

## **A look back at *Union Carbide's FIRST 20 Years in Nuclear Energy [The Y-12 Plant]***

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.

This series of articles is 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 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 of the report covers the Y-12 Plant, now the Y-12 National Security Complex:

### **“Y-12 ELECTROMAGNETIC APPROACH TO URANIUM SEPARATION”**

“The Y-12 Plant today [1962] includes about 170 buildings with a floor area approximately equal to 78 football fields or 4,500,000 square feet. The plant investment today is \$442,000,000. When the electromagnetic process was discontinued, most of the uranium isotope separation equipment was stripped from Y-12 and the plant assumed a new role with many widely diversified programs. Today's activities include the reduction of uranium hexafluoride – enriched in U-235 – to metal, followed by casting, rolling, machining, and fabricating the enriched metal into various forms, including nuclear weapon components.

“The Y-12 Plant was built on a ‘crash’ basis during World War II to produce enriched uranium by the electromagnetic process. The first production building went into operation January 27, 1944. By 1945, Y-12 employed 22,000 operating personnel. It was the first plant to produce large quantities of enriched U-235.

“The electromagnetic process involved ionizing uranium tetrachloride, accelerating a continuous stream of uranium ions to a very high speed, then bending the stream into semi-circular paths in a powerful magnetic field. The lighter U-235 traveled an arc of shorter radius than that of the heavier U-238, and the two isotopes were caught in separate containers at the end of a 180-degree arc.

“After the war, the electromagnetic process for U-235 separation was discontinued and only gaseous diffusion was used on a production basis. A few of the electromagnetic units are still used at Y-12 for separation of stable isotopes of other elements.

“Carbide has been the operating contractor since May 4, 1947, when Tennessee Eastman Corporation withdrew from the operation.

“In addition to developing and operating complex chemical processes, Y-12 makes significant contributions in the field of advanced metallurgy and special fabrication. An example is a high-temperature furnace with controlled atmosphere used in developing metal rolling techniques.

“Because of Y-12's vast reservoir of industrial skills, many problems in areas such as metallurgy, special fabrications, chemistry, chemical engineering and health physics are brought for solution to its development engineers.

“Y-12 has assisted in developing reactor fuels, particularly those employing uranium oxide. The plant perfected a procedure for producing hafnium-free zirconium, a material used extensively in Naval reactors. The first large-scale precision machining of beryllium, which is used in some reactors as a neutron reflector was performed at Y-12.

"In addition, development activities in the pressing and machining of various metals have made valuable contribution to the missile program. Y-12 also has developed and operates a plant for large-scale separation of lithium isotopes.

"About 5,500 are employed at the plant which is engaged in many exacting and complex processing activities. Its personnel have made Y-12 one of the nation's safest plants. In late 1950, more than 10 million man-hours were worked without a lost-time accident, setting a new record for Carbide's nuclear energy plants and the Corporation.

### **"EQUIPPED TO HANDLE ANY PROJECT"**

"Y-12 is engaged in continued development and pre-production work on fuel elements for the nuclear rocket program, and on shields for nuclear power sources used in space satellites. Considerable development work for the weapons program is also undertaken at Y-12 at the request of weapons design laboratories. Components for nuclear devices being developed for the Commission's Plowshare program, directed toward demonstrating the peaceful uses of nuclear explosives, are fabricated at Y-12.

"In conjunction with its various engineering, development, fabrication and production activities, Y-12 has developed ultra-precision analytical and inspection capabilities.

"AEC has said, about the Y-12 Plant: 'The capability and versatility of Y-12 are now proven assets to the United States nuclear energy effort. As the highly-skilled personnel of Y-12 continue to perform difficult production and engineering development jobs, frequently on lightning schedules, they add immeasurably to the nation's defense posture while at the same time advancing the peaceful applications of the atom.'"

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The report contained information on a 100-inch turning, facing and boring mill used for fabricating large parts, such as those used on reactors. Also there are tape-controlled, three-axis grinding, turning and milling machines used for specialized short-run items mentioned in the report. While computer controlled machines at Y-12 today are even more advanced, these 1962 versions were at the forefront of the nation's machining capability then and were stretching the industry by adding accuracy and capability well beyond what standard manufacturing techniques could produce.

It is interesting to note that the "complex chemical process" mentioned in association with Alpha 4 (Building 9201-4) was still classified in 1962 and while an outside photograph of the building was used, there was no discussion in the text about the COLEX (column exchange) process other than to mention briefly the large-scale separation of lithium isotopes.

Next we will look at the milestones of Y-12 during the first 20 years of Union Carbide's presence in Oak Ridge.