

# Mini-CSEWG, Port Jefferson, June 22, 2009

Chair: M.B. Chadwick

## Agenda

1. Opening – M.B. Chadwick (5')
2. ENDF/A status – M. Herman (10')
3. ENDF/B-VII.0 deficiencies – M. Herman (20')
4. Detailed discussion of individual materials for ENDF/B-VII.1 and review of CSEWG-2008 actions – All (270')
  - $^3\text{H}$ ,  $^6\text{Li}$ ,  $^9\text{Be}$ ,  $^{19}\text{F}$
  - $^{23}\text{Na}$ ,  $^{35,37}\text{Cl}$ ,  $^{39,41}\text{K}$ , Ti, V,  $^{55}\text{Mn}$ , Cr, Fe, Ni,  $^{63,65}\text{Cu}$
  - Gd, Cd,  $^{78}\text{Kr}$ ,  $^{89}\text{Y}$ , Zn, Zr, W
  - $^{233,236,237}\text{U}$ ,  $^{240,241}\text{Am}$ ,  $^{238,239}\text{Pu}$
  - fission spectra for 'Big 3'
  - missing gamma production
  - minor actinides
5. Status of ENDF/B-VII.1 covariances – P. Oblozinsky (30')
6. Final discussion – All (30')

## Working material

Excerpts from the CSEWG 2008 minutes

### Evaluation Committee Report

M.B. Chadwick, LANL  
Committee chair

#### ENDF/B-VII.1 release

Overall theme for VII.1:

- a) Improved criticality safety/structural materials
- b) Improved Li (n,t), and Be possibly
- c) Improvements to minor actinides
- d) [Include covariances for ~100 materials](#)

Items in blue added by M. Herman in June 2009

**Overall summary of isotopes and who has ongoing work for B-VII.1**

Isotope	Lab	Release	Timescale/Actions
3H	LANL	B-VII.1	FY09 – fix T(n2n)
6Li	LANL	B-VII.1	FY09 – new (n,a) above 1 MeV by Hale & Brown (LLNL) check breakup formats
9Be	LANL	B-VII.1 or 2	Goal - R-matrix with RPI data in FY09, but criticality issues complex & may take longer
19F	ORNL/LLNL	B-VII.1	BNL will merge, LLNL etc test against crits
23Na	BNL	B-VII.1	BNL new evaluation with covariances
35,37Cl	ORNL	B-VII.1	Some testing needed
39,41K	ORNL	B-VII.1	Some testing needed
Ti iso	LANL/ORNL	B-VII.1	Consider new RPI data, merge with FY10 48Ti ORNL data, LLNL fix(47) and retest
V	LANL	B-VII.1	FY09 – hope that modern higher energy eval will improve criticality testing.
55Mn	ORNL/BNL/LLNL	B-VII.1 or 2	LLNL compare fast region & assess. which merge with ORNL, BNL covariances, LANL in future?
Cr iso	ORNL	B-VII.1	Test against crits, incl. ZPRs, IPPE. k-inf. LANL evaluation later.
Fe	LANL	B-VII.1	Fix (n,x alpha) if needed, using Haight data.
Ni iso	ORNL/LLNL	B-VII.1	ORNL finish in 09, submit, test. Should LLNL advances be incl? LLNL to assess whether fixes keff crit. LANL upgr in '12?
63,65Cu?	LLNL	B-VII.1	LLNL assess whether their evaluation fixes Zeus & n trans. testing; consider adopting.
Gd	ORNL	B-VII.1 or 2	FY10-use new RPI data (~10% change at therm.), test with PSI, Chalk R, Russian crits
Cd	BNL	B-VII.1	Adopt recent upgrade; comp. with RPI data
78Kr	LLNL	B-VII.1	Check capture because of import. in reactors as FP; compare with B-VII & others, & test
89Y	LANL	B-VII.1	Ignatyuk says capture too low at lower en. (missing res); upgrade?
63-72 Zn	LLNL	B-VII.1	Document comparison with ext and B-VII.0, and check (with BNL) that res OK
Zr iso	BNL	B-VII.1	Update Zr90 (beta4) and 91 as necessary, use new RPI data, retest at Bettis & KAPL
W iso	IAEA/BNL	B-VII.1	Choose between IAEA and KAERI.
233U	LANL	B-VII.1	Fix DN typo
236U	LANL	B-VII.1	Mods to cap, fiss? Based on crit reac rates
237U	LANL/LLNL	B-VII.1	If LANL, use upgraded res. range & fiss to further improve match to LANL crits
Am240	LLNL	B-VII.1	Accept. Have Kawano look it over.

Am241	LANL	B-VII.1	Upgrade cap above 30 keV; possibly tweak fission based on LANL crit & FCA reac rates
238Pu	LANL	B-VII.1	Ignatyuk says total inelas. bad etc. Upgrade?
239Pu	ORNL	B-VII.1 or 2	Assess whether new Derrien res. improves crit testing including solutions and ZPRs.
Big3	LANL	B-VII.1	Fix fission spec > 10 MeV with finer grid.
$\gamma$ -prod	LANL	B-VII.1	Morgan White add lost $\gamma$ -production back,
MA	LANL	B-VII.1	consider adopting Bk, Cf, Es, Fm, 237Pu isotopes from Japanese actinoid file.

### Expected for ENDF/B-VII.2

2H	Chalk River/LANL	B-VII.2	Geel data planned, theory in progress, goal is to improve some of the crit testing.
9Be	LANL		See above.
16O	LANL/ORNL/LAPL	B-VII.2	New evaluation, including (n,alpha)?
Ni iso	LANL?	B-VII.2	Add in LANL work from ~FY12
235U	LANL/ORNL/LLNL	B-VII.2	Capture WPEC upgrade if needed, and new FIGARO fission spec
238U	LANL/ORNL/LLNL	B-VII.2	Capt. upgrade if needed, using Wallner data, & new FIGARO fission spec
239Pu	LANL/ORNL/LLNL	B-VII.2	New FIGARO fission spec; capture upgrade, inelastic scattering upgrade if needed.
Big3	LANL	B-VII.2	Possible change to preeq/inelastic based on Bethe sphere testing

### Detailed Minutes of the CSEWG 2008, (actions in red)

- Overview comments and plans for VII.1 and ENDF/A files, Chadwick, Herman, 15'

Michael Herman showed the list of ENDF/A files – files submitted for consideration as a future release. He also described the G-Forge way to keep track of updates to files – built on CVS.

- Release files for ENDF/B-VII.0.fix1, Little, 15'

Little described the MCNP ENDF70 library; it contains all ENDF/B-VII.0 except for 3 materials (Be7, Cf253, Es253 – too incomplete); it was produced at 5 temperatures, between 293.6K and 2500K. The library is being made available by users to RSICC, Oak Ridge. Fixes were made, note the S(alpha-beta) set released earlier by BNL was not quite right – owing to the processing for S(alpha-beta) being unclear.

For 1H, a tiny change was made to the capture gamma-ray energy. An NJOY fix was also made to get KERMA right. 45Sc – ang distributions changed to lab frame and poor excitation function definition changed. 89Y MT91 inelastic scattering to the continuum had negative cross sections! These were fixed, but it should be looked at. **Action - Patrick Talou to look at this and check that Little's fix is OK – or come up with a new file.** 96Zr and Mo-97 – values from Kalbach wrong (9.99 instead of 0.99); Eu153, Mt91 had negative distributions; 242gAm had no angular distribution for MT18 fission, and some strange MT51-54. Patrick Talou fixed these deficiencies.

**Action - 7 out of 8 fixes have been already sent to BNL, and the last one (Eu) will be sent by Little.**

We agreed to make the official version of B-VII.0 → B/VII.0fix. BNL may rebuild an NJOY created MCNP library. If they rerun with NJOY, then they will use Bob Little's inputs, including those that are needed to get S(alpha-beta).

### **Detailed Agenda for B-VII.1 Upgrade**

**D.** n-d scattering has discontinuities in the 3-4 MeV region. Elastic cross section has a big influence on certain crits, eg ZED-2 at Chalk River. Theory work is being done using Fadeev methods with various potentials with Canton (Padua), but still more theory is needed.

In data testing, Koziar sees a bias in k-eff as a function of leakage for VI.8. The ENDF/B-VII looks the best so far for the ZED-2 CVR, and things get worse when he adopts results from latest theory. But there's still a bias with B-VII.0. He also noted that earlier he was using an erroneous S(alpha-beta), but now he is using the correct ones.

**T.** For T(n,2n), fusion people claim B-VII worse than B-VI, apparently Hale agrees.

**Action – Hale send new T(n,2n) upgrade for VII.1.**

**Update on IAEA standards group efforts.** Allan Carlson discussed standards philosophy. We agreed that standards could have covariance data added to them, and to extend the energy range (eg up to 150-200 MeV). The standard group is collecting new data on: the 252Cf spectrum; the 235U thermal fission spectrum; 197Au(n,g) & 238U(n,g) Wallner experiments. Discussed new 'reference cross sections' (not as well known as standards), eg prompt gamma-ray production cross sections for Fe (n,n'g), and some (n,2ng).

Allan also talked about developing more complete covariance evaluations for the full ENDF/B-VII range.

**Action – for 235,238U and 239Pu, to be checked by Allan that right covariances are in the submitted ENDF/A files**

**6Li(n,t)**. Fix format error. Hale upgrade based on LANSCE data, and issues related to changing a standard.

**Action – Gerry will merge new results with standard below 1 MeV.** We will consider – for discussion – the possibility that the standard be changed a bit below MeV if the matching can be done more easily there. Carlson noted that the ‘lower compromise’ B-VII.0 evaluation was both a compromise between the LANL and Chen R-matrix evaluations, and also was influenced by other data in ratio to Li. **Action - Hale should address the latter issue, and whether this would change his new result below 1 MeV.** LLNL will also look at the new evaluation and comment.

Brown (LLNL) has noted ambiguities in what the breakup channels are – due to ambiguities in format treatments, showed toy calculations. **Action – Hale, ask Brown for details.**

**9Be.** Insights from new RPI data; fix of VII.0 interpolation problem; plans for future improvements. Hale/Danon/Chadwick, 1-2 slide.

**16O.** Comments on whether (n,alpha) should be changed, and when? Also note comments by Edwin Kolbe in his testing paper. Hale/Chadwick, 1 slide.

V. Anything new?

**19F.** Updates from ORNL, LLNL, Dunn/Lea/LLNL-EGAF 1-2 slides. New Reich-Moore LRF7 format, for cases where 2 inelastic channels open up, were used. The new evaluation was done up to 1 MeV; used 3 transmission measurements done by Larson et al from 5 eV to 20 MeV, and 1 capture measurement at ORELA by Guber up to 700 keV. Also used shape of data from Los Alamos, and used inelastic data from Obninsk. Covariances are being made available too.

Dunn noted some intermediate benchmarks are sensitive to fluorine – and these will be tested. This might involve Livermore experiments. Lubitz has some data with fluorine too. **Action – the data testing committee will establish a small group to test and give feedback on the new evaluation.** Try to involve Dave Heinrichs too because of LLNL fluorine crits experience.

Thermal neutron gamma-ray production has been evaluated by Firestone et al. DICEBOX is also used to get discrete and quasi-continuum gammas. The same total capture cross section was used.

**Action – We agreed to use the new LLNL/LBL data. BNL will merge the 2 files from ORNL and LLNL.**

**Action – LLNL 19F experience in data testing for gamma-ray leakage, which show deficiencies, will be looked at by LLNL who produced the new gamma-production evaluation EGAF.**

**22Na.** Resonance-total-width, who?

**Ti isotopes.** VII.0 took Ti from JENDL3.3. New evaluations from LANL. Testing in crits and pulsed spheres? ORNL 48Ti(n,g) – was this used? Note Danon’s expt talk on total x/s measurement 0.5-20 MeV and need for res. energy shift. Kawano/Leal 2 slides; LLNL 47Ti bug fix, Summers.

Neil Summer found bug in 47Ti(n,n’) – previous file had gamma-multiplicities way too high. A TALYS calc was used for the old evaluation, so LLNL recreated this new multiplicity.

**Action – Kawano will include LLNL fix in his new Ti isotope evaluations.**

Kawano described the new LANL evaluations. New resonance parameters were adopted from the Atlas, and the resonance energy was extended. GNASH calculations were done, also using Dashdorf et al GEANIE / LANSCE data for 48Ti. The elastic scattering distribution is important for matching the crits. Kawano adopted the B-VII.0 data that uses Argonne 1950s era scattering data. He found that rather than using a modern OM model didn’t give as good a prediction of the crits. He also reevaluated the total cross section by doing a least square fit of the measured total data (fluctuations exist up to 6 MeV).

Good benchmark testing was obtained for the HMF79,34 crits. and HMM crits. HMF79 was the new Ti benchmark from Russia. We agreed to adopt this new evaluation. Kawano also noted that the transmission testing didn’t seem to improve.

ORELA will be working on 48Ti – when they have new data in FY10, Kawano will include it for testing.

**Action for Kawano: Danon’s data at 0.5 MeV (resonance energy shift) and his new total cross section data should be considered; likewise for new ORNL data.**

**55Mn.** New ORNL evaluation. Results including comments on ZPR performance. Has LLNL worked on this too? Leal/McKnight/Marco Pigni, Summers 2 slides.

New data from GELINA Geel was included, as well as new ORNL data. Benchmark testing has been done with the NEA. McKnight has also done data testing and things look much better for the ZPR.

BNL has done covariance estimates for 55Mn in the fast region. There is also an effort by Capote at the IAEA at higher energies, which will be a complete file with covariances. LANL is also scheduled to do high energy next year. The resonance structure in the MeV range needs to be carefully accounted for. LLNL is doing an evaluation at higher energies.

Action – Brown will send 55Mn to BNL, who will review it, and the IAEA evaluation. We also encourage LLNL and Capote/IAEA to interact.

McKnight has tested against ZPR6/10. B-VII gave a 4% error. Earlier testing showed that 239Pu may be part of this (using B-V does better). Similar problems of B-V for Cr and Mn appeared. The new ORNL Mn evaluation seems to have the same good effect as using B-V for the Mn.

**35,37Cl.** ORNL evaluation submitted Feb 07; has it been tested? Dunn/Leal 1-2 slides.

New evaluation has been processed by NJOY08 (allows LRF7). It will also enable testing of covariances. Action – Skip will delegate some data testing.

**39,41K.** ORNL evaluation submitted Oct 2008, Leal/Dunn, 1 slide

Action – Skip will delegate some data testing.

50,52,53,54Cr. ORNL measurements and plans to submit evaluation in FY 2009, Leal/Dunn, 1 slide

Leal has a preliminary set for 52,53Cr. He is also working on 50, 54. 53Cr and nat-Cr transmission & capture were done recently by Guber. They go up to the first inelastic channel.

Most data testing doesn't have enough Cr in steel to show much effect. But the ZPR6.10 with carbon and Cr is very sensitive. Blair Briggs noted a k-infinity benchmark is quite sensitive to chrome – at IPPE. ENDF/B-V did a good job – it was elemental.

Action – Leal will finalize Cr evaluations this year (FY09) – and these will then be tested by Kahler et al.

LANL is doing high energy work, but not till FY 2011.

**58,60Ni.** ORNL measurements and plans to submit evaluation in FY09, Leal/Dunn, 1 slide

LANL is doing high energy work, but not till FY12. LLNL has done some work in the high energy region.

Data testing needed for LLNL's 58,60Ni to see if HMF3 improved.

Derrien has worked on this with Leal. New Guber measurements have been included. ORNL will finish in future.

**LLNL evaluation work.** Overview of LLNL evaluation methodology and summary of evaluations for isotopes of Kr, Co, Ni, Cu, Zn, Ga, Summers – a few slides. LLNL is

submitting two sets of evaluations, <sup>78</sup>Kr and <sup>63-72</sup>Zn. There are two projects - partial activation cross sections for ENDF/A, which are now being extended:

- First set was done with STAPRE by Hofmann. Koning global potential used. Regional systematics developed for level densities, strength function, etc, to allow extensions to unstable region. More recently, TALYS was used to calculate distributions – spectra and angular distributions, ENDL files created, and then ENDF files made.
- TALYS used for whole evaluation for Co, Ni, Cu, Zn, Ga. They are not evaluating ones that exist in ENDF, but use them to calibrate/test their simulations for the off-stability targets.

**<sup>78</sup>Kr** – LLNL when finalized it will be sent and likely be adopted.

Action – pay attention especially to capture because of its importance in reactor applications as FP. Compare with earlier VII evaluation which was part of the NEA/WPEC Subgroup 23.

**<sup>63-72</sup>Zn** – LLNL has new evaluation for these isotopes. They continued over information on resonance parameters. Action – LLNL will finish, submit evaluations and documentation (esp. pictures) to show various reaction channels. Livermore did use resonance parameters from earlier VII.0 evaluation (the elemental eval gave the individual elemental parameters) - LLNL will also work with BNL/Mughabghab to check if they are OK.

**Pb, W, Ta, Re, Al** – LLNL. Action for Pb, W, Ta, Re, Al – Neil will tell us if any of the ENDF stables need updating.

**Cu<sup>63,65</sup>**. Problems in the fast range have been noted by Mosteller, from his testing of the Zeus assembly. ORNL is working on intermediate range.

Action – Mosteller will send Zeus MCNP decks to LLNL (Marie-Anne Descalle), and she will see if new LLNL Cu<sup>63,65</sup> evaluations perform better in Zeus. Likewise, it would be good to see if the LLNL evaluations perform better than B-VII for 14 MeV transmission experiments (B-VII performed poorly).

**Fe(n,a)**. Did B-VII.0 at higher energies use Haight's (n,xa) data, and if not, can we do this. Talou/Haight.

**Gd**. Note planned RPI capture expts this year; ORNL evaluation planned for 2010. Mosteller comments from reactor community experience – longstanding view that <sup>155,157</sup>Gd (the main absorbers) is that “Gd burns out too fast”.

RPI paper was published on the Gd measurements, <sup>155</sup> and <sup>157</sup>Gd isotopes will be re-measured, to augment the elemental measurements. A 10% change was observed in

<sup>157</sup>Gd at thermal in the previous. ORNL's work will be done in FY10, though Danon will have resonance parameters earlier.

If we get a preliminary file from Danon (using his measured resonance parameters) we will test against some Russian experiments, and Chalk River & Cadarache (PSI experiments). Limited testing was already done at Cadarache claiming better results. Olivier Serot noted that the isotope and elemental capture values are inconsistent.

**90Zr.** Should the beta4 version be released? Feedback from KAPL & Kozier, as well as possible issues in VII.0 noted by Trkov in reactor testing? Note Yaron Danon's expt talk on elemental Zr total x/s measurement 0.5-20 MeV suggesting B/VI.8 was better. Marco Pigni, 1-2 slides.

RPI total cross section shows VI.8 was better than VII.0 below 16 MeV.

Propose deleting the bound level in <sup>90</sup>Zr and adjust gamma-width of first few levels in <sup>91</sup>Zr. New data suggest raising the <sup>91</sup>Zr capture cross section at thermal (with a corresponding change to <sup>90</sup>Zr) so as to also match the Zr data.

**Action – the new evaluation will be sent to Bettis and KAPL as well as Kozier to test.** Trkov noted worse performance. Danon showed data in the higher energy region ~ 4 MeV. BNL should consider using these data.

**Cd.** Adoption of BNL upgrade and positive results from data testing? Note Danon's expt talk on how RPI capture and transmission data support the change in the thermal region. Herman/Mughabghab/Mosteller, 1-2 slides

**Action – Bettis will test Cd evaluation.**

**182,183,184,186W evaluations.** ORNL resonance measurement (evaluation not till FY11?); LLNL work; adoption of new IAEA evaluation shown by Trkov at Physor08? Herman/Leal/Kim/(LLNL-EGAF) 1-2 slides

There are two evaluations:

- Now available, KAERI evaluation that uses EMPIRE. They used ENDF/B-VII resonance parameters, but made some changes to the unresolved resonances (G\_gamma) in order to improve criticality predictions. Their evaluation does better against the 11 MeV (n,xn) spectra. Slight improvement to 14 MeV Octavian and FNS leakage spectra, but still discrepancies (slight improvements over B-VII). For criticality, ZPRs look much better.
- The IAEA evaluation. ORNL did covariances, but did not change the cross sections (except changing the representation). ORNL will do measurements in FY09.

The present file is complete and has covariances. The match to ZPR etc criticals was improved (but not by changing resonance parameters); Ignatyuk - odd isotopes are responsible since the capture cross sections are highest and low energy inelastic – this should be addressed in case improvements in the odd isotopes are possible.

Action – not specified.

**Cu.** LLNL evaluation. Testing against crits including Zeus? Summers, 1-2 slides, new Chinese evaluation is underway. Future ORNL work in FY11? Chadwick, comments.

**Pu and U isotopes.** Fix fission spec > 10 MeV to have finer points, Chadwick 1 slide

**240Am.** New LLNL evaluation, Summers, 1 slide. No previous evaluation. They used TALYS, and used Younes/Britt surrogate data for the fission. They used 242(m probably) Am resonances.

Action – accept LLNL file, and have LANL/Kawano look at it for completeness.

**241Am (n,g) upgrade** – higher cross-section, Kawano, 1-2 slide

Action – we will adopt this new evaluation above 30 keV. Kawano will also fix thermal values (e.g. capture) as necessary – including insights from DANCE – and also Japanese and Plompen talk (?) from Santa Fe workshop.

**MA.** Possible adoption of certain Japanese minor actinide files in B-VII.1, **Kawano.** He proposes using recent JENDL files (JENDL4 “Actinoid”) for Bk, Cf, Es, Fm and 237Pu.

Action – Kawano will provide a list of new evaluations.

Possible modification to fission cross sections for 241,243Am, 237U, etc based on LANL reaction rate crit assembly testing and Japan FCA testing, Chadwick, 2 slides

**237U** from LLNL. Summers, LANL 237 upgrades, Chadwick 1-2 slide

Possible cumulative FP yield upgrades of E&R for certain fission products, Chadwick, 1-slide

Action – keep an eye on this issue as it develops.

**233U delayed neutrons fix** to B-VII.0, Little, 1 slide. We will adopt this.

Action – ask Bill Wilson to ensure the fixed values are in reasonable agreement with measurements/WPEC evaluation.

**237Np planned upgrade** – (n,2n), chi? Anything else planned? Kawano/Chadwick 1 slide.

Action: Kawano will also include upgrade (Mughabghab) to  $^{237}\text{Np}(n,g)$  at thermal.

**Missing photon data** that was erroneously not-carried-over from B-VI, and plans to include in B/VII.1, White 1 slide

**S-alpha-beta** in ENDF/B-VII.0 and in fix1. Comments, including observations from PHYSOR08 meeting, Little 1 slide

Action: Little will provide NJOY processing values/input decks used to create ENDF70 SAB to the NNDC for posting. Kahler/MacFarlane/Little will address the ambiguities present in NJOY by clarifying how to do this in the NJOY manual.

Need to be able to use LEAPR to generate data at arbitrary temperatures – requested by Kahler and MacFarlane. Need Bob's help to document this. Chalk River says that Bob had found the old files, but they didn't reproduce the B-VII values.

### **Detailed Agenda for longer-range issues for possible B-VII.2 release**

**1H(n,p)** scattering, Strakovsky, 10' + slide from Hale. They have a low-energy fit below 25 MeV (LE08). The latest Arndt evaluation agrees within ~1% with ENDF/B-VII.0.

Showed new data from Ohio-08? Carlson said it would be interesting to see what differences the Arndt v Hale methods would give if they used the same database. We asked if he could compare his scattering length with the value Gerry noted, where there are discrepant measurements.

Action – Hale will review this analysis and consider adopting insights from it as necessary. Hale will work with standards community to consider using these new analyses to extend B-VII.0 up to higher energies (~150 MeV).

**2D.** Any new data from Geel? Comments from Kozier, Hale. No new data yet from Geel.

**239Pu.** Resonance region, including collaboration with JEFF, Leal, 1-2 slides

**239Pu, 235,238U.** Fission chi spectrum LANL/LLNL plans; 235U recent Geel expt, Shusaku Noda, 2 slides

**239Pu, 235,238U 14 MeV** inelastic scattering/preeq plans and Bethe sphere testing. Chadwick, 2 slides

**235U.** Capture update, WPEC subgroup, Leal/Kawano, 1 slide

**238U.** Capture & standard evaluation & Walner measurement, Chadwick comments

**240Pu upgrade in fast region.** Any testing results? Talou, 2-slides,

**Actinide inelastic scattering in fast region.** Future theory and evaluation work, Kawano, 1-2 slides

**Dy.** ORNL measurements and plans to submit evaluation in FY11, Leal/Dunn, 1 slide

**239Pu** – new Derrien ORNL resonance file is available for testing.

Action – Kahler, Talou et al, check which is the file in ENDF/A – we need to test the new ORNL file against solution crits, ZPRs etc.

### **Covariances Planning for ENDF/B-VII.1**

232Th, 233,235,238U, 239Pu are in very good shape. BNL can create MF32 for resonance region from Atlas, for many nuclides. Our goal is to produce covariances for ~100 materials. It is understood that the full set of preliminary covariance data produced for GNEP/AFCI data adjustment project contain 108 materials:

- 19 actinides – 5 high-fi in ENDF/A; 14 MA are based SG26+Maslov update. Mark Williams replaced low energy Atlas with his own ORNL assessment. But overlap between GNEP and low-fi is a bit ambiguous. GNEP version had Atlas at low energies, but there were some problems at thermal and this is being modified.
- 75 low fi covariance files
- Light nuclei from LANL (~10); H, 6Li, 7Li, 10B of good quality; 16O is simple Kawano's estimate.
- Remaining structural, heavy, FPs from BNL.

We should use ORNL structural etc – K, Mn55, Cl, F; Ti, Gd in pipeline.

#### ***Proposal for discussion at the CSEWG meeting:***

Take present starting point as ~108 materials which have high-fi, medium, and low-fi covariance data and upgrade as necessary:

- Adding ORNL work (4-8 materials)
- Add normal LANL upgrades Ti, V, Pu240, 241Am, 16O, 237Np med/high quality
- Add fission spec for big 3
- Add 16O ang dist uncertainty ( $\mu$ -bar)
- Add ang dist for 239Pu, 238U, 56Fe, 23Na
- Replace low energy Williams low-fi with Atlas (MF32)

Goal – complete covariance files, even though some crude, in ENDF/B-VII.1 that can be used by customers.