A History of U.S. Uranium Enrichment in the 1950s

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By the late 1940s, the gaseous diffusion method of uranium isotope separation had evolved as the most economic and most productive U.S. method for the production of highly enriched uranium (HEU) for military purposes. The K-25 Plant, located in Oak Ridge, Tennessee, and constructed as part of the Manhattan Project, had proved to be a very successful production facility; however, its configuration at the time did not meet the anticipated HEU demands of the growing U.S. nuclear arsenal. Three additional large buildings (K-29, K-31, and K-33) were added at the K-25 Site in the 1950s. The early 1950s also saw the design of a second gaseous diffusion plant (GDP) to be located just outside of Paducah, Kentucky. (At the time it was thought that dispersal of GDP facilities at different sites was wise from a strategic standpoint.) The five major process buildings at Paducah were subsequently completed in 1953 and 1954. A third GDP was completed north of Portsmouth, Ohio, in 1955–1956 and consisted of three major process buildings. The combined employment at these facilities totaled nearly 3,000 persons. With three plants now available to the Atomic Energy Commission (AEC), the complex could be operated as what in essence was one large plant, with the product from Paducah feeding the higher U-235 enrichment plants at Paducah and Oak Ridge. In this manner, the consumption and costs of electricity were optimized. These plants were all located in areas where the cost of electricity was low due to the availability of inexpensive power from hydroelectricity (Tennessee Valley Authority) and dedicated coal-burning plants. During the 1950s, the three GDPs consumed a few percent of the total electrical energy produced in the United States. From 1958–1960, a German engineer, G. Zippe, and Jesse Beams of the University of Virginia developed the counterflow gas centrifuge in the United States. At the time, the gas centrifuge did not appear to be competitive with the GDPs from an economic or production capacity standpoint. It was not until the 1960s, with the looming growth of civilian nuclear power and improved centrifuge machines, that centrifuge technology appeared to be economically viable. This paper will discuss the above history in more detail and how developments of the 1950s led to the large worldwide uranium enrichment industry we see today.