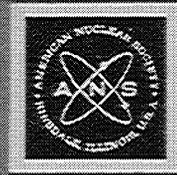


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9. Critical Parameters of Uranium (1.95) Metal Cylindrical Annuli/*E. B. Johnson (ORNL)*

Experiments have been performed at the ORNL Critical Experiments Facility to determine the critical parameters of lattices of cylindrical annuli of uranium enriched to 1.95% in U-235.

In the first series of experiments, the dimensions of the units were 7.2-in. o.d., 2.6-in. i.d., and 40-in. long, with an average mass of 442 kg, of which 8.6 kg was U-235. A total of 25 units was available. For the next series, the o.d. was reduced to 6.2 in., which decreased the mass of a unit to 308 kg (6.0 kg of U-235); the other dimensions were unchanged.

The units were latticed in water in both square and triangular patterns to determine the critical number as a function of spacing. With the units that were 7.2-in. o.d., it was found that the minimum for each pattern occurred at a water-to-uranium volume ratio of 0.65, and that the critical number of units arranged in a triangular pattern was half that required for a square pattern, as shown in Fig. 1. For the 6.2-in.-o.d. units, the minimum was found at a water-to-uranium volume ratio of 0.8, and the difference between the critical number of units arranged in square and triangular patterns was appreciably reduced.

In several critical lattices, water was excluded from the 2.6-in.-diam central region of each annulus by inserting coaxial Styrofoam cylinders (density = 0.024 g/cm³) of three different diameters. In all cases, exclusion of water from the central region decreased the reactivity. For example, the presence of a 1.55-in.-diam Styrofoam cylinder in each annulus of a lattice increased the critical number of units from 10 to 12.5, and shifted the position of the minimum volume ratio from 0.65 to 0.60 at a surface separation of 1 in. in triangular pattern.

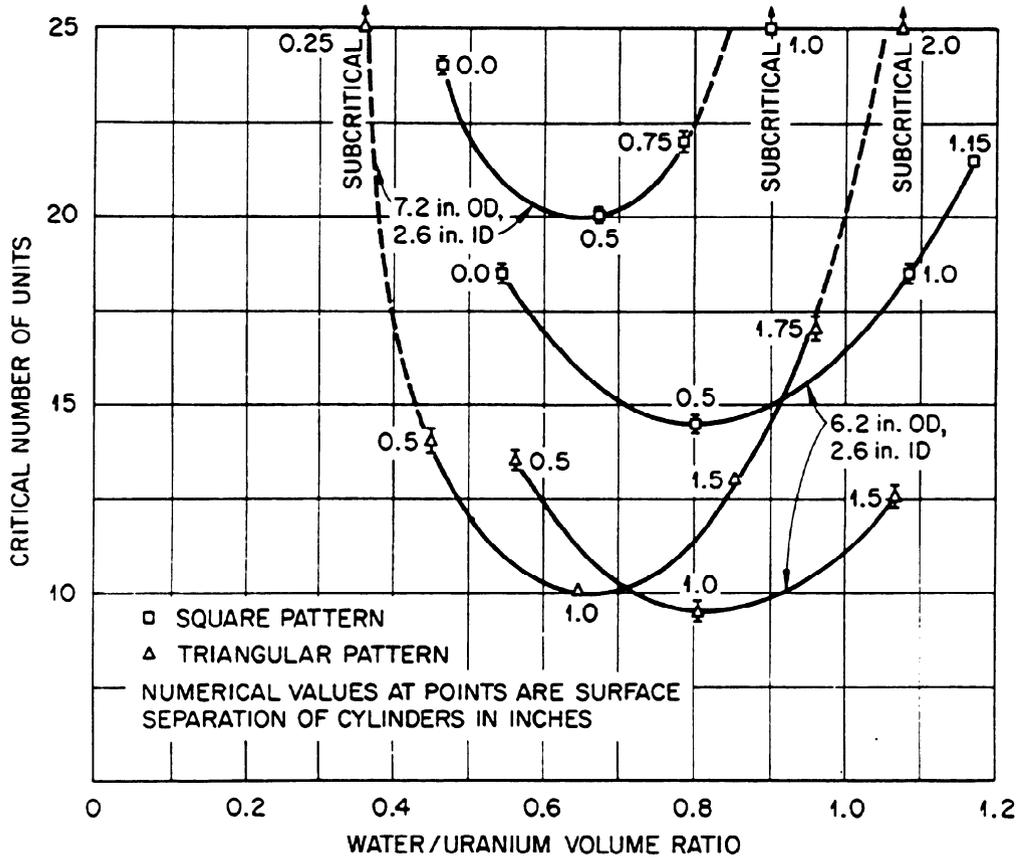


Fig. 1. Critical Lattices of U(1.95) Metal Annular Cylinders Moderated and Reflected by Water.