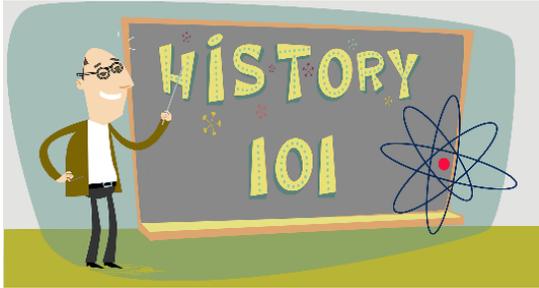


## Penn State University's Breazeale Reactor Celebrates 65+ Years



Pennsylvania State University's Breazeale Research Reactor is the nation's oldest licensed reactor. The reactor has been invaluable in research, training, and in establishing Penn State's well-regarded nuclear engineering program. As part of the Atoms for Peace program, it trained foreign engineers as reactor operators and tested fuel integrity for reactors exported to other nations. It is a historic marker of early reactor development.

In the early 1950s, universities raced to build research reactors. North Carolina State College jumped ahead when it contracted with the Atomic Energy Commission to build a reactor that started up in 1953. By 1955, 14 schools had applied to the AEC for the license required of new reactors under the Atomic Energy Act of 1954.

Penn State had two important assets in this race: money and William Breazeale. Penn State's board of trustees committed ample funds for construction and operation. To win AEC approval, Penn State followed NC State's successful strategy of raiding the AEC for faculty talent and a reactor design.

An electrical engineer by training, Breazeale had worked for several years at Oak Ridge National Laboratory supporting the design of thorium and uranium-fueled reactors. His signal accomplishment was in leading the design team for the Bulk Shielding Reactor, the prototype of the "swimming pool" research reactors built at Penn State and facilities around the world. Penn State hired Breazeale to serve as its first-ever professor of nuclear engineering.

The swimming pool reactor was safe, inexpensive, and startlingly simple. Engineers just placed the reactor fuel at the bottom of a tank 30 feet deep so that the water served as a source of cooling and radiation shielding. Faculty and students could stand on a platform directly over the reactor to operate and view it.

Nevertheless, the AEC's Advisory Committee for Reactor Safeguards (ACRS) made the path to licensing approval so challenging that a frustrated Breazeale once suggested the Committee did not "view the [reactor] hazard problem in its proper perspective." It wasn't the last time that ACRS safety concerns were challenged by applicants and vendors.

The ACRS fretted over the potential for theft of the fuel, power excursions, and the proximity of the reactor to college housing. The reactor's 3.6 kilograms of highly enriched fuel posed a safeguards risk, and the Committee demanded a combination of security guards and radiation monitors to protect it. Penn State had to carry out fuel test program and moved the reactor further away than planned from faculty housing. The ACRS also required an emergency plan for notifying local authorities, public evacuation, and cleanup. Ironing out these issues delayed licensing. When President Dwight Eisenhower gave the college's commencement address in June 1955, he could only look down into an empty tank with no fuel.

But persistence led to success. On the morning of August 15, Breazeale and doctoral student Robert Cochran started the reactor for the first time. Both veteran Oak-Ridge operators, their approach to criticality was careful but confident enough that they paused so that Cochran could run to the registrar's office. At 11:30 a.m., the reactor went critical. Then Breazeale and Cochran shut down the reactor and stored the fuel in a vault for two weeks. It was, after all, summer vacation.

The Breazeale reactor reminds us how much reactor safety has changed while staying the same. Its 1955 license was just two pages of conditions. When Penn State renewed it in 2009, the license had grown to 60 pages. Safety regulation is more complex today, but the inherent safety of Breazeale's reactor remains as important today as it was in 1955.

By Thomas Wellock, NRC Historian