

Y-12 lithium-6 production

The United States was not expecting the Soviet Union's explosion of their first nuclear device using hydrogen and other fusion materials on August 12, 1953. The explosion was quickly determined to be a thermonuclear-like test and was also believed to contain lithium. Y-12 chemists and engineers were already attempting to find ways to separate lithium-6 in the laboratory and using pilot processes.

Three potential types of chemical separation processes were being tested. This unexpected explosion of a fusion device caused a major increase in emphasis on that project as the United States progress toward building its first thermonuclear weapon depended on lithium-6 as a key part of the design.

The Oak Ridge National Laboratory chemists were working on the OREX (organic exchange) process at Y-12 and were struggling to overcome significant technical hurdles. The ELEX (electrical exchange) process had just been placed into production in Building 9204-4 in that same month. A third possible process, the COLEX (column exchange) was undergoing laboratory testing. While there was already a sense of urgency, the coming months would see a huge increase in demand for lithium-6 and even more urgency.

As a result of questions and some confusion regarding the location of these lithium laboratory and pilot processes, I have completed additional research to try and pin down the details. The locations of laboratory operations and pilot facilities listed below are taken from the report, *Mercury at Y-12*, originally published on August 18, 1983, and released in an unclassified version on April 3, 1995. Such details are important for historical accuracy and can often be overlooked. I certainly do appreciate those who call such potential inaccuracies to my attention.

The OREX laboratory work was done in Building 9733-1 in 1951 and 1952. A pilot OREX process was installed in Building 9202 in April 1953 and operated until May 1954.

The ELEX process had been developed earlier in 1950 and 1951 in Building 9733-2 and in Building 9201-2. The ELEX process was piloted in Building 9201-2 during 1950–1952.

In August 1953, an ELEX production plant was operational in Building 9204-4. However, its output was a far cry from what would soon be demanded as a result of the Soviet's thermonuclear-like test. The ELEX process filled one floor of the large Beta 4 facility. It was a horizontal arrangement and required constant agitation.

The 50,000 small motors running the stirrers needed to keep the process working made a lot of noise and the production rate was way too small to provide the quantities soon to be requested. However, the ELEX process operated until March 16, 1956 when it became obvious that the COLEX process would be able to meet the demand.

In September 1952, the laboratory work on the COLEX process was begun and a pilot operation for COLEX was conducted in Building 9201-2 until January 1, 1955. While the ELEX process was the one being placed into production in August 1953, the COLEX process was beginning to demonstrate laboratory results far more favorable than the ELEX. The news of the Soviet's test caused the Y-12 team to hurriedly perform calculations to show the full potential of the emerging COLEX process.

Immediately after the Soviet's thermonuclear-type test, representatives from the Washington, D.C. office of the Atomic Energy Commission came to Y-12 asking what could be done to speed up the process of separating lithium 6. This produced a virtual hotbed of urgent discussion and debate about the best way to improve the production of lithium-6.

During the discussions, the COLEX process was explained to the AEC showing the potential for significant improvement over both the OREX and ELEX processes. A decision was made almost immediately to proceed with the installation of the COLEX production process in two large buildings that had housed the Alpha II calutrons during the Manhattan Project.

Beginning in September 1953, a 15-month rush construction effort took place in Y-12 to ready the two buildings and to install the COLEX process. In January 1955 the COLEX process was operational in Building 9201-5 and then in June 1955 a second COLEX process was operational in Building 9201-4. These processes continued to function until 1963 when both buildings were shut down as sufficient lithium 6 had been processed for the foreseeable future needs.

The COLEX process implementation at Y-12 is where John Googin first demonstrated what would come to be routinely expected of him. He had the uncanny ability to take a large and complicated chemical process and visualize the method to implement a full scale production system that worked as well or better than the laboratory test process.

He worked closely with the design and construction efforts and was constantly aware of the progress of the installation. He would repeat this feat numerous times during his long and distinguished career as the "Scientist of Y-12."

John called himself a "junior chemist" when speaking about the early part of his career at Y-12. Next week we will look at this "Scientist of Y-12" with more scrutiny.