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PRELIMINARY CRITICAL TESTS USING AQUARIUM FUEL
ELEMENTS IN THE BSR GRID

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May 31, 1955

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Preliminary Critical Tests Using Aquarium Fuel Elements
in the BSR Grid

K. M. Henry, E. B. Johnson and F. C. Maienschein
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The preliminary critical tests for the Aquarium reactor were performed in the grid of the Bulk Shielding Reactor (BSR) May 14, 1955. Twenty of the full (170-g) Aquarium fuel elements were used, together with BSR equipment, instrumentation, rod elements and partial elements.

The first Aquarium loading (Fig. 1) was the result of an attempt to find the minimum critical mass. It will be noted that this loading was essentially a 5 x 5 fuel element array with the two back corners missing. The only BSR elements in this loading were the three partial elements through which the control rods move. The total U^{235} content was 3615 g and the excess reactivity was about 0.4%, as indicated by the regulating rod position.

The second Aquarium loading (Fig. 2) was an attempt to mock up the Aquarium control rod and source element positioning and at the same time to approximate the 5 x 6 BSR loading. In addition to the BSR control rod elements, this configuration contained two other BSR partial elements -- one in lattice position 15 and the other in

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lattice position 45. The U^{235} content of this loading was 3792.6 g and the excess reactivity was about 0.5%.

The substitution of Aquarium elements for remaining BSR elements in either or both of these loadings would presumably increase the excess reactivity since they are apparently more effective than BSR elements.¹

The critical mass of Aquarium elements was considerably lower than had been estimated by calculational procedures.²

For a clear evaluation of the cause of the discrepancy, a critical test using 170-g fully enriched elements instead of the Aquarium elements would be desirable. An attempt to duplicate the first Aquarium loading (Fig. 1) would be made. Such a comparison should indicate the importance of the resonance capture in U^{238} .

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1. E. B. Johnson and K. M. Henry, "Reactivity Measurements with a Single Aquarium Fuel Element," ORNL-CF-55-5-118 (May 19, 1955).
 2. C. E. Winters, "Preliminary Design Report, Project Aquarium," ORNL-CF-55-3-6 (March 1, 1955).

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Fig. 1. Preliminary Aquarium Loading No. 1 in BSR Grid.

Fig. 2. Preliminary Aquarium Loading No. 2 in BSR Grid.

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