On this basis, the decrease in 20 kev beta-particle activity relative to Pu^{239} alpha-particle activity is an indication that it is due to an isotope resulting from the (α,n) or (α,2n) reaction:

$$U^{238}(\alpha,n)Pu^{241}$$

$$U^{238}(\alpha,2n)Pu^{240}$$

Of these, Pu^{241}, with an odd number of neutrons, is the most probable source of beta-particle activity.

An estimate of the half-life for Pu^{241} beta-particle emission may be made with the following observations: (1) the beta activity of curve I, Figure 1, extrapolated to zero absorption as shown, is 1550 counts per minute, (2) in the same sample and at the same counting geometry there are 54 counts per minute of alpha-particles due to Pu^{239}, (3) the half-life for alpha particle emission of Pu^{239} is 24300 years, and (4) the yield from the (α,n) reaction relative to that from the (α,3n) reaction is usually ca. 0.01 in the 38 Mev helium ion bombardment of heavy isotopes. From these considerations the half-life of Pu^{241} for beta particle emission is ca. 10 years.

The rare earth fraction from a similarly activated uranium sample contained an alpha-particle activity (energy - 5.45 Mev) of long half-life. Numerous tracer chemical experiments which were carried out with such activity are reported in another paper.(7) The evidence obtained shows conclusively that the activity is due to a previously unknown element. The occurrence of relatively energetic alpha-particle emission in a rare-earth fraction (lanthanum fluoride carriable) may be considered sufficient evidence, of itself, for the presence of an isotope of a rare-earth-like heavy element, since alpha-particle emission is an extremely rare property in isotopes of atomic number less than 81. The direct formation of americium isotopes by the helium ion