Move in "History" Box

bbs 23

METALLURGICAL LABORATORY PERSONNEL — FEBRUARY 16, 1942

Arthur H. Compton, Project Leader

Samuel K. Allison, Experimental Chief

Enrico Fermi, Research Coordinator

Eugene P. Wigner, Theoretical Chief

Gregory Breit, Information Chief

R. L. Doan, Laboratory Director

J. C. Stearns, Personnel Chief

H. W. Byers, Procurement Chief

Norman Hilberry, Administrative Asst.

Haydn Jones, Shop Facilities
L. Szilard

RESEARCH ASSOCIATES:

Herbert L. Anderson
Seymour Bernstein
Lyle B. Borst
Alvin C. Graves
Elizabeth R. Graves
William P. Jesse
W. R. Kanne
Philip G. Koontz
Herbert N. McCoy
J. H. Manley
Alan C. G. Mitchell
Henry W. Newson
Louis A. Slotin
Arthur N. Snell
R. J. Stephenson
Alvin M. Weinberg
John A. Wheeler
Martin D. Whitaker
Ernest O. Wollan
Volney C. Wilson

RESEARCH ASSISTANTS:

Harold Agnew
John E. Brolley
James H. Coon
Francis L. Friedman
Homer W. Ibser
George Miller
Ardis T. Monk
Alexander V. Nedzel
Warren E. Nyer
H. Parsons
John B. Riddle

RESEARCH ASSISTANTS - Cont:

Leon Sayvetz
Robert H. Sehnert
Robert L. Walker

HIGH SCHOOL BOYS:

John Cali
Rowland W. Davis
Edward P. Littleton
Clarence E. Malloy
Melvin A. Miller
Arthur F. Petry
Theodore F. Petry
Glenn Sprankle

STOREROOM:

D. E. Schilling, Chief
Alexander Glon
John Moriarity
Walter L. Peterson

STENOGRAPHERS:

Anne Hultgren
Dorothy Johnson
Pearl Margolis
Opal L. MacDonald
Pauline McGrath
Gertrude Nissenbaum
Lucartha Sullivan
Katherine Tracy

SWITCHBOARD OPERATORS:

Celeste Hand
Lillian Sexton

SHOP:

T. J. O'Donnel, Chief
John Costa
S. W. Dietze
Clyde R. Emery
Joseph Getzholtz
Richard Gluck
John P. Larsen
Casmer Lesnieski
Joseph Novak

8. America December 31, 1941, to December 2, 1942

A chain-reacting uranium-graphite system was put into operation in Chicago on December 2, 1942.

7/12/67

1956
Voice Master Records

(Begin Record 12)

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. Byt having to negotiate for them through the ~~Exxxdax~~ Bureau of Standards became a major bottleneck of ~~PROGRESS~~ 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 ~~grixp~~ 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 ~~exexpaxtx~~ arcs into which boron is customarily put. Had we ntgotiated 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/~~examine~~ re-examine the uranium which was delivered to us and it turned out that our uranium was equally impure. ~~When~~ 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, xxxx 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

Perrin

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 Hugh 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)

While negotiations for materials formerlyhad to go through the Bureau of Standards now ~~xxx~~ negotiations for/the purchase of materials had to go through Murphy of Standard Oil of New Jersey. This division of authority hampered us throughout the first half of 1942. In spite of this somehow A. H. Compton managed to make arrangements for obtaining uranium purified in the right way so as to _____ unanium from neutron absorbing substances which the older way of preparing it did not remove. As purer grade uranium was obtained and _____ uranium metal began to come in it became clear that a self-sustaining chain reaction would be achieved. This much was clear to most of us including A. H. Compton, Director of the Project, in the spring of 1942. And on December 2, 1942 the chain reaction was actually started at ____ Field (Stagg?) on the campus of the university. As soon as it became clear that the chain reaction will succeed my attention and also the attention of _____ turned toward the problem of having an effective cooling system and of solving the technological

and engineering problems belonging to these cooling systems, So that a reactor high-powered output can be constructed and sufficient quantities of plutonium can be manufactured. There was a feeling in the Project that the cooling of a reactor is not a problem for physicists to worry about, that this is an engineering problem and should be entrusted to engineers. There was an engineering group set up in the project which set up an advisory committee having 8 members and I was one of the members but E. P. Wigner was not put on the committee since it was clear that Wigner thought more about engineering problems taking due regard to the physics involved than anyone has. I tried to correct this omission but I did not succeed and engineering group _____ took a position that they did want to enlarge the committee for it would be unwieldy. This engineering group then decided to adopt the cooling system such as a car cooling system, Number 1, and develop the process design along this line. Neither I nor Dr. Wigner thought that this design was good or that _____ approach of the cooling systen # 1 was acceptable.Wigner therefore tried to get an engineer attached to his group of physicists in order to work out an alternative system which I shall call system #2. It took a long time before the engineering group agreed that he should have and engineer, but finally he was given an engineer and they walked away quietly trying to develop with one engineer and a number of _____ physicists what we

might call a cooling systen #2. When, at the end of 1942, the _____ Company took over the construction of the plant for the manufacture of plutonium the official recommendation of the Project adopted the cooling system #1 advocated by the engineering group. After the _____ Company had a few weeks opportunity to study the system Dr. Wigner presented to them a process designed for system #2 which he had worked out with one engineer. The _____ company decided to use system #2 rather than system #1 which was unworkable. Physicists in the project were unhappy about the way cooperation with the _____Co. was set up. The DuPont (?) Co. had very good engineers but they did not have the required knowledge of nuclear physics. They were supposed to draw up the plans and the Project was given the right to object to any given solution which the DuPont Company may put forward. Clearly this is a very peculiar way of arriving at a design and for a long time most physicists on the Project did not believe that the DuPont Company will be able to produce a workable design on the basis of this trial and error proceedure. The ..... decided that it was not a good design but a design that worked. At least it worked for a while. And after ..... went into operation they were able to deliver material during the war without any serious hitch. The disagreement about the cooling system to be used put the form of a fight between the physicists and the engineers. The issue was, should the physicists be permitted to make their own designs or should all designing be

concentrating in the engineering group and the physicists merely act in an advisory capacity. This fight reached its end, of course, automatically at this time, when the Dupont Company took over the construction of the parts, for the responsibility was then clearly assigned to the Dupont Company. But gradually, ... the fight ended to the temporary victory of the engineers. Dr. Compton instructed the physicists to cease working on the process designs and to act as consultants to the engineering group. When the enginners came over to ask Dr. Wigner for his cooperation, Dr. Wigner asked, "What do you want to do?" "I mean, what do you want me to do ?" "Well," they said, " all we want you to do is answer our questions." "Oh," said Wigner, "if you know what questions to ask, you will find the answer to any question which you might ask and which I can answer in my files. All I have to do then, is give you the key to my file, which I shall be very glad to do. Obviously, in order to know the right answers otherwise you dont know what the right questions are." And this kind of cooperation would have lead us nowhere had we, in fact, adopted it. After it became clear that half our plans were successfully operating, the Chicago project relaxed. It then became possible for the physicists to take a more detached view and some of us began to think of the wisdom of making bombs , testing bombs, and using bombs. In March 1945, which was clear that Germany was defeated and after the defeat of Germany

8. No tape exists