possible. Important contributions were made through the improvement of the methods for the handling and measurement of radioactivity.[7]

In view of the fact that sufficiently intense beams of energetic particles with nuclear charge greater than two have not yet been available, it was clear from the beginning that there were only two methods of approach to the production of synthetic element 98. The first approach, which proved successful, was through the bombardment of curium with helium ions. This approach provided an advantage in that the yields of the (α,xn) reactions were more or less predictable. At the same time it possessed a disadvantage in that the isotopes of element 98 so produced should be neutron deficient and of relatively short half-life as the result of considerable instability towards electron capture and alpha-particle decay. The second approach was through intensive neutron irradiations of curium in order to eventually produce, through successive (n,γ) reactions, curium and berkelium isotopes of masses sufficient to be unstable toward negative beta-particle decay and so produce isotopes of element 98.

This second approach was subject to great handicap in that it involved great uncertainty in the prediction of the mass numbers of the desired curium and berkelium isotopes which decay by beta-particle emission. The first isotope of element 98 so produced might be of mass 248 or 250. Not only is the order of the reaction in which these isotopes are produced very large, but also the cross sections for the (n,γ) reactions cannot be reliably estimated. Thus, in this second approach, the intense irradiation of curium samples with neutrons bears a time scale uncertain within several years. So far this method has been employed without success.

One of the important problems which had to be solved was that of obtaining sufficiently large amounts of curium as sources for the production of element 98. Americium, the source for the production of curium, became available in milligram

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[7] Nelson B. Garden and co-workers, unpublished work.