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PHYSICS VERIFICATION PROGRAM

PART III, TASK 11

Quarterly Technical Report

July-September 1974

by

M. N. Baldwin

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Physics Verification Program, Part III, Task 11
Quarterly Technical Report, July-September 1974

by

M. N. Baldwin

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ABSTRACT

In experimental Task 11, the reactivity and power perturbation effects of poison pins in mockups of 17 by 17 fuel assemblies are being measured. The experimental facility - a water-moderated, slightly enriched UO_2 lattice - is arranged to mock up the fuel assemblies of a commercial pressurized water reactor. Each assembly contains 24 poison pin positions.

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1. INTRODUCTION

In January of 1974, Babcock & Wilcox (B&W) began Part III, Task 11, of the Physics Verification Program, entitled "17 by 17 Subassembly Mockups." The program is jointly sponsored by B&W and the U.S. Atomic Energy Commission. The principal objective of the task is to measure the reactivity and power perturbation effects of poison pins in mockups of 17 by 17 fuel assemblies containing 24 poison positions. A second objective is to measure the depression of power density in gadolinia-laden fuel pellets.

This report summarizes the experimental results obtained during the third calendar quarter of 1974. Results obtained during the two previous quarters are reported in references 1 and 2. Completed phases of the program are summarized in references 3 through 13.

2. DESCRIPTION OF ASSEMBLY

2.1. Facility

The facility, located at B&W's Lynchburg Research Center, is a critical assembly within an aluminum tank having a diameter of 5 feet, a height of 6.5 feet, and a wall thickness of 0.5 inch. The water-handling equipment, instrumentation, control system, and other auxiliaries are conventional.

2.2. Fuel Rods

The fuel rods are 0.475 inch in diameter by 61.59 inches long. The cladding is type-6061 aluminum, 0.032 inch thick, and the UO_2 fuel is enriched to 2.46 wt % uranium-235. The fuel is described further in reference 1.

2.3. Perturbing Pins

Neutron-absorbing poison pins are used to produce lattice heterogeneities for study. The small Pyrex* rods and the Vicor* rods that were used in measurements during the previous quarter are described in reference 2.

In addition, Pyrex rods of larger diameter are being used this quarter. The large rods contain 12.6 wt % B_2O_3 , are 0.462 inch in diameter, and 188 cm long.

2.4. Core Description

Top and bottom plates align the fuel rods in the core tank. The top and bottom "egg-crate" grid plates are 1-inch wide, slotted aluminum strips, which are interlocked to form a square matrix. The 0.160-inch-thick strips are spaced on centers on 0.644 ± 0.002 inch. The core is further described in reference 1.

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*Registered trade marks, Corning Glass Works.

3. MEASUREMENTS

The single core loading studied during the quarter is designated as Core XIV, loading 6. It differs from the loadings reported in references 1 and 2 only in the type of perturbing pins that occupy the 24 reserved locations in the central 17 lattice pitch square.

The moderator boron concentration for loading 6 was 1179 ppm. This concentration results in a k_{eff} of 1.0000 when the height of the moderator is 145.0 cm and all safety blades are fully withdrawn.

Results of the radial power distribution measurements for loading 6 are given in Table 3-1. The percentages listed in the table are standard deviations obtained from two or more measurements.

Table 3-1. Midplane Power Profile - Core XIV, Loading 6

		Distance East of Core Center, pin pitches								
		0	1	2	3	4	5	6	7	8
Distance South of Core Center, pin pitches	0	Water			Large Pyrex			Large Pyrex		
	1	1.104 (0.9%)	1.036 (0.3%)							
	2	0.935 (0.3%)	0.989 (0.2%)	0.957 (0.3%)						
	3	Large Pyrex	0.914 (0.4%)	0.918 (0.4%)	Large Pyrex			Large Pyrex		
	4	0.917 (0.2%)	0.983 (0.1%)	0.984 (0.5%)	0.927 (0.3%)	0.954 (0.5%)				
	5	0.956 (0.4%)	0.998 (1.3%)	0.976 (0.6%)	0.932 (0.7%)	0.903 (0.4%)	Large Pyrex			
	6	Large Pyrex	0.967 (0.7%)	0.995 (0.5%)	Large Pyrex	0.964 (0.5%)	1.028 (1.1%)	1.169 (0.7%)		
	7	1.030 (0.7%)	1.086 (0.5%)	1.124 (0.5%)	1.076 (0.3%)	1.128 (0.4%)	1.173 (1.0%)	1.229 (0.1%)	1.286 (0.8%)	
	8	1.186 (0.3%)	1.191 (0.6%)	1.228 (0.4%)	1.214 (0.1%)	1.251 (0.8%)	1.243 (0.8%)	1.291 (0.6%)	1.284 (0.8%)	1.329 (0.4%)

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