

Y-12 electromagnetic separation process wins approval

The review of the various processes being considered was conducted by a special committee Groves set up known as the Lewis Committee. Warren K. Lewis of the Massachusetts Institute of Technology led this committee appointed by Groves on Wednesday, November 18, 1942. The full committee consisted of Lewis, chairman, and three members from du Pont. Another member, Murphree, got sick and could not serve. Although the committee was heavily weighted with du Pont personnel, Groves insisted it begin its work immediately. Just like what we know of Groves, huh.

The gaseous diffusion, reactor pile and electromagnetic separation approaches were reviewed with each group attempting to show advances and results of their research. The Lewis Committee convened in New York on Sunday, November 22, 1942. On November 23, 1942, a Monday, the committee reviewed the gaseous diffusion process and found it to be very promising. However, they felt the organization and direction of the research was not well defined.

Next the committee went to Chicago on Thanksgiving and was briefed by Arthur H. Compton regarding Fermi's work. However, the Chicago pile had not yet produced a chain reaction. So this stop only served to bring Lewis up to speed as the three du Pont employees had just previously been briefed on Fermi's attempt to produce plutonium.

On Saturday, November 28, 1942, the Lewis Committee arrived in Berkeley where they were met by an enthusiastic Ernest O. Lawrence. Here they found something quite different than at the other two locations. Here was a well organized and well managed research team with a strong and optimistic leader. The committee was about to be very impressed with what Lawrence had prepared for them.

According to *The New World* by Richard G. Hewlett and Oscar E. Anderson, Jr., the committee was entirely too tired from the long train ride from Chicago to enjoy a most excellent dinner Lawrence had arranged for them at Trader Vic's. Hewlett and Anderson continue by stating, "However, they gamely returned to Berkeley for a full evening of presentations by Lawrence's enthusiastic staff."

"On Sunday morning they observed the operation of the calutrons in the cyclotron building. Everywhere they felt the impact of Lawrence's dynamic leadership, but the visit did not dispel their doubts that Lawrence could develop a full-scale electromagnetic process. Before the day was over, the committee boarded the train for Chicago, where they hoped to find Fermi's pile in operation."

This must have been a most frustrating development for Lawrence who knew he had the lead in the technology and knew he could design and install full-scale calutrons. I can just see him exclaiming to his staff when the committee was safe out of earshot, "What do we have to do to convince these folks? I know and you know we are on the right track. They will see it yet!" Or some such rant very much like that.

The Lewis Committee then returned to Chicago and on December 2, 1942 met to discuss the advantages of a heavy-water pile. While this discussion was ongoing, Compton took one of the committee members, Greenewalt, to view the final phase of the experiment Fermi was conducting. While they watched from a balcony above the squash court, Fermi continually removed short lengths of cadmium control rods until at 3:20 PM his instruments indicated a sustained chain reaction.

So, the Lewis Committee's whirlwind tour to see all the research being done on the various methods to create an atomic bomb being considered was completed and their report was actually drafted before arriving back in Chicago. Fermi's chain reaction was a foregone conclusion, it just had to eventually happen. The recommendation to proceed with the full size pile project was

included in the Lewis Committee report. However, Groves had already issued du Pont a letter authorizing design and construction – one day before the experiment succeeded in producing a chain reaction.

The Lewis Committee Report recommended the gaseous diffusion process as the one with “the best overall chance of success” according to *The New World* and a full-scale plant should be designed and constructed. As for Lawrence’s electromagnetic separation process using calutrons, they recommended “extensive development work on the experimental units at Berkeley to see whether the capacity of the calutron could be increased,” again quoting from *The New World*.

Interestingly, this single item in the report drew all the attention of the S-1 Committee to whom the report was given on December 9, 1942. Conant took the lead to advocate for Lawrence’s electromagnetic separation process to be also included as a full-scale production effort. Murphree, although still sick, wrote in support of the electromagnetic separation process.

Lawrence stated that the Lewis Committee had overestimated the difficulties and failed to consider recent improvements to the calutron design. Lawrence was so bold as to say he felt the calutrons could produce enough Uranium 235 for an atomic bomb by July 1944.

Conant also remembered that he had learned that the entire full-scale gaseous diffusion plant would have to be completed before enough Uranium 235 could be collected to produce one atomic weapon. The calutrons, on the other hand, could begin producing Uranium 235 as soon as the units could begin to be installed. Conant argued for an electromagnetic separation plant capable of producing 100 grams of Uranium 235 per day. The speed with which even small quantities of Uranium 235 could be produced ultimately helped the calutrons to be installed at Y-12.

The report that Groves was drafting on December 9, 1942 was intended for the President and the S-1 Committee struggled with just what to let him include of the Lewis Committee’s report. The final report was not finished at the end of the day.

Conant’s battle for electromagnetic separation continued the next day. Late in the day, the Military Policy Committee was working on the final wording of the report with Groves. Conant succeeded in getting agreement to revise Groves’ report to state that an electromagnetic separation plant would be constructed that would be capable of producing 100 grams per day, a compromise position that kept the process alive but did not recommend a full-scale production plant at this time.

Vannevar Bush sent the final report to President Roosevelt on December 16, 1942. It contained an increase in the estimate of total fissionable material needed for a bomb and reduced the number of approaches to obtaining the needed materials for a bomb to three – gaseous diffusion, a reactor to produce plutonium – both considered viable strategies - and the electromagnetic separation process – reluctantly included at Conant’s insistence. Conant even succeeded in getting the idea that the limited scale calutron plant might be expanded to a full-scale electromagnetic separation plant.

On December 28, 1942, President Roosevelt approved the recommendations. General Groves, however, had already talked to several of the nation’s largest corporations about designing, constructing and operating the huge industrial complex being considered. From his experience building the Pentagon, he still had several key contacts among the private companies. He did not hesitate to call the top managers and to immediately place them under pressure by calling on their patriotic duties.

Groves knew he was going to need all the industrial expertise the nation had to offer. It was a huge task he was undertaking, unlike anything that had ever been done before. The scale was

tremendous and the complexities great. Yet, the fear, shared by all who had knowledge of the project, was that in spite of the nation's best efforts, Germany might well beat us to the bomb.

As 1942 came to a close and 1943 began, enormous changes were happening in East Tennessee. People were moving out of the small communities that the government had taken. Although they did not fully comprehend what was happening to them or why it was happening, move out they did. Almost immediately, huge earthmoving equipment began to show up and major clearing and construction began almost before the people could get out of the way.

The first construction to begin was the Administration Building known locally as the "Castle on the Hill" but not far behind that construction was the Y-12 construction that began in Bear Creek Valley. The New Hope community was soon reduced to a single cemetery. The houses, barns and other outbuildings were demolished. The entire north east section of the valley from the base of Pine Ridge to the base of Chestnut Ridge was soon cleared and foundations were being poured.

The construction moved rapidly and the buildings soon began to take shape. Y-12 is the holder of several records regarding the Manhattan Project. It was the first site to begin construction (February 1, 1943), the first to go into operation (November, 1943), the largest at 22,400 workers at its peak, the only plant that was operating for a year and the only plant turning out the fully enriched uranium 235 needed for an atomic bomb until December 31, 1946.

So, from the decisions of late 1942 to February 1943 resulted in Y-12 construction beginning even before the full design of the calutrons was fully known. Lawrence continued to work on the design in Berkeley. Conant continued to push for the construction of a full-scale electromagnetic separation plant. Groves seemed to push forward, almost ahead of formal decisions, on all aspects of the project.

Next we will look at the specifics of the early planning and construction of Y-12.