

Conclusions of the CSEWG Meeting on ENDF/B-VII Validation  
Oak Ridge National Laboratory, July 13, 2005

## Actions from July'05 Meeting

Mark Chadwick, LANL  
and  
Pavel Oblozinsky, BNL

Reviewed at CSEWG Meeting, Nov 8-10, 2005

\*\*\*\*\*

**Action Item List (See Bold Items)**  
Completion of Actions, Status Oct 24, 2005

1. Gd-156, 158, 160 will be redone by **Leal in the resonance region. 155 and 157 will be improved by BNL and LANL.** New versions with only cross sections (without covariances) will be released in September for the Beta-1 library.

Action: Full set of 8 isotopes of Gd was re-evaluated by BNL, including resonance and fast region, results included in b1.

2. 242,242mAm and 243,245Cm had no fission neutrons. **Talou/Young/Kawano will check these files – we think the Am files are already fixed.**

Action: BNL discussed with Kawano early Oct 05, he thought that the problem was already fixed. Once b1 was released, Van der Marck (NRG Petten) reported the problem in 242g, 242mAm, 243Cm and 249Cf. Koning noticed that dummy mf4/mt18 should be added to solve the problem. BNL corrected on Oct 24, 2005, files seem to be ok.

3. Ca-00 crashes in HEATR. **MacFarlane will check.**

Action: Ok in b1, Ca-00 was removed and replaced by isotopic evaluations (JEFF-3.1) that were successfully processed by NJOY-99.90.

4. New LANL 89Y, 191,193Ir, and Tm-169 dosimetry files could be made complete evaluations and put into. **Do by the B-VII release if possible- Herman.**

Action: Not yet done, LANL dosimetry files not yet available.

5. 237Np. Existing LANL file is reasonable. No action.
6. Cu-63, 65. Russ complains about performance. **Kawano will ask JENDL about their file.**

Action: BNL discussed with Kawano, JEFF-3.1 adopted ENDF/B-VI.8 files that are 1998 evaluations by Koning, Chadwick and Hetrick, therefore no change in b1.

7. 232Th. Replace by JEFF/Maslov or IAEA/Herman/Leal. **Action – Herman.**

Action: IAEA evaluation up to 60 MeV is included in b1.

8. List of problems found by Herman, eg NJOY/RESEND calc. –ve cross sections, residual nucleus incorrect, nonzero threshold, etc. Herman will post this list. Prompt KE of gammas = 6 eV (instead of MeV). Many of these have been cleaned and fixed by Dunford. The current status of these problems should be re-assessed for B-VII, and then fixed! **Herman will generate updated list of problems; Little/MacFarlane/Kawano will try to fix, and will distribute this list.**

Action: Observed problems should largely disappear in b1 as many problematic files were replaced by more modern evaluations. BNL will prepare new list of deficiencies.

9. 238Np and some others end at a very low energy. Should these be thrown out for B-VII – or substitute using other JENDL evaluations? **Action: Kawano /Little/Herman.**

Action: BNL discussed with Kawano, JENDL-3.3 included in b1.

10. Cullen reported problems with files: Mg24, Ar40, K-41, Ti isotopes, Ni-59, and Np-238, Cf-253, Es-253, we'll consider taking them from JEFF/ JENDL. (Other materials he listed, such as 3,4He, 6Li, natC are fine we think – eg the n2n threshold is above 20 MeV, so not a problem). **Then we would eliminate the Ti-nat evaluation, etc. Look into adoption JEFF evaluations for the dosimetry files. Herman will do this (and other natural v. isotopic evaluation issues). Blair Briggs will look into Ti benchmarks.**

Action: Adopted in b1 were 24-Mg (JEFF-3.1), 40-Ar, 41-K and Ti isotopes (all replaced by JENDL-3.3), Ti-nat removed, Ni-59 and Np-238 (both JENDL-3.3), Cf-253 left with no change, Es-253 removed as incomplete.

Ti benchmarks: ???

11. Zr isotopes. **Herman suggests a possible adopting the SG21 recommendations,** which involve mixtures of new BNL, JENDL, and BROND. Blair notes HEU-

COMP-INTER-005 and COM-MIXED-003 Obninsk Zr criticality assembly this will test Zr. **Cecil and Skip will test. BNL will send SG23 recommended files immediately and Cecil and Skip will test, together with the JENDL files. Kawano will also check these as he has studied capture for these. Cecil will give an assessment by early Sep 2005.**

Action: Kawano reviewed SG23 files (largely based on JENDL-3.3), then Nakagawa (JAERI) fixed inconsistencies with JENDL-3.3, Kawano found that capture is too high.

Afterwards, these files were given to KAPL for testing, preliminary finding indicates too high capture RI, Said reviewed MF2 for all isotopes and discussed with Cecil, Said made minor modifications in 91,96-Zr, but he does not see sufficient evidence to change his RI in 91-Zr. These modified files were included in b1.

12. Pa-231, 232, 233. We should ask Trkov's opinion on which are the best files. **LANL/Chadwick should also look at the Bordeaux/ Geel fission data. Assess whether or not to take 2 isotopes from JENDL (for 231,233).**

Action: BNL consulted Trkov, files from JENDL-3.3 included in b1.

13. 232Th. ENDF is old but does have covariances. There is a new IAEA/CRP file from Leal (resolved), unresolved (Geel), and Herman. This needs to be tested – after Leal has finished his work. We can test high energy performance against THOR. Mosteller's light-water breeder test can be done too. Leal can make covariance data with IAEA high-energy estimates too.

14. Mosteller – likes many aspects of the new evaluations, but...UNRES res region for 235U. ZEUS assembly (HEU plates with graphite with Cu reflector). As the spectrum changes, there's a big trend in B-VI and B-VII evaluations – softer spectrum leads to a drop in reactivity, whereas B-V is better. Is this due to 235U unresolved resonance range? **This poor performance is in contrast to HEU\_MET\_FAST-7 results from Kahler, where things looked good. We'll discuss with Mosteller, but no changes likely before beta-1.**

Action: ???

15. Mosteller - Th: The original ENDF performs poorly, Maslov/JEFF performs better; Mosteller – SB-5 (which includes U and Th, in thermal) shows 0.9957 (low). But we're not sure why- the JEFF Th doesn't much improve this. IEU-COMP-INTER-ICI-001 has 4 cases with 40-49% absorption in Th, from fast – thermal. Current results for thermal are badly off (7-8% off!). **Leal/Herman to finalize a Th232 for testing by MacF and Mosteller, with the additional Th benchmark ICI-001 involving testing. Leal to give LANL by August 1, 2005.**

Action: Leal finalized resonances and gave to LANL in July 2005, file for 232-Th was completed in Vienna and included in b1.

16. Fast cross sections for Cu: Unmoderated ZEUS benchmark (HEU with Cu reflector). We now calc 1% high for new B-VII. B-VI looks better. Look into how JENDL Cu performs. (JEFF used ENDF6.8 Cu). BTW, Comet uses a Cu reflector, so it would be good to have it right – McKnight notes we should check that the integral assembly model is right. **Kawano will look at JENDL Cu data, and Bob/Russ already has processed and will test.**

Action: BNL discussed with Kawano, decided to keep Cu-63, 65 as in b0.

17. Mosteller: 233U – 2 thermal cases he looked at, one has k above and one below 1, so hard to assess new thermal nubar 0.3 % change.

18. Mosteller: 239Pu thermal Pu-ST-09 calculates 2% high. This is one of many experiments, and there are trends that many have noted (eg Heinrich). Can't be solved by B-VII. No action.

19. 1D angular distributions. VI.4 to VI.8 led to poor performance with the new 2H angular distributions, in reflected HEU spheres. But another series of unreflected cylinders with large error bars that perform better with new data. Hale is also looking at microscopic predictions. **Hale will study this with a recommendation for beta-1 in September 2005.**

Action: ???

20. 233U – check Heinrich's previous testing to assess the 0,3% possible change for nubar-thermal. **Dave Heinrichs will dig up old data testing results and distribute, and then use beta-0 files to recalc, along with the modified thermal value. Bob will send Dave the ACE files.**

Action: Dave will report results at the CSEWG meeting, Nov 8-10, 2005.

21. 9Be. The new result – using Hale's R-matrix analysis for the total elastic, looks much better – the Be thickness bias is much reduced. Westfall suggests looking at some benchmarks that have Be. Need to also check the LANL Pu/HEU –with Be reflectors. ZIPR-20 cores are massively over-predicted, and need to be calculated too (space reactor criticals). Be ball is in progress. **LANL/Hale will also explore using Hale's angular distributions too. We will use the new Hale version of 9Be – and explore using Hale's angular distributions.**

Action: ???

22. S-alpha-beta. MacFarlane studied the methods used. MCNP works at 293.6K, but ENDF has data at 296K. MacFarlane recomputed S at 293.6, for better self-

consistency. Also, there were too few grid points on the alpha-beta grid in the evaluation, and putting in more points improved the results based on the integrals. The number of incident energies was also changed. MCNP sampling scheme was also changed to use an improved sampling.

**Bob will give us recommendations and files by Sep 2005. Bob will also supply Cecil with total cross section, with temperature dependence.**

Action: New files from Bob received and included in b1.

23. 1H. MacFarlane – going from 332.0mb to the Standard value of 332.6mb, causes about 0.1 – 0.06% decreases in k-eff. (but, note that the temp effects would take it down slightly. There were arguments presented by Lubitz and Kahler that they preferred the 332.0 value. They would see a drop by 0.14%. Our tentative conclusion is to stick with 332.0mb – it is within the experimental error bar (332.6+/- 0.7). **MacFarlane et al will test Hale's new latest-latest 1H evaluation and Hale will discuss with Carlson** whether this should be the one used in the standards (this still has 332.0 at thermal).

Action: New H1 received from LANL that agrees with the Standard, included in b1.

24. Skip Kahler. Used RCP01 calculations, using B/VI.8 and VII.beta0. Overall:  $k=1.00000(14)-0.0023(50)*A$  A=above fraction leakage. Pretty good. He then looked at faster assemblies, HUE-MET-FAST-007 from ORNL – the B-VII data look much better – they are hotter, and k is v. close to 1. HEU metal with polyethylene – at various spectrum hardnesses everything looks much better. No trend in calculations for the 26 assemblies. Generally, Bettis codes are 0.1% lower than MCNP. Using the Mattes kernel instead of ENDF results in a very tiny decrease in k – in the noise. MacFarlane saw a tiny increase. LCT-6 look excellent - 1.000 essentially.

25. 208Pb. Skip saw some effects of poor Pb reflection for LCT10.1-4 (they over-calculate), and we noted that we need to assess 206. 207Pb too. There are also indications that LCT10.9-13 for iron reflectors also shows too much over-calculation. **Kawano will look at improving scattering in Pb isotopes.**

Action: BNL discussed with Kawano, 208-Pb left unchanged, 206,207-Pb taken from JEFF-3.1 (evaluated by Koning in 2004).

26. **Bob will send Cecil and Dick all s-alpha-beta kernels for BeO/BE O Be/O kernels.**

Action: ???

27. All natural evaluations will be removed from b1 if isotopic evaluations are available. **Action BNL.**

Action: Out of 15 natural evaluations in b0, 12 were removed since isotopic evaluations are available, only 3 natural remained in b1 (C, V and W).

28. Fission products. Deficiencies in URR noted by K. Guber on 155,157Gd (will give information to BNL), **Y. Danon will provide his new data to BNL** (data not yet published).

Action: Guber comments were reviewed by BNL, discrepancies with Wisshak data are actually in fast region, not in URR. BNL re-evaluated 155, 157-Gd with Empire and fixed the problem.

29. Fission products. **NJOY99 patch for JENDL-3.3 should be used by NJOY2003 - MacFarlane.**

Action: All fission products in b1, including files adopted from JENDL-3.3, were successfully processed by NJOY-99.90.

30. Photonuclear. LANL is working on improved photonuclear data for actinides, current Obninsk files will be replaced by new LANL. **LANL will supply new actinide files for b1.**

Action: LANL supplied new actinides, included in b1.

31. 51-V. BNL made a modification, too high H production at 14 MeV (complaint from fusion community). BNL fixed the problem. **Improved file will be included in b1.**

Action: Improved file was included in b1.

32. McFarlane reported b0 Actinides testing.

- U235 spectrum too soft, inelastic scattering probably?
- 233U pretty good
- Bigten consistent with Godiva
- McFarlane will look into U235 spectrum (?) and some other issues, small changes only.

33. Lubitz: Thermal 235U standards, what to do? Fission agrees (new, VI.5, old standard), scattering cross section differ quite a lot, little can be done to change this. Nubar: old-new = -0.14%, k1 new 721.606, old 719.49, nubar can be adjusted, the only option. Lubitz suggested to ignore 235U thermal nubar from standards. Nubar already higher in JEFF-3.1 compared to new standards. **We need next round of standards, then repeat the exercise and decide what to do.**

Action: ???

34. Gd. **Action BNL, ORNL, LANL:** Resonances 156,158, 160Gd from BNL to ORNL; fast region 155, 157Gd new from BNL to LANL. New covariances will be produced by ORNL and LANL. It remains open what to do with 156, 158, 160Gd fast.

Action: In August 2005, BNL sent SG23 files to ORNL and Leal produced new covariances in resonance region. In meantime, Said completed his Atlas and BNL re-evaluated full set of Gd isotopes (8 isotopes) in fast region and merged with new mf2 from Said. BNL-LANL made progress on covariances in fast region and first results are available.

Leal is redoing resonance covariances using the latest files included in b1. BNL-LANL should complete covariances in fast region. Full set of 8 isotopes including covariances in mf2 and mf3 should be included in ENDF/B-VII.

35. Re. Ok, in future new resonance data from RPI. No action.
36. 233-U. Resonance region is ok. Kawano will discuss with Mark what to do with fast region.
37. 232-Th. **Leal will provide covariances for resonances in RRR and URR (August 2005).** Fast region is feasible, will be done later (BNL, LANL).

Action: Leal supplied covariances to IAEA, included in b1

38. 235,238U and 239 Pu covariances will be done probably in 2006. No action.
39. Covariances for standards. **Action:** LANL will provide 11-B evaluation (end of July 2005?). Then, Pronayev will need 2 months to produce covariances for single materials. Full covariance matrix is not needed.
40. Processing. ORNL will have something operational this fall (M. Dunn). NJOY – no plan for this year, McFarlane wants to process MF=30 for hydrogen. ERRORJ, author Chiba, some improvements underway, not his main job, may invite him to LANL. NNDC should use NJOY and ERRORJ from Leal to process new covariances for b1.
41. Bob Little: What to do with covariances from B-VI.8? **Bob should provide recommendation on this.**

Action: ???