

Performance of ENDF/A Evaluations for ^{240}Pu , Cl and W

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CSEWG 2009 Annual Meeting
Brookhaven National Laboratory *Nov. 3-5, 2009*



Introduction

- Evaluations available in ENDF/A for data testing included ^{240}Pu , Cl, and W.
- ^{240}Pu tested in Fast and Thermal Systems
- Cl tested in Thermal Systems
- W tested previously by Andrej Trkov (JSI)
- Summary and Conclusions



Performance in Fast Systems containing ^{240}Pu

ENDF/B-VII.0 with ENDF/A ^{240}Pu		Benchmark k_{eff}	$k_{\text{eff}} \pm 1\sigma$	C/E $\pm 1\sigma$
PU-MET-FAST-001	Jezebel	1.00000 ± 0.00340	0.99999 ± 0.00002	0.99999 ± 0.00200
			0.99986 ± 0.00002	0.99986 ± 0.00200
PU-MET-FAST-002	Jezebel-240	1.00000 ± 0.00200	0.99990 ± 0.00002	0.99990 ± 0.00200
			0.99962 ± 0.00002	0.99962 ± 0.00200
MIX-COMP-FAST-001	ZPR-6/7	1.00051 ± 0.00087	1.00150 ± 0.00005	1.00099 ± 0.00087
			1.00068 ± 0.00005	1.00017 ± 0.00087
MIX-COMP-FAST-002	ZPR-6/7 H240	1.0008 ± 0.00090	1.00028 ± 0.00005	0.99948 ± 0.00090
			0.99919 ± 0.00005	0.99839 ± 0.00090
ZPPR-LMFR-EXP-001	ZPPR-10A L07	1.00096 ± 0.00038	1.00103 ± 0.00005	1.00021 ± 0.00038
			1.00021 ± 0.00005	1.00103 ± 0.00038
MIX-COMP-FAST-003-1	ZPR-3/48	1.0013 ± 0.0007	1.00194 ± 0.00007	1.00064 ± 0.0007
			1.00139 ± 0.00007	1.00009 ± 0.0007
MIX-COMP-FAST-003-2	ZPR-3/48B	1.0017 ± 0.0007	1.00184 ± 0.00006	1.00014 ± 0.0007
			1.00137 ± 0.00006	0.99967 ± 0.0007
MIX-MISC-MIXED-001	BFS-97-4	1.00110 ± 0.00270	1.00229 ± 0.00007	1.00119 ± 0.00270
			1.00207 ± 0.00010	1.00097 ± 0.00270

Performance in Thermal Systems containing ^{240}Pu

ENDF/B-VII.0
with ENDF/A ^{240}Pu

PU-SOL-THERM-018 Case	Pu Conc., gm/l	Benchmark k_{eff}	$k_{\text{eff}} \pm 1\sigma$	C/E $\pm 1\sigma$
1	140.00	1.00000 ± 0.00340	1.00925 ± 0.00009	1.00925 ± 0.00343
			1.01034 ± 0.00009	1.01034 ± 0.00344
2	116.00	1.00000 ± 0.00340	1.01260 ± 0.00009	1.01260 ± 0.00344
			1.01336 ± 0.00009	1.01336 ± 0.00345
3	99.26	1.00000 ± 0.00320	1.01058 ± 0.00008	1.01058 ± 0.00323
			1.01134 ± 0.00009	1.01134 ± 0.00324
4	85.53	1.00000 ± 0.00300	1.00875 ± 0.00008	1.00875 ± 0.00303
			1.00911 ± 0.00008	1.00911 ± 0.00303
5	75.64	1.00000 ± 0.00300	1.00767 ± 0.00008	1.00767 ± 0.00303
			1.00813 ± 0.00008	1.00813 ± 0.00303
6	65.12	1.00000 ± 0.00310	1.00571 ± 0.00008	1.00571 ± 0.00313
			1.00608 ± 0.00008	1.00608 ± 0.00313
7	56.34	1.00000 ± 0.00320	1.00501 ± 0.00008	1.00501 ± 0.00323
			1.00518 ± 0.00008	1.00518 ± 0.00323
8	46.83	1.00000 ± 0.00330	1.00463 ± 0.00008	1.00463 ± 0.00334
			1.00486 ± 0.00008	1.00486 ± 0.00334
9	40.58	1.00000 ± 0.00340	1.00291 ± 0.00007	1.00291 ± 0.00343
			1.00305 ± 0.00007	1.00305 ± 0.00344

Performance in Thermal Systems containing ^{240}Pu

ENDF/B-VII.0
with ENDF/A ^{240}Pu

PU-SOL-THERM-012 Case	Pu Conc., gm/l	Benchmark k_{eff}	$k_{\text{eff}} \pm 1\sigma$	$C/E \pm 1\sigma$
6	105.00	1.00000 ± 0.00070	1.00833 ± 0.00009	1.00833 ± 0.00071
			1.00861 ± 0.00009	1.00861 ± 0.00071
17	21.70	1.00000 ± 0.00430	1.00669 ± 0.00007	1.00669 ± 0.00433
			1.00663 ± 0.00007	1.00663 ± 0.00433

- Eigenvalues are overpredicted; this overprediction increases with increasing Pu concentration in the PST-18 and PST-12 criticals.
- The new ^{240}Pu evaluation aggravates this overprediction in k_{eff} slightly (by ~ 0 -100 pcm).

Performance in Thermal Systems containing Cl

ENDF/B-VII.0
with ENDF/A ²⁴⁰Pu

HEU-SOL-THERM-044 Case / Experiment	Benchmark k_{eff}	$k_{\text{eff}} \pm 1\sigma$	$C/E \pm 1\sigma$
2 / 7	0.9944 ± 0.0097	0.99075 ± 0.00006	0.99633 ± 0.00972
		0.99104 ± 0.00007	0.99662 ± 0.00972
3 / 49	0.9964 ± 0.0047	1.00483 ± 0.00006	1.00846 ± 0.00476
		1.00549 ± 0.00006	1.00912 ± 0.00476

- These experiments are not suitable for data validation because of their large uncertainties.
- Nevertheless, the effect of the new Cl evaluation is demonstrated to be very small (<10 pcm).

Performance of IAEA evaluations of W isotopes

- Results presented in June, 2009 at Port Jefferson meeting by Andrej Trkov.
- Based largely on high-fidelity “as-built” models of ZPR-9 Assemblies 1-9 which have displayed strong trends with W using previous W evaluations.
- Results with new IAEA evaluation (available in ENDF/A) are a noticeable improvement, though not all discrepancies are eliminated.



Summary and Conclusions

- New evaluations of only minor nuclides available for testing in ENDF/A.
- Limited integral data available with sufficient sensitivity to these nuclides to allow “validation”.
- Limited results demonstrate that changes in these evaluations produced small changes. Results for ^{240}Pu are generally poorer, although the changes are small and dominated by other more important data.
- High-fidelity models retain the precision as the actual experiments, thereby allowing some small judgment regarding the quality of the data.



Thank You