

## **Y-12 begins to separate lithium isotopes**

During the years from 1946 through the early 1950s, Y-12 continued to expand as needed to meet the demand for a growing primary mission of machining uranium. The increased support was required as the nuclear weapon stockpile was being built and the testing of new designs continued.

With the decision by President Truman to develop the hydrogen bomb, Y-12 soon became engaged in manufacturing parts for both the standard atomic weapons and the new designs being considered. The test of Mike, on October 31, 1952, marked a significant change in direction for the manufacturing of parts at Y-12.

Then the August 12, 1953, nuclear explosion by the Soviet Union proved to be even more unsettling than had been the earlier atomic explosion patterned after Fat Man. The Soviets were now on equal footing with a thermonuclear weapon capability. Y-12 was charged with increasing production and adapting to even more demands for support of the now rapidly expanding nuclear weapons program.

Unlike previous atomic weapons, these new thermonuclear weapons derived their explosive force from both fission and fusion of hydrogen atoms. This truly was the "Super" that Edward Teller had promoted from early in the Manhattan Project, but had been set aside and now saw a huge rebirth, largely because of the Soviet's quick adaptation of their program to include the thermonuclear technology.

The thermonuclear weapon process required the addition of several materials that were not included in the original atomic weapons. Lithium-6 was one of the new materials that brought a significant amount of challenge and new work to Y-12.

In late 1950, there was already serious discussion about the potential for use of Lithium-6 in the nuclear weapons program. This discussion was taking place at the Oak Ridge National Laboratory. On August 31, 1950, ORNL successfully enriched Lithium-6 on a laboratory scale. By March 1951 the pre-pilot plant studies on a bench scale model of the ELEX (electrical exchange) troughs was completed.

On April 4, 1951, Dr. Nordhaim of Los Alamos met with Oak Ridge Operations personnel and indicated that the nuclear weapons program would require kilogram quantities of lithium-6 within a year. By April 19, 1951, that request was official coming from the military to the Atomic Energy Commission. Y-12 was then engaged in the experimental laboratory work to separate lithium-6.

In June of 1951, Y-12 separated one gram of lithium-6 and one gram of lithium-7 using calutrons and shipped the two isotopes to Los Alamos. In Princeton at a conference on thermonuclear weapons held June 16 and 17, 1951, it was determined that very large quantities of lithium-6 was desirable for the nuclear weapons program.

The ELEX process was started in building 9201-2 in 1952. This was the direct result of the tremendous pressure being placed on Oak Ridge Operations to quickly produce large quantities of lithium-6.

In a July 11, 1951 meeting of the Isotope Separations Committee, the following recommendation was made, "In view of required need for  $\text{Li}^6$  and short time available, a competent design, construction and engineering group should evaluate the ELEX process and plans should be made for construction of a full scale plant."

A small pilot ELEX plant was in operation by September 1951. In this same month, work began to design a small-scale pilot plant using the OREX (organic exchange) columns. The OREX design was completed and a pilot plant started on November 15, 1951. While proceeding with the implementation of the ELEX process, other designs were considered in parallel. Again, this was done because of the intense pressure to create quickly large quantities of lithium-6.

The first estimate for a full-scale ELEX plant was \$4 million on August 1, 1951. By October 5, 1951 the estimate was revised upward to \$9 million because of the increased requirements for more lithium-6 produced sooner than earlier demanded.

Soon, the estimate increased again to \$35 million and then in March 3, 1952 to \$44 million. Meanwhile the research into the OREX process was showing only limited potential for success and the process was beginning to be questioned. Funding for research continued, however, and the construction of a full-scale plant was being considered.

Nevertheless, ELEX continued to be the primary method planned for implementation, and by June 1952 construction of the ELEX plant inside Building 9204-4 was beginning to take shape. A component test facility was started up in January 1953.

It was also in January 1953 that the COLEX or column exchange process was first described to Oak Ridge Operations by Y-12 as thought to be economically feasible for a large-scale lithium-6 production plant. Ultimately the COLEX process turned out to be the one that did the job!