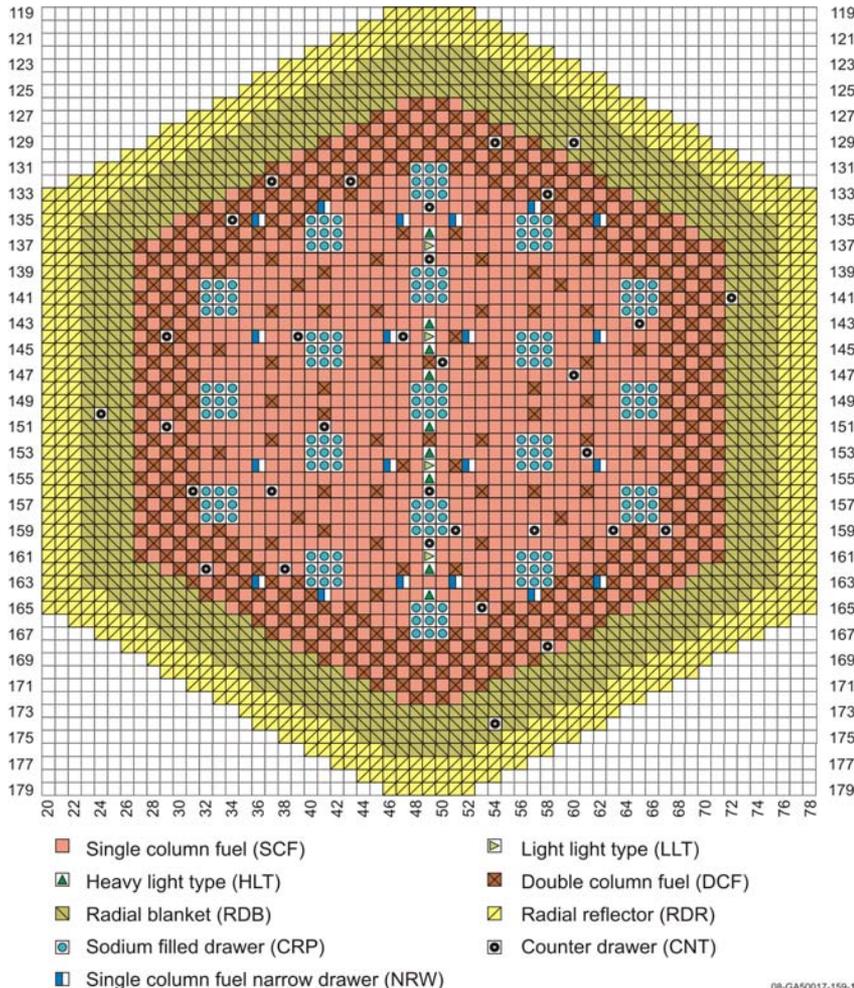# Performance of ENDF/B-VII.0 for Rod Worth and Na-Void Worth Analyses for a Large LMFBR

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ANL ZPPR Assembly 10A

Single column fuel (SCF)
Heavy light type (HLT)
Radial blanket (RDB)
Sodium filled drawer (CRP)
Single column fuel narrow drawer (NRW)
Light light type (LLT)
Double column fuel (DCF)
Radial reflector (RDR)
Counter drawer (CNT)

08-GA50017-159-1

- This experiment (performed in late 1978) was a 650 MWe-class sodium-cooled MOX-fueled LMFBR core mock-up critical experiment with two homogenous zones with control rods (CRs) or control rod positions (CRPs) filled with sodium

- Detailed (i.e., exact "as-built") Monte Carlo models were generated corresponding to the subcritical reference configuration plus an extensive series of large zone sodium voided configurations plus an extensive series of control rod and control rod channel configurations of ZPPR-10A

ZPPR-10A – Detailed As-Built Models with MCNP5

Loading	ENDF/B-VI k-eff $\pm$ σ	ENDF/B-VII.0 k-eff $\pm$ σ	Experiment k-eff $\pm$ σ
7	1.00690 $\pm$ 0.00007	1.00088 $\pm$ 0.00008	1.00096 $\pm$ 0.00038
12	1.00519 $\pm$ 0.00008	0.99940 $\pm$ 0.00008	
13	0.99576 $\pm$ 0.00008	0.99008 $\pm$ 0.00008	
15	0.95914 $\pm$ 0.00015	0.95341 $\pm$ 0.00008	
26	0.93501 $\pm$ 0.00015	0.92902 $\pm$ 0.00007	
29	0.97231 $\pm$ 0.00015	0.96616 $\pm$ 0.00008	
31	1.00222 $\pm$ 0.00008	0.99668 $\pm$ 0.00008	
33	1.00309 $\pm$ 0.00007	0.99720 $\pm$ 0.00008	
34	1.00395 $\pm$ 0.00008	0.99794 $\pm$ 0.00008	
37	1.00443 $\pm$ 0.00008	0.99854 $\pm$ 0.00008	
40	1.00416 $\pm$ 0.00007	0.99806 $\pm$ 0.00008	

ZPPR-10A – Control Rod Worths with MCNP5

Loading	V6 k-eff ± σ	Δk ± σ	Experiment Δk ± σ	C/E	
12	1.00519± 0.00008				Reference Configuration
13	0.99576± 0.00008	0.00943 ± 0.00011	0.00886 ± 0.00010	1.06433	Central CR
15	0.95914± 0.00015	0.04605 ± 0.00017	0.04496 ± 0.00048	1.02424	CR's 2-7, 6 rods in Ring 4
26	0.93501± 0.00015	0.07018 ± 0.00017	0.07156 ± 0.00105	0.98072	CR's 8-19, 12 rods in Ring 7
29	0.97231± 0.00015	0.03288 ± 0.00017	0.03237 ± 0.00037	1.01576	CR's 8,10,12,14,16,18 in corners Ring 7
Loading	V7 k-eff ± σ	Δk ± σ	Experiment Δk ± σ		
12	0.99940± 0.00008				Reference Configuration
13	0.99008± 0.00008	0.00932 ± 0.00011	0.00886± 0.00010	1.05192	Central CR
15	0.95341± 0.00008	0.04599 ± 0.00011	0.04496 ± 0.00048	1.02291	CR's 2-7, 6 rods in Ring 4
26	0.92902± 0.00007	0.07038 ± 0.00011	0.07156± 0.00105	0.98351	CR's 8-19, 12 rods in Ring 7
29	0.96616± 0.00008	0.03324 ± 0.00011	0.03237 ± 0.00037	1.02688	CR's 8,10,12,14,16,18 in corners Ring 7

Well calculated with either ENDF/B-VI or ENDF/B-VII.0 data.

ZPPR-10A – Sodium Void Worths with MCNP5

	V6		Experiment	C/E	
Loading	k-eff ± σ	Δk ± σ	Δk ± σ		
31	1.00222± 0.00008				
33	1.00309± 0.00007	0.00087 ± 0.00011	0.00076 ± 0.00001	1.14474	88 drawers, 8 inches per half
34	1.00395± 0.00008	0.00173 ± 0.00011	0.00145 ± 0.00002	1.19310	172 drawers, 8 inches per half
37	1.00443± 0.00008	0.00221 ± 0.00011	0.00187 ± 0.00002	1.18182	172 drawers, 16 inches per half
40	1.00416± 0.00007	0.00194 ± 0.00011	0.00159 ± 0.00002	1.22013	172 drawers, 20 inches per half
	V7		Experiment		
Loading	k-eff ± σ	Δk ± σ	Δk ± σ		
31	0.99668± 0.00008				
33	0.99720± 0.00008	0.00052 ± 0.00011	0.00076 ± 0.00001	0.68421	88 drawers, 8 inches per half
34	0.99794± 0.00008	0.00126 ± 0.00011	0.00145 ± 0.00002	0.86897	172 drawers, 8 inches per half
37	0.99854± 0.00008	0.00186 ± 0.00011	0.00187 ± 0.00002	0.99465	172 drawers, 16 inches per half
40	0.99806± 0.00008	0.00138 ± 0.00011	0.00159 ± 0.00002	0.86792	172 drawers, 20 inches per half

No trends and over-predicted with ENDF/B-VI data.
Large trend and under-predicted with ENDF/B-VII.0 data.