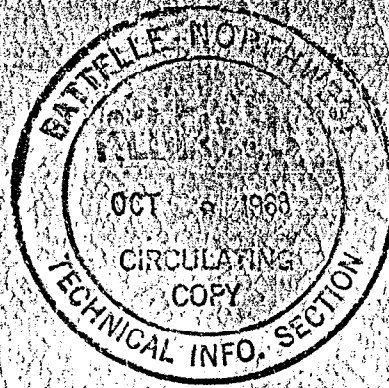


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AEC RESEARCH AND DEVELOPMENT REPORT



HW-54591

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NUCLEAR PHYSICS RESEARCH QUARTERLY REPORT OCTOBER, NOVEMBER, DECEMBER 1957

THE STAFF OF NUCLEAR PHYSICS RESEARCH

MARCH 5, 1958

HANFORD LABORATORIES

HANFORD ATOMIC PRODUCTS OPERATION
RICHLAND, WASHINGTON

GENERAL  ELECTRIC

W. E. Converse	37024 P. 5	OCT 11 1957

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Buckling Measurements of Fuel Elements in a Random Array,Water Moderated

R. C. Lloyd

Buckling measurements of random arrays of fuel elements have been made to see if such configurations would have bucklings significantly less than these resulting from uniform distribution of fuel elements. The following slug types were used in these measurements:

<u>O. D.</u>	<u>I. D.</u>	<u>Length</u>	<u>Slug Cover</u>	<u>% U²³⁵</u>
.925	--	4 inches	Bare	1.007
1.66	0.94	4	Bare	1.007
1.37	0.48	8	I & E	1.44

The 0.925-inch fuel elements were dropped randomly into a tank giving an H₂O/U volume ratio of $.863 \pm .007$ on four different loadings. The following table gives values of these measured bucklings:

BUCKLING OF 0.925-INCH - 1.007% FUEL ELEMENTS

<u>Exp. No.</u>	<u>Buckling</u>
32	- 113 μ B
33	- 727
34 - 35	839
36	568

The large differences in the bucklings are due to the variations of H₂O/U volume ratio in the slug distribution within the tank. The average of these four measured values is 142 μ B. Since previous measurements of the uniform distribution were made with H₂O/U ratios above 1.37 and their extrapolation to a ratio of 0.87 was very uncertain, a uniform measurement was made at 0.87. The buckling of this uniform loading was 1377 μ B.

Similarly the 1.66-inch hollow slugs of 1.007% U^{235} were measured in four random loadings. The H_2O/U volume ratio was 1.48 ± 0.02 . The buckling values are listed in the following table.

BUCKLINGS OF RANDOM 1.66-INCH HOLLOW 1.077% U^{235} SLUGS

<u>Exp. No.</u>	<u>Buckling</u>
38	2139 μB
39	2149
40	2428
41	1480

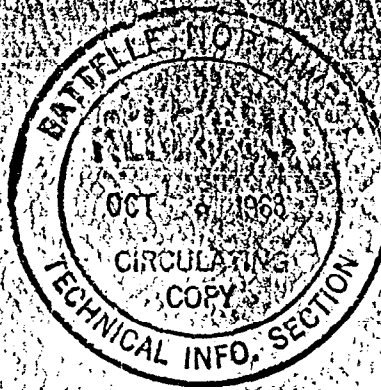
The average of these measured bucklings is 2050 μB . The buckling for this fuel element in a uniform array clad in aluminum was estimated to be 2750 at this H_2O/U ratio. The effect of the aluminum was calculated to be 325 μB . This would give a comparable bare slug value of 3075 μB . This shows a reduction of buckling by about 30 per cent for these elements in a random array at the H_2O/U ratio of 1.48.

Measurements are now in progress with the 1.37-inch I & E fuel elements of 1.44 per cent U^{235} . These elements load into the tank randomly with an H_2O/U ratio of about 1.78. A preliminary value of the buckling is about 3250 μB . The buckling of a uniform distribution at this H_2O/U ratio is about 5500 μB .

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