Oak Ridge, Tennessee

Heritage Tourism Plan Manhattan Project Veterans Reunion June 8, 2005 Proposal for K-25 Preservation Oak Ridge: WWII's Secret City

The Manhattan Project built huge facilities at a secret site in Oak Ridge, TN, to test three techniques in parallel for separating the isotopes of uranium. One isotope, U-235, found in less than one percent of naturally occurring uranium is "fissile" or suitable material for an atomic chain reaction. The challenge for the Manhattan Project was to separate the U-235 isotope from the abundant U-238 isotope. Eventually all three techniques developed at Oak Ridge contributed to producing the ingredients for the bomb dropped on Hiroshima on August 6, 1945. Shortly after the war, S-50 or the thermal diffusion facility was taken down but the other facilities, at the K-25 and Y-12 sites, remained productive for 20 years or more. The story of Oak Ridge is one of near disaster and ultimate triumph.

The first approach was the electromagnetic separation technique developed by Ernest Lawrence at the University of California at Berkeley. Deciding to go ahead with a full-scale separation facility built on Berkeley's model at Oak Ridge in January 14, 1943, General Groves ordered that the facility be completed in less than six months. The speed and scale of the operations were staggering as Tennessee Eastman Corporation, Westinghouse, Allis-Chalmers, Chapman Valve and other contractors scrambled to deliver.The second technique was gaseous diffusion. The K-25 plant built to house the gaseous diffusion process consisted of 50 four-story buildings in a U-shape measuring half a mile by one thousand feet. Inside, a series of over 1,000 huge cells were linked in a cascade through which uranium hexafluoride gas traveled, with small fractions of the U-235 isotope separated by a barrier material with microscopic pores. Operated by Union Carbide, at first K-25 was plagued with problems but by March 1945 was producing the first enriched uranium. A third separation approach used thermal diffusion. Besieged with trouble with the Y-12 and K-25 plants, Groves decided to invest in the technique developed by Philip Abelson for the Navy. This time the contractor, H.K. Ferguson Company of Cleveland, was given just 90 days to construct the facility, involving 2,142 columns, each over 40 feet tall. With the pressure of the war, there was no time to pursue each process sequentially. Each of the facilities was a gamble on an enormous scale. As of April 1945, none of the processes worked well. In an almost desperate but insightful move, Oppenheimer ordered that Oak Ridge's three enrichment processes be run serially. The thermal diffusion process, a huge facility built in less than three months, achieved less than two percent enrichment but this slightly enriched material greatly increased the efficiency of the gaseous diffusion process. When this product, enriched to about 23 percent U-235, was fed into the electromagnetic separation process or calutrons, the result was about 84 percent enrichment. Fortunately that was sufficient as demonstrated by the Little Boy bomb dropped over Hiroshima on August 6, 1945. The Atomic Heritage Foundation is spearheading an ongoing effort to preserve the Y-12 and K-25 plants. In addition, a large part of the National Traveling Exhibit is devoted to helping people understand how these processes worked and how dangerously close to failure the entire Oak Ridge operation came. The exhibit also reinforces how the ingenuity, willingness to try unorthodox approaches, and dogged determination of the participants were essential to the success of the Manhattan Project. Artifacts in this exhibit include one or two wooden crates labeled "Clinton Engineer Works" with spare parts that were ordered for the electromagnetic separation facility at Y-12. Some vintage instruments in wooden cases from the 1940s were used at Y-12. Video footage of Alvin Weinberg, the chief designer of the X-10, explains how it worked. A model of the reactor lets visitors insert mock fuel rods and measure the increasing levels of "radioactivity" as the model reactor goes "critical."