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Boron Poisoning in Critical Slabs

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A series of experiments has been initiated to determine the effect of partitioning with boron slabs on the criticality of a slab of solution. The multiplying media being studied are bare, as well as partially water-reflected, aqueous solutions of UO_2F_2 in which the uranium has been enriched 93.3% with U^{235}.

Because of the inherent experimental difficulties in providing a neutron reflector above the solution, the reflected slabs being studied are only half-reflected; that is, the level of the reflector water is brought to approximately the same height as the center of mass of the fuel solution. The poison partition sheets used have been, for the most part, $\frac{1}{4}$-in. boral sheets clad in stainless steel. However, one set of experiments was run from which a comparison could be made between $\frac{1}{4}$-in. boral, $\frac{1}{2}$-in. boral, and a stainless steel-covered slab of boron carbide. The $\frac{1}{4}$-in. boral sheet contains about 300 mg of boron per square centimeter.

In a typical experiment the fuel solution was added to an aluminum container with a 30 $\times$ 60 in. rectangular base. A number of equally spaced poison partition sheets had been placed vertically in this container parallel to the longer base dimension. The critical height of the fuel solution level corresponding to this number of poison sheets, that is, to the compartment width, was then measured. At present all experiments have been performed with a solution concentration corresponding to an $H:U^{235}$ atomic ratio of 78.7. Very preliminary data thus far obtained are summarized in Figs. 2.3 and 2.4 where the critical heights and critical masses have been plotted as a function of the width (inside measurement) of the compartment formed by the boral sheets. The curves for the completely reflected slab were obtained from the data by assuming the reflector savings, which would be incurred by adding a water reflector above the solution, to be equal to those resulting when the reflector was added to the bottom of the slab.

Doubling the boral thickness in the partitions increased the critical mass slightly. A $\frac{3}{8}$-in. layer of stainless steel placed below the slab of solution serves as a partial reflector; when the steel separates the slab from a thick water reflector, it increases the critical mass. The results are in agreement with those previously reported.[2] The experiments will be continued with solutions of lower concentration.

[2] D. Callihan, D. F. Cronin, J. K. Fox, and J. W. Morfitt, *Critical Mass Studies, Part V*, K-643 (June 30, 1950).

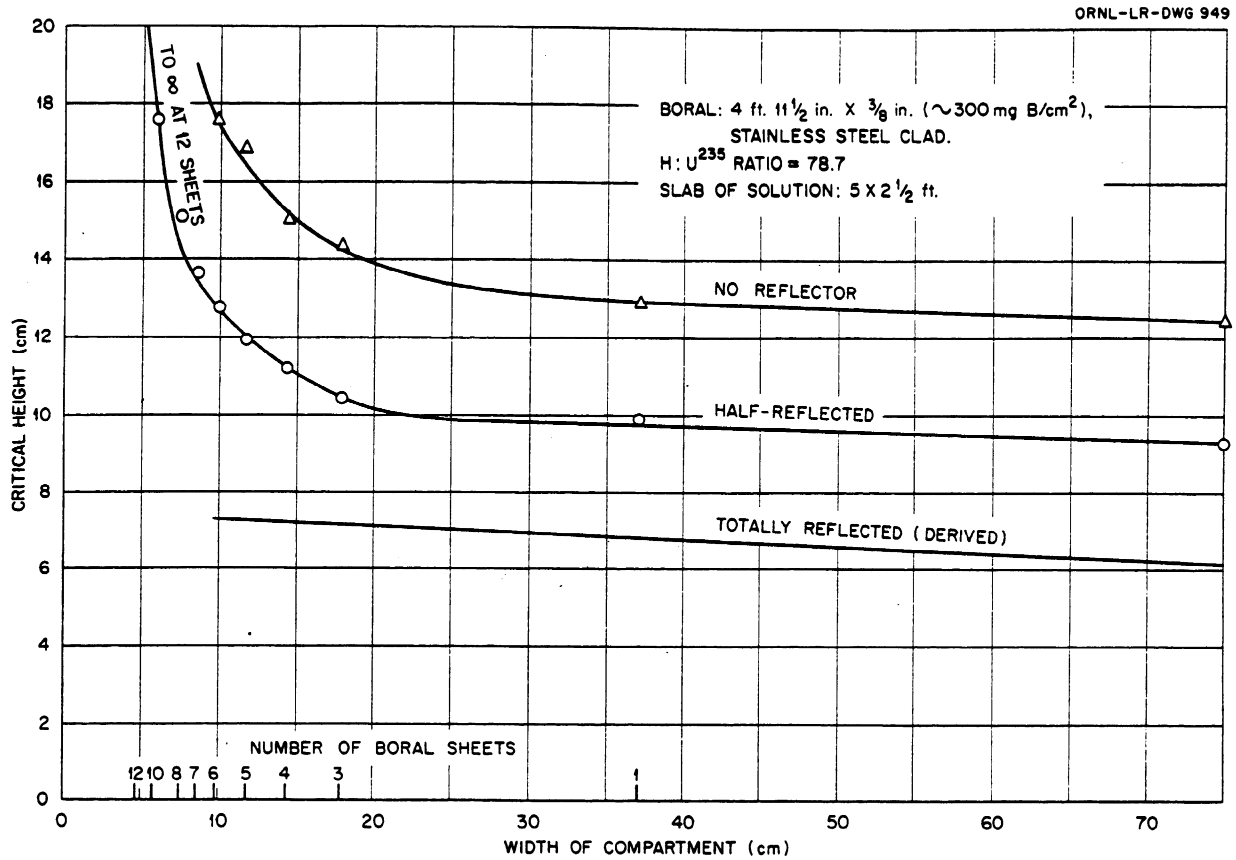

Fig. 2.3. Effect of Boron Poisoning on Critical Height of a Slab of Uranium Solution.

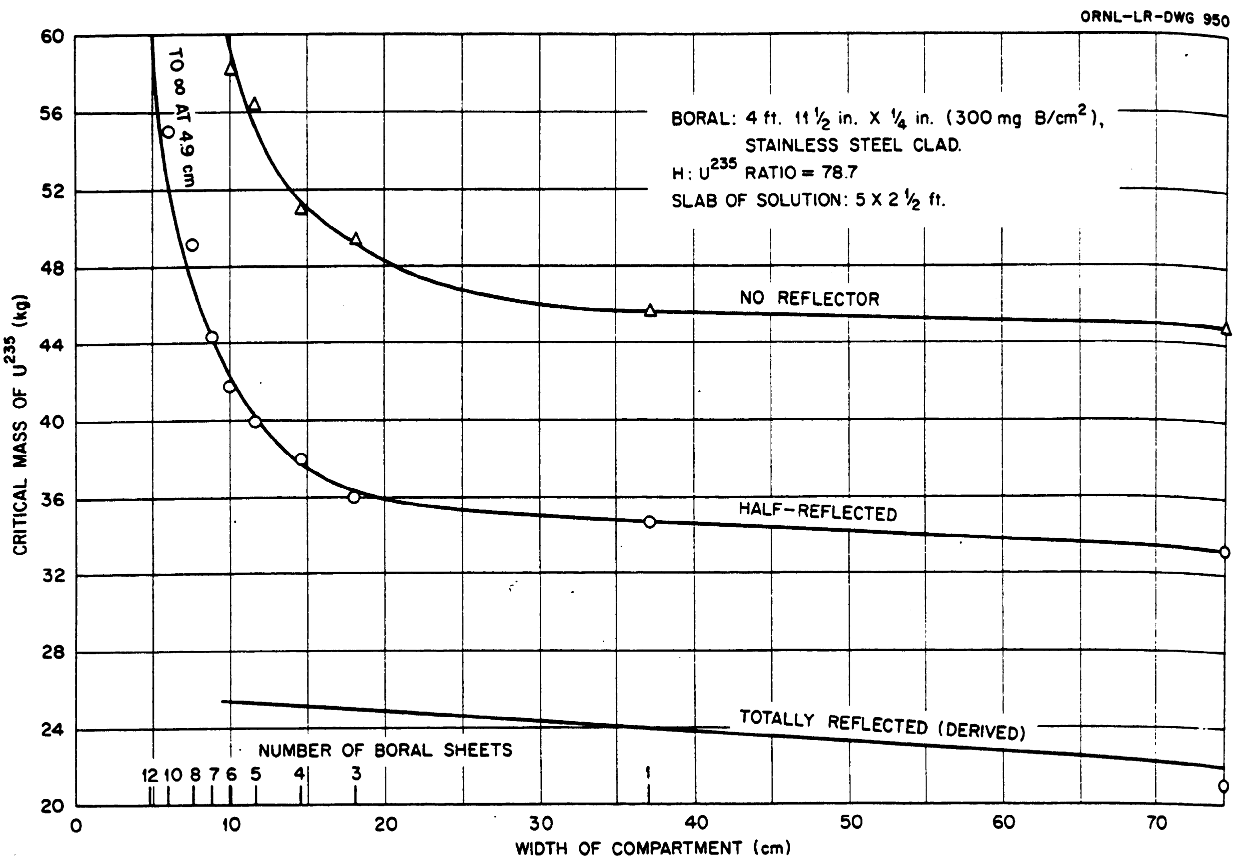

Fig. 2.4. Effect of Boron Poisoning on Critical Mass of a Slab of Uranium Solution.