Disclosures of July 1939

In order to evaluate these disclosures one has to be aware of the fact that Mr. Fermi and I were jointly engaged in experiments on heterogeneous mixtures of uranium and water. The purpose of these experiments was to learn something about the multiplication factor in such systems. In June 1939 Fermi was engaged in extensive calculations to determine the best ratio of uranium to water in such mixtures and attempted to reduce the resonance absorption by trying to find the most favorable geometry. The paper which Fermi, Anderson, and I sent to the Physical Review in June 1939 reflected our conviction that a multiplication factor can be made very close to 1 but there was doubt whether the multiplication factor can actually reach 1.

I am enclosing a photopopy of a letter written by Fermi to me July 1, 1939 in which he writes, "I am thinking of several possibilities for reducing the absorption at resonance during the slowing down process and I shall let you know if I reach any conclusion."

To this letter I replyed July 3rd proposing the replacement of hydrogen by carbon and stating that carbon would be better than hydrogen if the capture cross section of carbon were below the upper limit of .01 and giving a minimum amount of uranium to carbon of 1 to 10. When I wrote this letter, I had in mind a heterogeneous system of uranium and carbon similar to a heterogeneous system of uranium and water which had been investigated in June 1939 but I had not yet realized the advantage which carbon would offer by putting uranium-containing elements separated with thick layers of carbon. An advantage which carbon has by making possible the use of thicker layers is first mentioned in a letter to Fermi dated July 5, 1939, in which I wrote, "Carbon would also have an advantage over hydrogen insofar as there is not change in

the scattering cross section in the transition from the resonance region to the thermal region. Consequently, if layers of uranium oxide of finite thickness are used, the diffusion of the thermal neutrons produced in the carbon to the uranium layer is not adversely affected as in the case of hydrogen by such a change." My letter to Fermi dated July 8 1939 is already in your files and I enclosed a further letter written by me to Fermi on July 11 1939 and a copy of a letter written by Fermi to Anderson dated July 18 1939. The last paragraph of that letter refers to the method of determining the length $A=\frac{1}{a}$ which was described in my letters to Fermi dated July 5 and 11.