclear reactions
 - 3He+3He, 3He+6Li, T+3He, T+6Li, T+T
 - D+3He, D+6Li, D+7Li, D+D, D+T
 - p+6Li, p+7Li, p+T
 - Expected
 - 236, 240U
 - 239Pu (up to 150 MeV)
 - 237Np, 240, 241, 242g, 242m, 243Am
 - Gd isotopes
 - 237Np photonuclear
 - Delayed neutrons for 235, 238U, 239Pu
- b) ORNL: materials important for criticality safety, resolved resonance region & unresolved resonance region
- 27Al, 233U
 - Expected
 - 16O, 19F, 28,29,30Si, 35,37Cl, 55Mn
 - 235, 238U
- c) BNL: fission products, resonance + fast energy region, BNL-KAERI collaboration

- ^{99}Tc , ^{153}Eu , ^{157}Gd (submitted by BNL)
- ^{95}Mo , ^{101}Ru , ^{103}Rh , ^{105}Pd , ^{109}Ag , ^{131}Xe , ^{133}Cs , ^{141}Pr , 143 , ^{145}Nd , 147 , ^{149}Sm (submitted by KAERI)
- Expected
 - 150 , 151 , ^{152}Sm , ^{155}Gd
 - 70 , 72 , 73 , 74 , ^{76}Ge (for homeland security, focus on photon production)
 - Recommendations for the bulk of fission product evaluations (WPEC Subgroup 21 collaboration)

Standards

NIST, LANL and ORNL

- Includes mutual cooperation of 3 groups: CSEWG, WPEC, IAEA.
- Partial set of neutron cross-section standards to allow adjustment of key evaluations and their validation, submittal assumed after the IAEA CRP meeting, October 2003.
- Full set of neutron cross-section standards, submittal without covariances assumed in 2004, followed by covariances later.

Formats and processing

Adopted has been ENDF-6 format, there will be no ENDF-7 format. As a consequence, the current processing codes will be able to handle ENDF/B-VII in a straightforward manner.

Validation

- a) ANL
 - Coordination of CSEWG effort, detailed planning expected in November 2003
- b) LANL
 - Validation of LANL actinide evaluations ongoing
 - Validation of photonuclear evaluations ongoing
- c) ORNL
 - Validation of ORNL evaluations ongoing

4. Workshop on Nuclear Data Needs for Generation IV Nuclear Energy Systems

The Workshop was held at BNL, April 24-25, 2003. It was organized by T. Taiwo, ANL and hosted by P. Oblozinsky, NNDC. Altogether, 25 reactor and nuclear data experts attended the Workshop.

A complete set of presentations along with the Minutes, Agenda and List of Participants is being prepared on CD. A copy is available upon request from the NNDC (cataldo@bnl.gov).

