# RADIOACTIVE DECAY STUDIES OF NUCLEI PRODUCED FROM BOMBARDMENT BY INTERMEDIATE ENERGY NEUTRONS

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An intermediate energy secondary neutron irradiation facility capable of handling gram quantities of target material has been in operation in the isotope production-area beam dump. The neutrons are produced in a 2.5 inch metal copper beam stop. Targets are transported into the beam dump using a solid target transport system whose transit time to the receiving terminal in the chemistry trailer is about 5 sec.

Initially we measured the neutron flux, $\phi_n$, on target for a range of proton beam energies. The flux measurements were made by bombarding Al samples and using the known[1] cross section for the production of 15-hour $^{24}Na$ by the $^{27}Al(n,\alpha)^{24}Na$ reaction. These results are summarized in Figure 1, where we compare the specific neutron flux ($n/cm^2/sec$ per $\mu A$ of protons) with that obtained at the Brookhaven Medium-Energy Intense Neutron (MEIN) facility.[1] We observe a factor of 4 increase in the overall excitation function as compared to that of BNL (MEIN). We owe this increase to geometry considerations in fixing the irradiation position immediately behind the stop. The neutron irradiation facility is for parasitic use when thin target proton irradiations are being made.

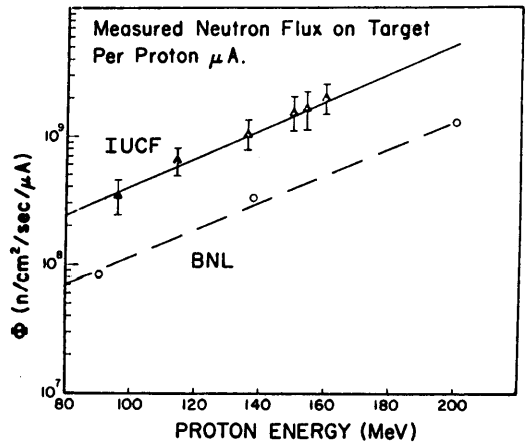


*Figure 1.*

Investigations of nuclei far removed from stability in both neutron deficient (Y-Zr, Nb-Mo) and neutron-rich (Er-lu,Hf) regions have been undertaken. Results of these various studies are summarized below.

Decay of $^{84}Y$. Irradiation of $^{89}Y$ has yielded new results in the decay of $^{84}Y$(38.5 min.) produced in the (n,6n) reaction in addition to confirming the previous results of Doron and Blann[2] and Rester et al.[3] Ambiguities remain in the decay, in particular the ground state spin, parity and the population of high spin states in $^{84}Sr$ remain in doubt. Radiochemical investigations will insure a higher degree of reaction specificity and will aid in answering some few questions concerning the production and decay of this isotope.

A Search for New Isotopes of Zr, Nb and Mo. Bombardments of enriched $^{92}Mo$ with fast neutrons have been initiated to search for the neutron deficient isotopes $^{84}Zr$, $^{86}Nb$ and $^{88,89}Mo$. Yield distribution data indicate substantial production cross sections for nuclei in the $\beta$ stability line 4-6 nucleons removed from the target. Several unassigned $\gamma$-rays have been observed. The possibility of $\beta$ delayed proton emitters has been suggested by Kelly et al.[4] in the case of $^{89}Mo$ decay, and a search for beta delayed activity will be made.

The Search for Neutron Rich Isotopes $^{174}Er$, $^{181}Lu$ and $^{185}Hf$. Natural tungsten and enriched $^{176}Yb$ have been bombarded with fast neutrons and successive $\gamma$-ray spectra have been obtained. No new activity or unassigned $\gamma$-rays were observed. Estimates of the lifetimes of these activities are of the order of 5-30 min. The low production cross section for the (n,2pxn) re-

actions makes a direct measurement of the activity a difficult task without radiochemistry. No radiochemical facilities existed at the Cyclotron until recently, therefore, the next series of experiments will involve the use of these facilities.

1) S. Katcoff et al., Nucl. Instr. Meth. 129, 473 (1975).