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6. A Natural Uranium Booster for T-D Sources,

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Accelerator-driven T-D neutron sources have become a cheap and convenient means for neutron radiography purposes. It was felt that a booster might enhance the intensity of the sources and reduce the target replacement costs. Natural uranium was chosen as a booster material as it is readily available in Brazil and avoids the safeguards problems associated with highly enriched uranium. Spherical calculations were made with the S_n code XSDRN. A density of the uranium oxide of 5 g/cm^3 was assumed. A gain of about ten can be obtained using uranium dioxide with a thickness of 70 cm around the target (Fig. 1). The initial energy of the neutrons is well above the fission threshold of ^{238}U, so they are multiplied by a factor of 2 to 3. Fission neutrons have a shorter mean-free-path in water than 14-MeV neutrons, so they are thermalized nearer to the source. This enhances the thermal flux with another factor of 2 to 3. Using boosters with a thickness of more than one mean-free-path offers nearly no increase in flux.

We used loosely packed U_3O_8 from the IEA purification plant. It had a density of only 2.3 g/cm^3. Even so, a 50% increase in the flux as measured with indium foils could be observed (Fig. 2). It is expected that further tests with sintered pellets of higher density will confirm the encouraging results of the calculations.

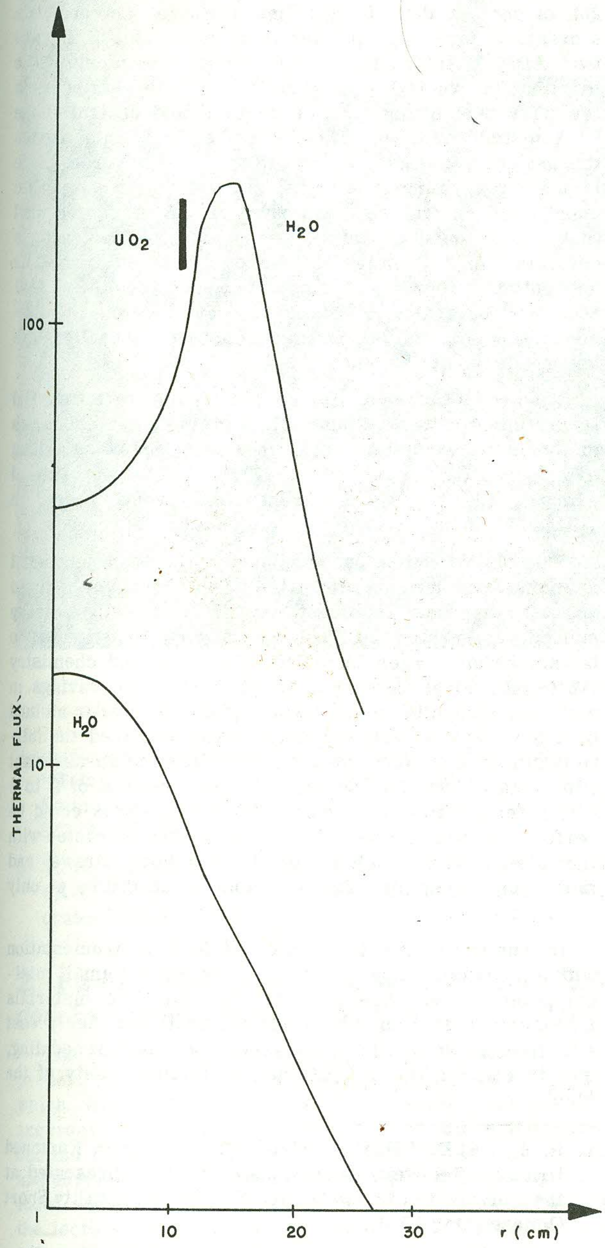

Fig. 1. Calculated fluxes.

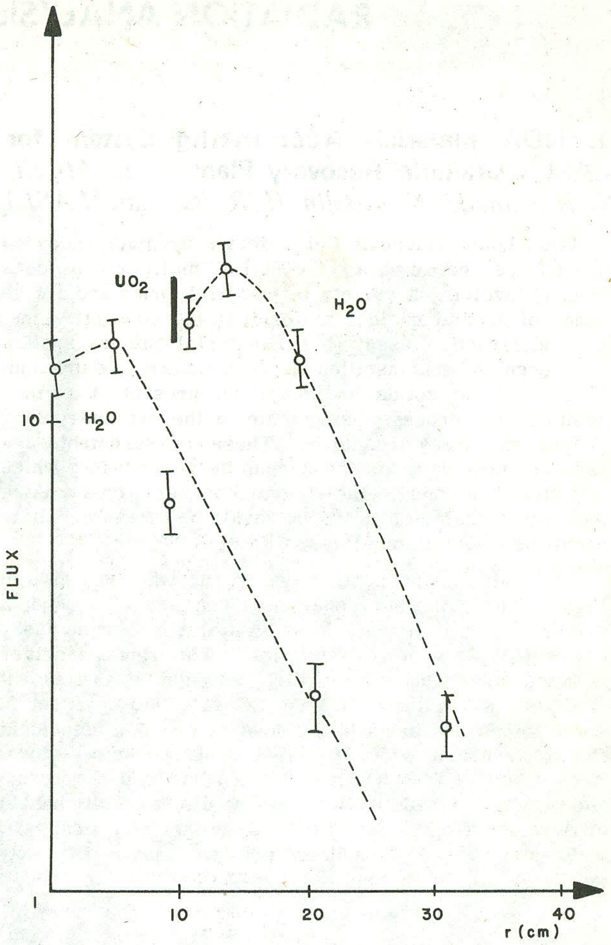

Fig. 2. Experimental results.