

GENERAL REMARKS

From the very start of the uranium projects there has been something wrong with the mechanisms used for reaching decisions and a number of important decisions which were taken were clearly recognized as mistakes by us at the time when the decisions were announced. It usually took them from four to eight months before it was officially recognized that a mistake had been made and it was attempted to remedy the situation. It would seem that we can ill afford mistakes of this type and that we shall not be able to avoid them in the future unless there is a fundamental change of the attitude which is responsible for this state of affairs.

Of the important decisions taken in the last two years some were bad and some were good, and the bad ones and the good ones both had this in common: they were based on false premises. It appears worth while to review the history of the last two years by going through, one by one, the crucial decisions which were taken during that period to note on what premises the decisions were made, to recall whether or not the decision was generally recognized to be a mistake at the time when it was announced and to record how the decision worked out when it was recognized as a mistake and what damage resulted.

1. In January 1942 we were informed that Murphree of Standard Oil of New Jersey was given authority to provide for the Chicago project the required materials. The chief issue was the development of a method for making pure uranium metal and the organization of its manufacture. At the time when this decision was announced it was clearly recognized as a mistake by practically everybody and a number of us were very outspoken about it. We continued to protest against this division of authority but it took about five months until a change was effected.

This division of authority almost wrecked our project and we got through this situation by the "skin of our teeth" through a series of lucky chance successes. These were as follows:

Dr. Compton, through his personal connections with the Mallinckrodt family was able to arrange for a purification of the uranium nitrate by ether ~~purification~~ extraction. I was able by disregarding directives to show, with the help of the Brush Beryllium Company, that magnesium which was commercially available in a pure form could be used for producing uranium metal in place of calcium which was not commercially available in sufficient degree of purity, and finally, Dr. Spedding at Ames was able to work out the magnesium reduction and to organize the production of uranium based on magnesium reduction at his college on a factory scale. He very quickly brought up the production to two tons a day at a cost of about \$1.00 per pound successfully beating the competition of all large firms who were in the meantime brought in by the Army.

We see in this case that a decision which deprived the Chicago project the authority to provide for the material which it required for its work was recognized as a mistake from the start. We further see that the premises on which the decision was based, namely that the Chicago group was not able to make the arrangements needed for the production of these materials, was false. Through a series of lucky circumstances our work was not wrecked by that mistake of organization. However, it was considerably retarded by perhaps as much as six months.

2. At the time when the Chicago project was organized it was announced that the responsibility given to the Chicago project did not cover the engineering development which was necessary to prepare process

design for a cooled power unit but that this responsibility would probably be given to Murphree.

This decision had the consequence that an engineer recommended by Murphree, Mr. Thomas Moore, was put in charge in Chicago of developing a process design for the power unit. He decided to work out a helium cooled plant and built up an engineering department for that purpose.

The development of a process design was recognized by us from May 1942 on as an urgent task and most of us were strongly in favor of having, apart from a helium cooled design, other cooling methods worked out at least into the stage of the process design. I myself would have liked to look after designing a bismuth cooled power unit, whereas Wigner decided to work out a design for a water cooled power unit. I never had the cooperation of an engineer and Wigner, after considerable difficulty, had just one engineer attached to his group for the purpose of working out the design of a water cooled plant.

Thus there was a period of indecision from January to July 1942 in which it was not at all clear just how the responsibility for the engineering development should be arranged and to that indecision, which was clearly recognized as harmful by all of us, must be attributed a delay of which perhaps two months fall into this particular period of time.

3. At the end of June we were informed that the War department had been given the responsibility of building power plants and production plants and that we were supposed to design and build a power unit as a joint enterprise of the Chicago laboratory and Stone and Webster under the general supervision of the army engineers. It was obvious to prac-

tically everybody in the Chicago laboratory that this arrangement simply could not work. Anyone who would have taken the slightest trouble to make inquiries regarding what engineers could be made available by Stone and Webster would necessarily have had to come to our conclusion. It took from the end of June until October 1942 until our point of view received official recognition and the intervening period would have to be considered as a total loss as far as the process design of a cooled power plant was concerned had it not been for some work done by Wigner's group off the line of helium cooling and along the line of water cooling which at that time received no official recognition.

The decision to build a helium cooled power plant in collaboration with Stone and Webster was thus clearly recognized as a mistake by most of us and led to a loss of three months with respect to the preparation of a usable process design for the power plant.

4. It was decided in July 1942 to build a power plant for the production of about 1 gram of plutonium per day and a chemical separation plant attached to this power plant near Chicago. Work along this line started in July and the plant was scheduled to be in operation in May 1943. This decision was approved by almost all of us and strongly acclaimed by our chemists.

However in September 1942 it was decided^{not}/to build the separation plant in Argonne forest but to build it at Site X. This decision was based on the assumption that a helium cooled production plant would eventually be built at Site X and that the chemical separation plant would be used both for the power plant producing 1 gram a day and the helium cooled production plant. This decision was condemned in the

strongest possible terms by practically everybody in the laboratory. It was based on the false premise that the production plant would be built later on at Site X and it ~~has~~ led to a delay of five months in supplying plutonium to our chemists and Site Y. It has further led to a splitting of the personnel of the Chicago laboratory between Site X where the 1 gram a day plant went into operation in the last week of October 1943 (in place of May 1943 as originally scheduled at the location near Chicago). Indirectly this decision is also responsible for depriving us from a real pilot plant for the water cooled production plant which will eventually be built at Site W.