

A look back at Union Carbide's [first] 20 Years in Nuclear Energy [The Gaseous Diffusion Plants]

Note: Union Carbide Nuclear Division, which started out as Carbide and Carbon Chemicals Company, operated the Atomic Energy Commission/Energy Research and Development Administration/Department of Energy sites in Oak Ridge, Paducah, KY, and Portsmouth, OH, until 1984, some 40 years. The report this series of articles is documenting covered ONLY the first 20 years. I am working on documenting the second 20 years of UCND's accomplishments as well. Bill Wilcox, retired Technical Director of both Y-12 and K-25 as well as the official Oak Ridge City Historian, is helping with that effort.

The articles in this series are taken from a publication produced by Union Carbide Nuclear Division in the early 1960s which provides some insights into technological advances and substantial manufacturing accomplishments that were made in Oak Ridge just 20 years after the Manhattan Project came to East Tennessee. Tim Gawne of Oak Ridge National Laboratory provided the publication to me when he found a copy in the ORNL Library archives.

This section covers the Gaseous Diffusion Plants:

“PROCESS IMPROVEMENTS”

“The process development program supporting fissionable materials production is one of the most rewarding activities carried on by the Commission. Major reductions in cost of fissionable materials have resulted from these efforts. The program is conducted by contractors operating the major fissionable materials production facilities, and is analogous to the development and improvement programs pursued by progressive private industries.

“All components of the gaseous diffusion process, such as barriers, gas compressors, gas coolers, and coolant, have been under study since the K-25 plant at Oak Ridge was put into operation in 1945. As a result of these studies, intensified when the expansion program started, improvements have been made in every part of this process. Net results of the improvements over the years are that the capital costs for diffusion plants built since 1946 have been several billion dollars less than if the plants had been built utilizing the same types of equipment as in the original K-25 plant. In addition to the savings in capital investment, these improvements also have resulted in annual operating costs which are several hundred million dollars less than plants of the K-25 type.

“A LARGE-SCALE OPERATION”

“The gaseous diffusion process is huge. Through the cooling towers at the K-25 plant and at Paducah, KY, more than 400 million gallons of water are circulated every 24 hours. This is enough to serve a city of two million people.

“Other statistics are equally staggering. The AEC capital investment in Oak Ridge and Paducah diffusions plants is \$1,644,000,000. This is equivalent to more than \$300,000 capital investment per employee, and about 10 times the average per worker in the chemical industry. The diffusion process buildings at Oak Ridge and Paducah cover about 420 acres. Electrical power consumption for these two plants is about twice that of New York City. In February, 1962, the plants completed shipments of more than one million pounds of uranium hexafluoride for AEC's Civilian Applications Program. This uranium will be used in power reactors all over the world.

“Shown above is a portion of the largest fluorine plant in the free world located at Paducah. Fluorine is used to manufacture uranium hexafluoride feed for the cascade. From the time Carbide agreed to operate the diffusion plant, its personnel have had an active interest in the manufacture of diffusion barrier and uranium hexafluoride feed. Carbide carried out successful development programs to improve the manufacture of both vital materials. The success resulted in construction of the feed plants in Oak Ridge and Paducah.

MILESTONES IN GASEOUS DIFFUSION

1939 – U.S. Vanadium developed a process for preparing uranium concentrate as a byproduct from their vanadium operations. Union Carbide's Linde Research Laboratory developed a process for preparation of pure sodium diuranate from the concentrate.

1940 – Scientists at Columbia University became interested in the large-scale separation of uranium isotopes. This work was sponsored by Naval Research Laboratory, and later by the Office of Scientific Research and Development.

July 1, 1941 – An OSRD contract was signed with Columbia University which specifically called for diffusion research. The contract was followed by others with OSRD, and later with the Manhattan District, and led to the organization of the SAM (Substitute Alloy Materials) Laboratories at Columbia. This organization had the primary responsibility for gaseous diffusion research and development.

October 31, 1941 – Dr. Leo Szilard requested 8 pounds of uranium oxide from Union Carbide for analysis by the National Bureau of Standards.

August 1, 1942 – Union Carbide received an order for 2,000 pounds of uranium oxide for experimental purposes. It was shipped from stock the next day.

October 20, 1942 – The U.S. Engineers Office ordered 80,000 pounds of uranium oxide, the first order under Contract W-7401 eng-15.

December 14, 1942 – The Manhattan District signed a contract with the Kellex Corporation, a subsidiary of M. W. Kellogg Co., to serve as architect-engineers for construction of a gaseous diffusion plant.

January 18, 1943 – J. A. Rafferty, president of Carbide & Carbon Chemicals Co., accepted a letter contract to operate a gaseous diffusion plant, and to perform certain research and development and consulting services on the project. Lt. Col. K. D. Nichols signed for Manhattan Engineer District.

May 18, 1943 – J. A. Jones Construction Company signed contracts to build the K-25 powerhouse, cascade buildings, and administration area at Clinton Engineer Works.

June 1943 – Ground was broken for the powerhouse at the gaseous diffusion plant.

July 9, 1943 - A contract was signed by Ford, Bacon and Davis, Inc. for construction of the conditioning area.

September 1943 – Ground was broken for the K-25 building.

April 1944 – Carbide assumed overall management of the gaseous diffusion barrier development and production program. Dr. George T. Felbeck had primary responsibility for the program.

January 1945 – The first cascade equipment was operated with uranium hexafluoride.

February 1, 1945 – Carbide took over responsibility for management of SAM Laboratories from Columbia.

March 19, 1945 – The first enriched uranium was shipped from K-25 to Y-12.

August 15, 1945 – The K-25 cascade was in full operation.

December 1945 – The K-27 building was in full operation.

December 1946 – The electromagnetic separation facility at Y-12 was shut down.

December 1947 – Barrier plant and uranium hexafluoride feed plant started operation in Oak Ridge.

August 1949 – January 1951 – Construction of K-29 plant at Oak Ridge.

November 1949 – December 1951 – Construction of K-31 plant at Oak Ridge.

December 1950 – Construction started on Paducah Gaseous Diffusion Plant.

April 1, 1951 – The first Carbide payroll at the Paducah site was established.

July 10, 1952 – Plans were announced for expansion of Oak Ridge and Paducah plants, and for construction of a new gaseous diffusion plant at Portsmouth, Ohio.

September 18, 1952 – Goodyear Atomic Corporation a subsidiary of Goodyear Tire and Rubber Co., was announced as operating contractor for Portsmouth Gaseous Diffusion.

November 7, 1952 – Interplant operations were started between Oak Ridge and Paducah diffusion plants.

February 1953 – The C-31 plant at Paducah was on stream.

July 1951 – October 1953 – Construction of C-33 plant at Paducah.

August 1952 – November 1954 – Construction of K-33 plant at Oak Ridge.

August 1952 – April 1954 – Construction of C-35 plant at Paducah.

September 1952 – December 1954 – Construction of C-37 plant at Paducah.

July 1953 – Uranium Fluoride feed plant at Paducah in operation.

August 1955 – An improvement program started in Oak Ridge and Paducah plants.

August 1956 – Feed plant expansion at Paducah in operation.

September 17, 1956 – First shipment of enriched uranium hexafluoride made under AEC's Civilian Applications Program.

December 1956 – Initial operation of the uranium metals plant at Paducah.

November 1960 – Electronic Data Processing building housing the IBM 7090 computer was completed. Construction started in October 1959.

December 1961 – The new Development Laboratory for Chemistry and Physics departments of Technical Division was completed. Construction started November 1960.

February 1962 – Gaseous diffusion plants ship their millionth pound of uranium hexafluoride for use in the Civilian Applications Program.

Next we will look at the history and milestones of the Oak Ridge National Laboratory.