CSEWG Report

to

NEANSC Working Group on
International Evaluation Cooperation
JAERI, Tokai-mura, Japan
28–29 May, 1992

The Cross Section Evaluation Working Group (CSEWG) held its 1992 meeting at Brookhaven National Laboratory, 12–14 May. The next CSEWG meeting will take place at the end of September or early October 1993 at BNL. During the meeting, a banquet was held honoring Sol Pearlstein, the founding chairman of CSEWG, on his retirement as head of the National Nuclear Data Center.

A new committee, the Nuclear Data Measurement Committee, will be added to CSEWG. This committee will be responsible for the nuclear measurement coordination activity formerly assigned to the US Nuclear Data Committee. Donald Smith of ANL will be the chairman and will be responsible for determining the future tasks for the committee. Among those items he will be considering are the DOENDC Status Reports and the Data Request List.

The budget for FY93 for the DOE nuclear data program was reduced by about 2.5 million dollars. The impact of this reduction was concentrated at three national laboratories. The ANL Fast Neutron Generator will be closed by October 1, 1992. The data measurements and ENDF/B evaluation work done by Alan B. Smith and his colleagues will cease. The support for ORELA will be reduced by about 1.5 million dollars, resulting in a drastic cut in both experimental data measurements and ENDF/B evaluation work at Oak Ridge. Lastly, the budget of the National Nuclear Data Center at BNL will be reduced by 950 thousand dollars. While most of that reduction will be absorbed in the nuclear structure and data services tasks of the NNDC, the CSEWG support will be decreased and there will be limited capacity to support major new releases of ENDF/B.

ENDF/B-VI Evaluations

During the past year, the charged-particle sublibraries (proton, deuteron, and triton), the decay data sublibrary and the fission product yield sublibrary were released, thereby completing ENDF/B-VI. In addition, the first revision of the neutron sublibrary containing primarily minor corrections was distributed. The summary documentation for ENDF/B-VI (ENDF-201) was completed and published in 1991 as was a set of update pages for the format manual (ENDF-102).

In the fall of 1992, CSEWG plans to release a second revision to the neutron sublibrary which is expected to contain new evaluations for nitrogen-14, the silicon isotopes, and iodine-127. Revisions to the resonance region for the hafnium isotopes has been completed and are now being reviewed. Additionally revised evaluations for several fission products with updated resonance regions and capture cross sections have been completed. This work includes the cadmium isotopes, neodymium-143 and -145, ruthenium-101 and -102, and samarium-150. The revision will also contain the copper isotopes (minor corrections), technetium-98 (corrected MAT number) and cobalt-59 (new resonance parameter evaluation). A new evaluation for d-t will be reviewed and possibly added to the deuteron

sublibrary. It is also possible that corrections will be made to the graphite, Be and BeO thermal neutron scattering sublibrary.

New evaluations for natural zirconium and cadmium are underway but may not be ready for release this fall. A preliminary version of the Harwell uranium-238 resonance parameter evaluation was included in ENDF/B-VI. Mick Moxon described the improvements which have been made in the meantime at the CSEWG meeting. If the work is completed in time, we will include it in a revised uranium-238 evaluation. Larry Weston described revisions to the normalization of his ^{240}Pu fission cross section measurements in the few keV region. This work is part of the work of subgroup 5 and probably will not be available in final form in time. The problem of the continued underprediction of the epithermal α for ^{235}U was also discussed. Several solutions were discussed. The one most favored is the addition of one or two pure capture resonances at low energies for which there is some experimental evidence. A revised file to reflect these changes is also unlikely for the next revision.

Data Testing Results

Integral data-testing results based on the ENDF/B Version VI evaluated nuclear data files have been very limited in scope and very slow in arrival. Participants in the recent CSEWG meeting shared data-testing results in the areas of shielding, thermal reactors and fast reactors.

Shielding

Several of the ORNL Broomstick measurements, including iron, oxygen, nitrogen, and sodium, have now been analyzed with Version VI data. For each of these, the results are very similar to the Version V results and generally indicate adequate total cross section data for these materials. The Version VI oxygen data produce some slightly more discrepant values at higher energies (especially above 6 MeV), whereas the Version VI nitrogen data display significant discrepancies (as did Version V) in the valleys of the spectrum at 1.5 and 3.5 MeV.

The Version VI data for iron show dramatic improvements in LWR pressure vessel dosimetry analysis. Significant differences in the the neutron flux in the reactor cavity are caused by the new iron data.

Preliminary results for the LMR Radial Shield Benchmark from the US-Japan JASPER Program Radial Shield Experiment also indicate dramatic improvements in C/E values (for flux) using Version VI data for iron and Boron-11.

Thermal Reactors

Initial benchmark results with ENDF/B Version VI indicate results generally close to the Version V results, with some results somewhat worse. Specifically, the Version VI eigenvalues for low leakage U-235/water criticals are underestimated by $\sim$0.5% (whereas Version V values are close to unity). This appears to be due to the U-235 thermal data which is less reactive in Version VI. Furthermore, Version VI data testing results have a trend of increasing eigenvalues for U-235/water criticals with increasing epithermal fission fraction, suggesting the U-235 resonance evaluation may be too reactive. The ρ_{28} parameter is changed only slightly with Version VI (relative to Version V) and is still overestimated

(by ~2%).

Fast Reactors

Preliminary results for a series of fast benchmark assemblies have been generated by LANL and ORNL. Both sets utilized Version VI constants prepared by NJOY. These results are in general agreement with each other (except for the Big-10 assembly). These results are in general slightly improved with the Version VI data. For example, C/E's on eigenvalues computed with Versions V.2 and VI include:

	k_{eff} C/E	
Assembly	Ver. VI	Ver. V.2
JEZEBEL	0.999	0.998
GODIVA	0.998	0.999
JEZEBEL-23	0.994	0.994
JEZEBEL-PU	0.999	1.000
FLATTOP-25	1.003	1.007
FLATTOP-PU	1.005	1.006
FLATTOP-23	1.024	1.024
BIG-10	1.012	----
ZPR-6/6A	1.008	0.992
ZPR-6/7	1.004	0.998

Note that eigenvalues for all the reflected assemblies are larger than for the bare assemblies. The very high value for FLATTOP-23 is unchanged from Version V (U-233 was not changed for Version VI). For the ZPR (LMR-type) assemblies, the bias between U-235 and Pu-239 fuel is not eliminated, but reversed between Versions V.2 and VI. Changes in the C/E values for central reaction rate ratios obtained with Version VI (relative to Version V.2) in these fast assemblies are slightly improved and are more self-consistent. The overprediction of capture in U-238 relative to fission in U-235 (or Pu-239) is reduced by 4% (or 2%, respectively). The threshold fission ratios tend to be underpredicted (2-3%), particularly in the harder spectra.

Summary

The results of ENDF/B-VI data-testing are still very preliminary and far from complete. This is due both to the general lack of support (funding) for the processing and testing of the Version VI files and to the considerable difficulty which the changes in Version VI data and formats have created for the processing codes. Further development on the processing codes is continuing (as discussed below) and additional data-testing results are planned. In the mean time, these initial integral results are already being considered in plans for future revisions of the Version VI evaluations.

Processing Code Status

NJOY R. MacFarlane – LANL

NJOY91.38 is the latest version needed to properly process ENDF/B-VI. That version has just been provided to RSIC. It's needed to properly process MLBW with multiple J values and NAPS=1 option for structural materials with RM

representation. Problems still exist for F-19 capture gamma production and for (n,2n).

AMPX M. Greene – ORNL

Progress being made on RM processing and incorporation into AMPX system. Two paths for self-shielding are being pursued, Bondarenko factor and a flux calculational approach (under development at LSU by M. Williams).

ETOE-MC2 C. Stenberg – ANL

Being upgraded to process ENDF/B-VI. Not much progress since last year.

NJOY-COMBINE J. Ryskamp – INEL

Thermal data testing - want to finish up the package and submit to RSIC.

SRL, ABB/CE, KAPL are using NJOY as a front-end processor to feed data into their calculational systems. ORNL also uses NJOY to produce multigroup data and translate it to AMPX format for use in that system.

Proposed Changes to ENDF-6 Formats

The following are proposed changes to ENDF-6 formats received since the release of REV 1. CSEWG is concerned that previously approved formats have not yet been completely reflected in many of the codes which process data in the ENDF format. Therefore the Methods and Formats Committee will review these to assess their impact on the current ENDF/B-VI data files and processing programs. If there is no or minimal impact, they may be approved and incorporated into the Format Manual.

1) Electron and positron formats - D.E. Cullen, LLNL

2) Refinement of ENDF/B-6 interpolation law 6 - D.E. Cullen, LLNL

3) Include in the format manual explicit equations on how to interpolate - D.E. Cullen, LLNL

4) Modifications to MF= 8, 9, and 10 - M. Nikolaev, Russia

5) Additional option for MF=12 data representation - M. Nikolaev, Russia