

WPEC Subgroup Proposal
TBD, CEA (JEFF)
R. D. McKnight, ANL (ENDF)

Title

"Coordinated evaluation of ^{239}Pu in the resonance region"

Justification for a Subgroup

In recent history, the US and Europe have adopted the same evaluation for the ^{239}Pu resonance region, largely based on work from ORNL and the CEA. In data testing for ENDF/B-VII.0, a general overprediction of Pu-SOL-THERMAL assemblies was noted, with an overprediction of typically about 0.5% - a very serious discrepancy indeed. In recent years, two efforts should be mentioned. Firstly, the JEFF community has developed an updated ^{239}Pu file for JEFF-3.1.1 that has modifications to the original file, at thermal energies, that has improved some of the aforementioned discrepancies. Secondly, at ORNL, Derrien and Leal have developed a new set of resonance parameters that have been incorporated into a file in ENDF/A for testing. This most recent evaluation is more consistent with the cross section resonance data and believed by the evaluators to be the best representation of these data to date. Nonetheless, this new evaluation does not improve the poor integral performance of the ENDF/B-VII.0 file, and in fact most of the discrepancies become slightly worse, as was noted by McKnight at the June 2009 CSEWG meeting. The goal of the new subgroup would be to bring together the experts in this area in the OECD/NEA community to see if a new evaluation can be developed that both uses the most accurate fundamental cross section data with nuclear theory constraints, and also better models the relevant integral criticality data. It is hoped this proposed collaboration would lead to the type of improvements obtained previously by WPEC collaborations in SG22 for ^{238}U .

Subgroup Monitor

TBD

Subgroup Coordinator

TBD (perhaps, O. Bouland)

Subgroup Participants (Proposal, to be revised, updated etc)

*H. Derrien, ORNL (ENDF); L. Leal, ORNL (ENDF); TBD, JAEA (JENDL);
TBD, O. Bouland, CEA (JEFF);*

(Note: Above names are placeholders. The data projects will identify appropriate participants from their community.)

Definition of the project and proposed activities

It is proposed as a mandate for this new WPEC subgroup to work on an improved ^{239}Pu resonance evaluation. This evaluation would build on the recent work done in the US (e.g., by Derrien et al), in Europe (e.g., refinements at thermal), and relevant work done in Japan. The goal is for the experts in this field to develop the best possible evaluation that is consistent with our fundamental cross section data, and hopefully leads to improvements in calculations of integral data, especially for the long standing overprediction of the Pu-thermal solution critical assemblies.

Relevance to Evaluated Data Files

Resource to advance quality of Evaluated Data Files to meet accuracy requirements of reactor analysis and criticality safety for thermal and intermediate energy systems.

Tasks:

- *^{239}Pu resonances*
- *^{239}Pu fission spectra (χ) – we note that LANL has done simulations to test the impact of various prompt neutron spectra on criticality, and found a significant sensitivity of the results to the χ matrix adopted. The proposed WPEC subgroup should take advantage of ongoing work, coordinated by a new IAEA CRP, on the prompt fission spectrum;*

Time-Schedule and Deliverables:

It is anticipated that the experts of this SG could complete and document the activities (mandate) listed above within 2 years.

- | <u>Date</u> | <u>Deliverables</u> |
|--------------|--|
| • June, 2009 | <i>Review of SG Proposal by WPEC;
initiate Subgroup activities</i> |
| • June, 2010 | <i>New resonance evaluation, if possible,
for consideration for adoption by ENDF, JEFF, JENDL, etc.
(In the case of ENDF, a goal would be for ENDF/B-VII.2)</i> |
| • June, 2011 | <i>Present Final Report of Subgroup activities,
including documentation and recommendation of a new
resonance evaluation for ^{239}Pu and of the improved
performance for Pu-fuelled thermal and intermediate energy
systems. Include motivation for new ^{239}Pu measurements,
if needed.</i> |

Other background:

The following issue will not be part of this WPEC proposal, but the group should be aware of it. In the fast region, ENDF uses a LANL evaluation, and JEFF uses a CEA/B-III evaluation. At a recent workshop on fission in Los Alamos, Romain (VEA) showed that although both labs model Jezebel criticality accurately, they do so for very different reasons, and the contributions from capture, inelastic, etc are quite different. Maslov has also illustrated differences between various evaluations for inelastic scattering, for example. Additionally, LANL would like to better model the calculated spectral index for $^{238}\text{f}/^{235}\text{f}$, for example, which is currently underpredicted at the center of Jezebel and may be due to issues in inelastic scattering or fission spectra. Longer term, it would be good to refine the evaluations to address these differences.