p. 122

While up to this point we had suffered from the lack of official recognition, during this period we were suffering from having official recognition. H. C. Urey was under orders not to discuss with Fermi and myself the possibility of preparing substantial amounts of Uranium 235. Because of this compartmentalization, we failed to put two and two together, and at no time were we or any other physicist able to say to the American government that atomic bombs could be made with amounts of Uranium 235 which it was practicable to obtain. Thus our project and Urey's remained projects of low priority until the British colleagues, who were not so compartmentalized (hamstrung?), pointed out that making atomic bombs of Uranium 235 must be regarded as a practical proposition.

This led to a reorganization of the project and the group working at Columbia University was transferred to Chicago [in February 1942].

[EDITORS' NOTE: In these oral reminiscences Szilard does not cover his activities at the "Metallurgical Laboratory" in Chicago from February 1942 to the spring of 1945. During that time his title was Chief Physicist. The scientific aspects of this period, in the form of some thirty reports written by Szilard, will be included in the forthcoming collected works. Szilard picks up the story again in 1945.]

7. America November 1940 to December 31, 1941

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Hist G 6683

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May 22, 1956

Begin Record 12) (needs re-listening for corrections)

In November 1940 a contract was given to Columbia University by the government for $40,000 for the purpose of developing the Fermi-Szilard system of establishing a chain reaction in uranium. My main concern was to get uranium, if possible in the form of metal, of sufficient purity and to get graphite of sufficient purity to make a valid experiment. What we wanted mainly to do is to test directly by measurements on a pile composed of graphite and a lattice of uranium containing bodies whether or not said sustaining chain reaction can be expected to occur if the pile were maid sufficiently large. We did not have funds to purchase materials in any appreciable quantity but _____promised that such funds would be made availablethrough the National Bureau of Standards which was supposed to purchase these materials for us. The trouble was that these materials could not be obtained in sufficient purity commercially. But having to negotiate for them through the Bureau of Standards became a major bottleneck of progress. Varied contacts with manufacturers of material is very important if no finished product is commercially available because only through private conversations can you discover how the quality of the material might be improved. One important fact came out of a casual conversation with representatives of the National Carbon Company. Fermi and I had lunch with two men from the National Carbon Company from whom we expected to buy

some graphite. The graphite seemed to be fairly pure and the total impurity would have been dangerous only if it has contained some element that was very strongly absorbing neutrons. When we had our luncheon I said, half-jokingly to one of these men, "You wouldn't put boron into your ~~xxixp~~ graphite, or would you?" The two men looked at each other and there was an embarrassed silence. "As a matter of fact," said one of them, "samples of graphite which come from one of our factories contain boron because it so happens that we manufacture in that factory graphite electrodes for electric ~~xyxxpaxis~~ arcs into which boron is customarily put. Had we negotiated as we were supposed to do with these men through the National Bureau of Standards we would have never discovered this important fact. We had worse luck with uranium. We were given the specifications of the uranium oxide which was supposed to be delivered to us and the uranium seemed to be pure enough on the basis of those specifications . But then on a visit to the factory which made uranium metal out of the uranium oxide for our experiments we discovered another list of impurities which differs from ours which was much worse. This was a purely accidental discovery. It led us to re-examine the uranium which was delivered to us and it turned out that our uranium was equally impure. ~~Wehnxi~~ When I looked into the process how the uranium was purified I was struck by the fact that an

important group of elements which were strong neutron absorbers if they were never removed from the finished product. But when I discussed with the National Bureau of Standards whether we shouldn't change the procedure of purification I was told that the process which would improve the quality would take a long time to prepare and since we were in a hurry to get the chain reaction going the Bureau of Standards was not willing to advocate a change in the chemical purification. Because all these troubles were besetting us I got more and more impatient during the first half of 1941. Somehow we did not seem to be able to get the things done which we knew needed to be done. During this early period I was also haunted by the fear that it might be possible to detonate the uranium metal by fast neutrons if a sufficiently large quantity of this metal is assembled. Whether or not this is possible depended on the following thing: the bulk of natural uranium is Uranium 238 and it fissions only if it is hit by fast neutrons. In this fission it emits fast neutrons and whether or not a chain reaction can be maintained depends on how fast the neutrons emitted for fission are slowed down so that they might lose their effectiveness if further uranium. Dr. and I pursued therefore a side line investigation to determine how fast uranium metal slows down fast neutrons and we did not stop this line of investigation until we were satisfied that uranium metal cannot be used to make a bomb.

Things would have dragged on in a most xx unsatisfactory way had not the British recognized that xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx it is possible to separate sufficient quantity of Unranium 235 to make atomic bombs. Anybody could recognize this fact: xxxxxxxx we knew two things - how much uranium ? could be separated with a reasonable industrial effort and how much (U 235?) it took to make a bomb. At Columbia University xxx Urey and the _____ office of Naval xxxxxxx Research/xxxxxxxxx worked on the separation of uranium isotope 235, xxxxx While Fermi and I worked on the nuclear properties of uranium. It so happens that I actually measured the cross section of Uranium 235 for medium velocity neutrons in the first half of 1939 . From this I could have computed how much Uranium 235 it takes to make a bomb. The amount seemed faily large and I did not know that it was possible to separate such quantities of xxxxxx uranium 235. Urey's contract specified that he was not supposed to discuss his results with Fermi and me who were not fitted and therefore we were not able to put two and two together and come out with a simple statement that bombs could be made out of reasonable quantities of xxxxxxxxuranium 235. In Britain there were a number of German refugees such as Simon ____ and Fish (?) who at the beginning of the war were not permitted to work on anything of military significance and therefore took to working on uranium. Simon was interested inthe separation of uranium 235, Fish

was

and and Paris (?) were interested in nuclear properties. Nothing prevented them from talking to each other. They put two and two together and they informed the British government of the possibility of making Uranium 235 bombs with quantities of material that were industrially available./ The British Government informed the American Gov. So for the first time our attention was directed to the problem of making atomic bombs rather than merely to the problem of making a chain reaction of producing parts for driving submarines. _____chain reaction now began to appear in terms of making _____ (plutonium) chain reaction to make bombs and for the first time the government realized that our project was important. Oliphant came over here from England and attended a meeting of the Uranium Committee which neither Fermi nor I were permitted to attend. He realized that something was very wrong and that the work on uranium was not pushed in an effective way. He discussed his concern with E. O. Lawrence who in turn approached Compton and as a result of this agitation it was decided to reorganize the project. A. H. Compton was supposed to be in charge of setting up a chain reaction with a view of producing plutonium. Mr. Urey was supposed to be put in charge of separating Uranium 235 by the fusion method and Lawrence was supposed to be in charge of separating Uranium 235,

by_____method. Actually reorganization took place around the first of Jan. 1942. At that time the project from Columbia University was moved to Chicago and all of the grant funds were put at the disposal of the project. However, even now the authority to purchase materials was not given to the project. (End of Record S 12)

2nd set
May, 1969

Additional Notes to page 122 (section 7)

Telegram, L.S. to Wigner Feb. 26, 1941

Telegram, Gregory Breit to L.S. Aug. 12, 1941
Invitation to conference at National Bureau of Standards,
Aug. 22-23, 1941

Bk f 9. (1)

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DR L SZILARD= QR

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CONFERENCE ON THEORETICAL ASPECTS PLANNED FOR AUGUST 22 AND 23 NATIONAL BUREAU OF STANDARDS PLEASE INFORM WHETHER YOU CAN ATTEND AND WHETHER YOU WISH YOUR TRANSPORTATION REQUESTS FROM PRESENT ADDRESS TO WASHINGTON AND RETURN TO SAME ADDRESS=

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