Y-12 moves toward the COLEX process

In the chronology *An Overview of the History of Y-12, 1942–1992* by Bill Wilcox, Forrest Waldrop is credited with the original idea that ultimately resulted in the successful column-exchange process known as COLEX. However, the person credited with taking the pilot laboratory process to fullscale production is John Googin, Y-12's renowned scientist.

Interestingly, the percentage of lithium-6 compared to lithium-7 in its naturally occurring state is 7.4 %, roughly equivalent to the same percentage of uranium-235 in natural uranium ore. The separation of that scarce lithium-6 posed a challenge not unlike that Y-12 had faced separating uranium-235.

The new separation challenge was given to Oak Ridge by the Atomic Energy Commission, who were getting pressure to catch up with the Soviets on thermonuclear weapons. Edward Teller was promoting the hydrogen bomb, and although opposed by several scientists and politicians, including Robert Oppenheimer, he succeeded on all fronts.

When stiff opposition continued to face him at Los Alamos, where he had returned immediately after the explosion of an atomic bomb by the Soviet Union to again urge the development of the hydrogen bomb, he soon was lobbying for a new weapons laboratory, independent of Los Alamos.

Teller succeeded in convincing the Atomic Energy Commission to build the Lawrence Livermore Laboratory as the second weapons design laboratory and the primary focus of this laboratory was to be the design and development of the hydrogen or thermonuclear bomb. The actual development of thermonuclear weapons there was the result of Edward Teller holding out for that designation before agreeing to work there.

As these changes were occurring nationally, Y-12 was continuing to experiment, along with the newly forming Oak Ridge National Laboratory (ORNL), methods to obtain appreciable quantities of lithium-6. The COLEX process proved to be the ultimate answer.

But the COLEX process was not the first process used to separate lithium-6, it just turned out to be the most successful in the long run. Other processes were also attempted.

The ELEX (electrical exchange) was begun in Building 9733-2 and expanded into Building 9201-2 in 1950 and 1951. This process ultimately was put in production in Building 9204-4 in August of 1953. ELEX was done under the technical oversight of ORNL and operated by Y-12 personnel.

This arrangement demonstrated the transition of technical and research activities to the laboratory allowing it to grow in stature and the manufacturing role of Y-12 to become firmly established. The strength of this arrangement has continued to serve Oak Ridge well over the years and has brought a substantial amount of new work to both the laboratory and Y-12.

Regarding the ELEX process, Bill Wilcox states in his Y-12 chronology that the ELEX plant was a "real spectacle." He describes the entire cascade of cells as being installed in one huge open area. This would have been the high bay area where the Beta calutrons had originally been placed in 1945, since having been totally removed from the building.

Bill goes on to describe long metal trays filled a few inches deep with lithium process solutions. The trays were equipped with 50,000 agitators placed about four inches apart to keep the solution in constant motion. Can you imagine the sound of 50,000 motors running, no matter how small, Bill states the sound was described by witnesses of the process as "most impressive."

A most unusual pressing capability was added to Y-12 in October of 1953 when the breech of a 16-inch naval gun capable of pressures up to 40,000 pounds per square inch was placed in operation. This is an example of the unique manufacturing tools that were already being added to Y-12's capabilities. The push for the thermonuclear weapon resulted in tremendous upgrades in machine tools and new equipment with ever increasing accuracies.

In October 1953, lithium parts were first machined at Y-12. The capability to create specific sizes and shapes of material to meet demanding specifications enabled Y-12 to manufacture and assemble the first thermonuclear device test parts by November of 1953. This allowed the design laboratory to run tests on actual parts made from lithium.

By October 1954, the first thermonuclear weapons components were created, machined, assembled and shipped from Y-12. This was done amid the continuing experimentation of the OREX (organic exchange), ELEX (electrical exchange), and the emergence of the COLEX (column exchange) processes for separating lithium-6.