REFERENCE 189

J. D. WHITE AND C. R. RICHEY, "NEUTRON INTERACTION BETWEEN MULTIPLYING MEDIA SEPARATED BY VARIOUS MATERIALS," TRANS. AM. NUCL. SOC. 8: 441-442 (1965).

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4. Neutron Interaction Between Multiplying Media Separated by Various Materials/ *J. D. White, C. R. Richey (BNW)*

The quantity of material necessary to effectively isolate multiplying media is a primary concern to the safe and efficient design of shipping containers and the storage regulations for fissionable isotopes. In a series of critical experiments conducted at the Battelle-Northwest Critical Mass Laboratory, the effective isolation thickness was determined for several materials. Those materials tested were inserted at the interface of two multiplying media that comprised the fuel core of a critical assembly. The critical length of the fuel core was then determined as a function of test-material thickness, i.e. the effective isolation thickness being defined as that thickness for which the critical core length approaches an asymptotic value. Figure 1 shows the resulting curves for polyethylene, borated polyethylene (10 wt% B), and compressed wood (ρ = 1.341 g/cm^3).

The critical assemblies, in the form of rectangular prisms, were assembled by a remote split-table device[1]. Plutonium dioxide-polystyrene compacts (1.12 g Pu/cm^3, Pu-240 = 2.2%, and H/Pu atomic ratio = 15) in 2-in. cubes were the basic fuel material. These were alternated with 2-in. cubes of Plexiglas ($C_5H_8O_2$) to form a three-dimensional checkerboard array of fuel and Plexiglas. The fuel core had cross-sectional dimensions of 12.16 × 12.06 in. While the length of one section of the fuel core remained fixed at 2.03 in., the other section located on the opposite side of the test interface was varied to achieve criticality.

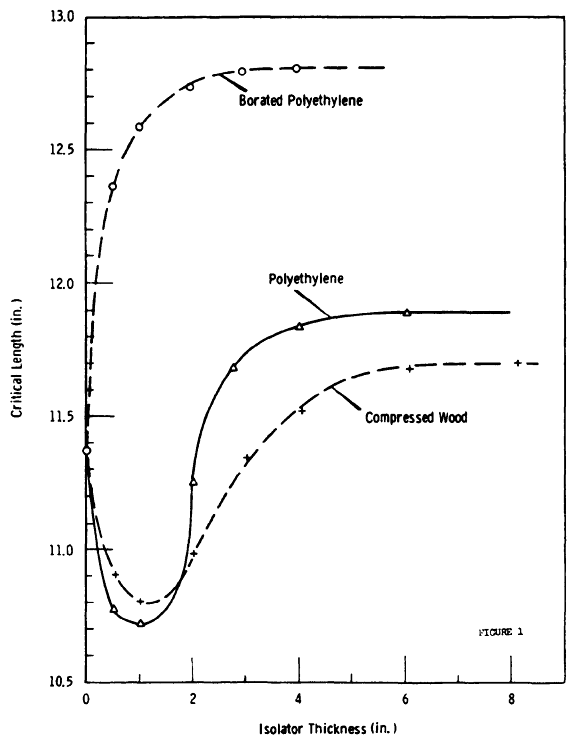

Fig. 1. Variation of Critical Size with Isolator Thickness for Polyethylene, Borated Polyethylene and Compressed Wood.

It is evident from the results summarized in Table I that a considerable reduction in the effective isolation thickness is obtained by the addition of highly neutron-absorbing isotopes. Another advantage to using the highly absorbing isolators is evident from Fig. 1; the critical mass of the isolated unit is considerably increased, permitting larger quantities of fissile materials to be stored in the array.

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1. RICHEY, C. R., et al., Hazards Summary Report for the Hanford Plutonium Critical Mass Laboratory, Supplement No. 1, "The Remote Split-Table Machine," HW-66266 Sup. 1 Rev. (October 1963).

TABLE I

Material	Effective Isolation Thickness (in.)
Polyethylene	6.5 ± 0.5
Polyethylene[a]	3.5 ± 0.25
Polyethylene[b]	3.0 ± 0.25
Borated Polyethylene	3.5 ± 0.25
Compressed Wood	8.0 ± 0.5
Concrete	9.0 ± 1.0
Borated Concrete	5.0 ± 0.5
Lead	8.0 ± 0.5

[a] 0.02-in. cadmium sheet inserted between variable core and polyethylene.
[b] 0.02-in. cadmium sheet inserted at both core-polyethylene surfaces.