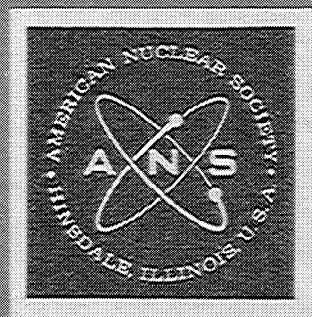


E. B. JOHNSON, "CRITICALITY OF URANIUM OF LOW ENRICHMENT IN WATER," TRANS. AM. NUCL. SOC. 12: 336 (1969).

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NUCLEAR CRITICALITY SAFETY

1. Criticality of Uranium of Low Enrichment in Water, E. B. Johnson (UCC-ND)

As a part of a continuing program investigating the critical dimensions of lattices of uranium rods in aqueous solutions, limited measurements were made with rods containing uranium dioxide, and measurements with unclad metal rods were extended.

In the first series of experiments, the uranium, as UO_2 , was enriched to 3.95% in ^{235}U . The fuel-bearing region of each rod was 1.27 cm in diameter and 138.7 cm long, clad in 0.046-cm-thick Inconel tubing. Because of the limited number of rods, it was possible to make only a few lattices critical in water. However, it was established that the minimum number of these rods that can be made critical, when moderated and reflected by water, is 149, in a square pattern at a pitch of 2.64 cm; this was a 12×13 lattice with seven rods removed from one face and contained 9.5 kg of ^{235}U .

Further measurements have been made with U(5) rods 0.234 cm in diameter latticed in water, extending work previously reported.^{1,2} The minimum critical mass in a spherical water-moderated and -reflected lattice is 1.6 kg of ^{235}U . As shown in Fig. 1, which compares the calculated and experimentally determined minimum spherical critical masses, this value is less than those for rods of larger diameter and also less than that for a sphere of aqueous $\text{U}(4.98)\text{O}_2\text{F}_2$ solution at a concentration of 45.3 g of ^{235}U /liter, and is greater than that predicted by Clark³ by essentially the same amount as were those reported earlier for rods of large diameters.

1. E. B. JOHNSON, *Trans. Am. Nucl. Soc.*, 10, 190 (1967).
2. E. B. JOHNSON, *Trans. Am. Nucl. Soc.*, 11, 674 (1968).
3. H. K. CLARK, "Critical and Safe Masses and Dimensions of Lattices of U and UO_2 Rods in Water," DP-1014, Savannah River Laboratory (1966).

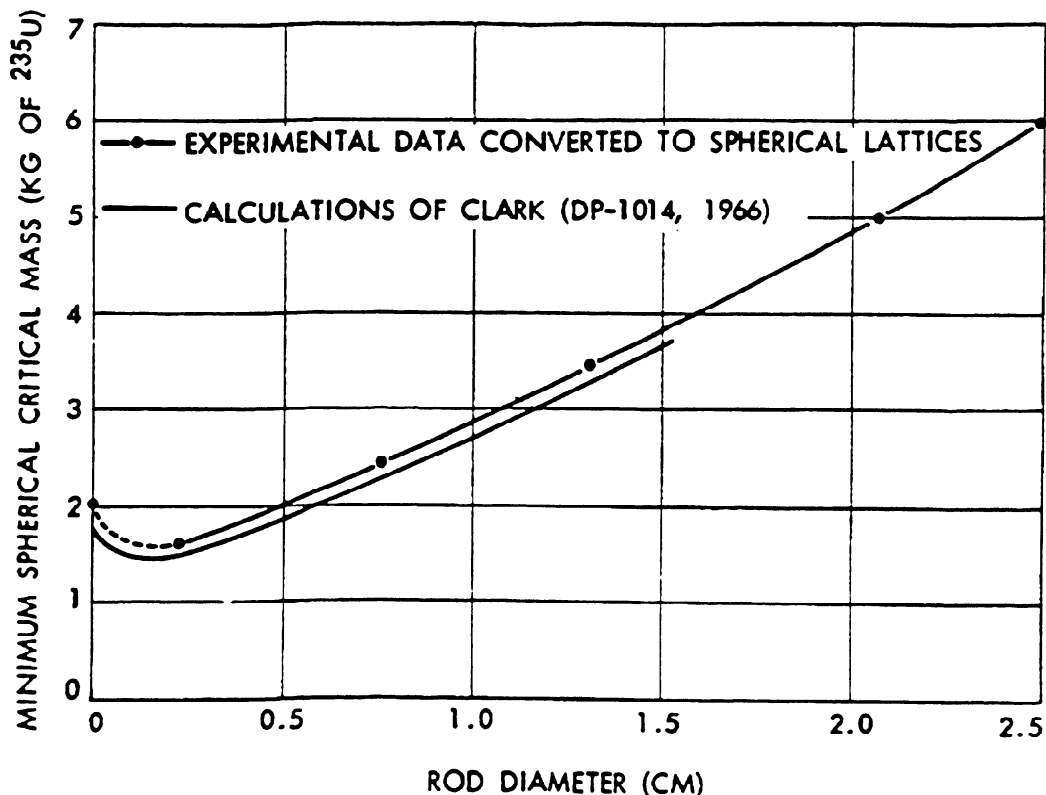


Fig. 1. Comparison of calculated and experimental water-moderated and -reflected minimum critical lattices of U(4.89) rods of several diameters.