

2nd RCM on Nuclear Data Libraries for Advanced Systems-Fusion Devices (FENDL3)
23 – 26 March 2010
Vienna, Austria

SUMMARY REPORT

1. INTRODUCTION

The participants of the second Research Coordination Meeting (RCM) on Nuclear Data Libraries for Advanced Systems - Fusion Devices (FENDL-3) were welcomed by N. Ramamoorthy, DIR - NAPC who stressed the important role of the IAEA CRP for development of nuclear data for fusion applications. He discussed the management personnel changes at NDS. The CRP started by Alberto Mengoni with the present head of NDS, Robin Forrest, currently in charge of the CRP.

The Coordination Research Project (CRP) officer, Robin Forrest, gave introductory remarks that addressed the CRP history, objectives, scope and schedule. He discussed information added to the FENDL-3 website since the 1st RCM. The goals of the 2nd RCM were presented. That includes presenting progress by participants, modifying CRP objectives if necessary, and deciding on the way forward. U. Fischer was elected as the chairman of the meeting and M. Sawan as rapporteur. The proposed Agenda was discussed and adopted. The meeting continued with the presentations as follows.

2. PRESENTATIONS

Summary of presentations to be added.

3. DISCUSSION

An extensive discussion took place after the presentations. A major part of the discussion addressed the status of the evaluations for the 88 materials in the starter general purpose neutron library (FENDL-3/SLIB). The materials were discussed one by one with respect to adequacy of evaluation used, existence of better evaluation, and availability of high-energy (>20 MeV) data. Several changes were decided for evaluations to be utilized. In addition, several materials were approved for addition to the library based on input solicited from the fusion neutronics community, ITER, and IFMIF. Evaluations that will be used for these added materials were identified. Issues related to availability and utilization of co-variance in FENDL-3 were discussed. The activation data files for neutrons, protons and deuterons were discussed. The activation library for Fusion applications which will be part of the FENDL-3 package will be mostly based on EAF-2010. Issues related to the generation of the general purpose charged particle data library were also addressed. This library will be based primarily on TENDL-2009 or -2010.

Details of the decisions made and action items are given below.

4. FENDL-3.0 GENERAL PURPOSE NEUTRON LIBRARY

4.1. Revised Evaluations for Existing Starter Library Materials:

Following review of the evaluations used for the 88 materials in the starter library, several changes were agreed on.

TENDL means 2009 or 2010

H-1: Currently has data from ENDF/B-VII that extends to only 20 MeV.

Y. Watanabe provides extension to higher energy from JENDL-HE.

Standards only <20 MeV. Kawano will check if extension is possible.

D-2: No change.
H-3: No change although data only to 20 MeV.
He-3, He-4: No change although only to 20 MeV. No HE data is available.
Li-6, Li-7: Currently has data from ENDF/B-VII that extends to only 20 MeV. Y. Watanabe will join to TENDL above 20 MeV.
Be-9, B-10, B-11: Same procedure as for Li.
C-12: No change.
N-15: Use new Russian RUSFOND evaluation to 20 MeV and join to TENDL at higher energies.
N-14, O-16, F-19: No change.
Na-23: Use most recent JENDL-HE that is expected in 6 months. Consider the new better evaluation from BNL. Action for Kawano to check availability.
Mg-24,-25,-26: No change.
Al-27: No change.
Si-28,-29,-30: Keep from ENDF/B-VII but check and consider using the new JENDL evaluation due to unsatisfactory benchmark results. Action on Watanabe (Konno) to check.
P-31: Change to TENDL because ENDF evaluation used below 20 MeV is old.
S-32,-33,-34,-35: Keep ENDF/B-VII.0 below 20 MeV and joined to TENDL. Also consider replacing totally by TENDL for better quality. Action on Koning to check.
Cl-35,-37: No change.
K-39,-40,-41: No change but consider possible use of new resonance evaluation for K isotopes in ENDF/A. Also consider replacing totally by TENDL for better quality. Action on Koning to check.
Ca isotopes: Keep but Koning will check the more in-depth JEFF-3.1 evaluation for possible inclusion.
Ti isotopes: Keep but consider new ENDF evaluation below 20 MeV. Action on Kawano (Leal) to check.
V-51: JENDL-HE.
Cr isotopes: JEFF evaluation to be adopted subject to justification and approval. Action on Fischer (Pereslavitsev, Leal).
Mn-55: Keep JENDL-HE but consider the option of using the IAEA evaluation. Action on Trkov.
Fe-56: Keep JEFF with HE extension (recoils) to be fixed by Koning.
Fe-54,-57: Keep ENDF/B-VII.
Fe-58: Switch to JEFF. Koning to check.
Co-59: No change.
Ni-58,-60: Keep JEFF. Co-variances and resonance data to be rechecked in JEFF and ENDF/A by A. Trkov (Leal).
Ni-61,-62,-64: Keep ENDF/B-VII.
Cu-63,-65: No change.
Ga isotopes: No change.
Zr isotopes: No change.
Mo isotopes: No change.
Sn: Isotopic evaluations from RUSFOND files (or JENDL-4 if available) to be joined to TENDL at $E > 20$ MeV. Otherwise use TENDL only. Action on Watanabe to justify switch to JENDL-4.
W isotopes: Use the IAEA evaluation.
Ta-181: No change.
Au-197: No change.
Pb-206,-207: Use JEFF.
Pb-208: Use JEFF.
Bi-209: Switch to JEFF.

4.2. Materials to be Added to the Library:

Several materials listed below were approved for addition to the library based on input solicited from the fusion neutronics community, ITER, and IFMIF. These are 23 elements with their constituent isotopes. Only 3 actinide isotopes will be added as they are (U) needed for neutron measurement by

fission chambers or exist in the ITER concrete (Th). Evaluations that will be used for these added materials are identified here.

Re: TENDL
Zn: JENDL-HE
Ag: ENDF/B-VII+TENDL for the HE part. Ignatyuk to check the resonance parameters.
Ba: ENDF/B-VII+TENDL
Y: ENDF/B-VII+TENDL
Cd: ENDF/B-VII+TENDL. Trkov to replace resonance data with new better data.
Ce: ENDF/B-VII+TENDL
Ar: JENDL-HE
Er: ENDF/B-VII+TENDL
Sb: ENDF/B-VII+TENDL
Rh: JEFF. Action on Kim to compare with recent ENDF evaluation.
Sc: JEFF (new in-depth evaluation)
Br: JENDL-4+TENDL
Ge: JEFF (new in-depth evaluation)
I: JEFF+TENDL
Lu: TENDL
La: TENDL
Cs: JENDL-4+TENDL
Pt: TENDL
Hf: ENDF/B-VII (includes HE part). Action on Kunieda to compare with JENDL-4.
Gd: JEFF-3.2 (includes HE part). Action on Kunieda to compare with JENDL-4.
U-235,-238: Use standard, i.e. ENDF/B-VII for $E < 20$ MeV with extension by JENDL-HE
Th-232: ENDF/B-VII. No need to extend to HE

In addition, six isotopes were identified as missing in both the FENDL-2.1 and FENDL-3/SLIB libraries. These will be added in FENDL-3 as follows.

C-13: TENDL
O-17,-18: TENDL
V-50: JENDL-4+TENDL
W-180: IAEA evaluation
Pb-204: JEFF

5. COVARIANCE DATA LIBRARY

Shadow library coming from TENDL-2010 will include all isotopes as in FENDL. Those evaluations in FENDL that have covariance data will be used in the shadow library. It will be recommended to use the shadow library if the full set of covariance data are required.

Comparison of covariance data by means of calculations with defined spectra (thermal, Cf, ITER, and IFMIF). The last two spectra to be provided by Fischer in 640 groups plus extension for IFMIF. Action on Trkov.

Covariance format will be recommended to Koning. The approach of using MF=40 to be checked by Trkov to confirm if it is processable.

6. ACTIVATION FILES

EAF-2010 to be adopted as activation file. This includes new uncertainty data as shown in presentation by Kopecky.

Must be converted into ENDF data format which should also include uncertainty data (action on Sublet and Trkov).

Format extension proposal sent to CSEWG. Space is reserved and can be used. No MT numbers were allocated but no definite decision is made.

Use EAF data for p and d induced reactions. Leave basically EAF-2007d and p as is and integrated improved calculated data from Avrigeanu and Ignatyuk, and experimental data from Tarkanyi (action on Sublet). No uncertainty data will be included in p and d data.

Tarkanyi will provide his compilation of experimental d data by summer of 2010 and by September 2010 for protons.

7. GENEREAL PURPOSE CHARGED PARTICLE DATA LIBRARIES

Proton library ENDF/B-VIIp (LA-150) has 30 nuclides, TENDL-2009 has 1170 nuclides, Koning mentioned that quality assessment was made by Konobeev.

Roberto will look into 30 ENDF/B-VII evaluations and compare with JENDL-HE. The latter is probably better because it is more recent.

Si, Al, Mo, Fe proton data to 200 MeV from Korea could be considered for addition. Action on Kim.

p- and d-induced starter library from TENDL-2010 with stable targets then replace important targets by improved evaluations coming from other sources (if any). Action on Roberto.

8. FENDL-3 PROCESSING

ENDF data libraries (FENDL-3/T) to be provided by April 2011. This will be followed by processing with NJOY ACER, testing and correction before release at end of 2011. Processed ACE files to be available two months after release of ENDF data files to allow time for testing and benchmarking before the next RCM meeting in fall of 2011. Neutron library processing will be provided by Trkov. NDS will provide documentation and organization for proton library. Deuteron library will be provided by Koning. Multi-group processing will follow testing of ACE files.

9. SCHEDULE

Video/audio conference in May of 2011 to decide on content of the libraries. Date TBD.
Next RCM around October 2011.

8. CONCLUSION