5. Experiences from Use of JENDL-3.3 and Requests to JENDL-4
5.2 Analysis of MOX Critical Experiments with JENDL-3.3

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In order to confirm the applicability of the latest version of Japanese Evaluated Nuclear Data Library (JENDL3.3[1)]), we performed MCNP4C[2)] calculations against high plutonium content MOX experiments (VIP, VIPO and VIPEX) with JENDL3.3. We performed also the same calculations with ENDF/B-6[3)] release 8 to be compared with JENDL3.3 results. Recently, ORNL reevaluated U235 and U238 cross-sections[4)]. We evaluated the effect of the cross-sections on MCNP criticality calculations with both JENDL3.3 and ENDF/B-6.8.

The experiments we used in the benchmark calculations were performed in the VENUS critical assembly at SCK/CEN of Belgium. The VIP (VENUS International Program) was carried out as a mock up simulation of MOX and UO2 PWR assemblies. The VIPO (Void Coefficient Measurements In Plutonium Mixed Oxide Fuel Lattice) was performed to investigate the characteristics of the core with large void fraction. The VIPEX (VIP Extension) was carried out 6 years after VIP to measure the A_m effect, etc using the same core configurations as VIP experiments.

Table 1 shows the calculated results for the neutron multiplication factors (keff). The mean keff of VIP, VIPO and VIPEX obtained with JENDL3.3 is 0.99431. That with ENDF/B-6.8 is 0.99112. From the viewpoint of criticality evaluation for MOX, we find JENDL3.3 is superior to ENDF/B-6.8. Although both libraries slightly underestimated the keff's, the standard deviations were as small as 0.0008 and 0.0009 for JENDL3.3 and ENDF/B-6.8, respectively. It shows that good accuracy was maintained throughout the core for configurations including those with large void and H-MOX(12.6w/o Pu/MOX) and M-MOX(8.6w/o Pu/MOX).

By using ORNL U-235 and U-238 cross-sections instead of original ones, the keff's with JENDL3.3 and ENDF/B-6.8 libraries were increased by about 160 pcm and 520 pcm, respectively. The different effect of the new ORNL cross-sections made JENDL3.3 and ENDF/B-6.8 consistent with each other, both giving the keff's of about 0.996.

Since the new ORNL U-235 and U-238 cross-sections improved the JENDL3.3 results as shown above, we expect those data should be included in JENDL near future.

Table 1 Multiplication factors in VIP, VIPEX and VIPO analyses for each library

	VIP	VIPEX	VIPO				Average
	keff	keff	10×10 M-MOX with void box	10×10 H-MOX with void box	10×10 M-MOX without void box	10×10 H-MOX without void box	
Cross section			keff	keff	keff	keff	keff
①JENDL3.3	0.99471 ± 0.0003	0.99535 ± 0.0003	0.99444 ± 0.0003	0.99448 ± 0.0001	0.99321 ± 0.0003	0.99368 ± 0.0003	0.99431 ± 0.0008
②JENDL3.3+ ORNL(U235,U238)	0.99571 ± 0.0003	0.99646 ± 0.0004	0.99589 ± 0.0003	0.99699 ± 0.0003	0.99515 ± 0.0004	0.99503 ± 0.0003	0.99587 ± 0.0008
③ENDF/B-6.r8	0.99114 ± 0.0003	0.99253 ± 0.0003	0.99114 ± 0.0003	0.99174 ± 0.0003	0.99003 ± 0.0003	0.99016 ± 0.0003	0.99112 ± 0.0009
④ENDF/B-6.r8+ ORNL(U235,U238)	0.99552 ± 0.0003	0.99749 ± 0.0004	0.99592 ± 0.0003	0.99689 ± 0.0003	0.99556 ± 0.0003	0.99633 ± 0.0004	0.99629 ± 0.0008
Differnece(pcm)							
②-①	100	111	146	252	195	136	157
④-③	441	498	481	518	557	621	519

References

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