



“My curiosity is the greatest inspiration. Could a new idea make the process better?”

Susan Hogle,
Nuclear Engineer



A World Leader in Isotope Production

Since building the first continuously operating nuclear reactor and ushering in the nuclear age, Oak Ridge National Laboratory (ORNL) has pioneered world-changing technologies and applications enabled by harnessing the atom. Soon after the Manhattan Project, the Lab started research, development, and production of isotopes of strategic importance to the United States. That work continues 75 years later and remains an essential part of various industries, national security, and basic science research.

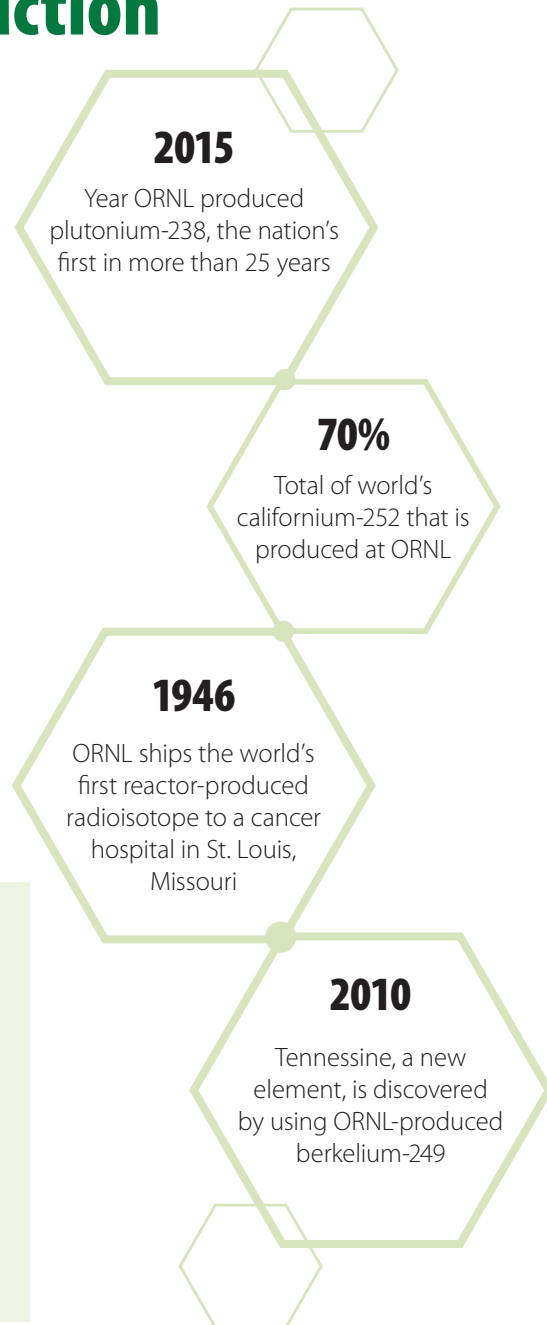
Real-World Impacts

Researchers use ORNL's High Flux Isotope Reactor (HFIR) to irradiate targets with a steady stream of neutrons. They can then perform a process to extract and purify isotopes in ORNL's shielded hot cells. This unique research and development environment supports a range of science and technology activities, including a focus on producing isotopes not capable of being produced anywhere else in the world. ORNL's isotopes enable the following:

- Cutting-edge cancer treatments
- Deep space missions
- Security at our airports and other points of entry across the country
- Discovery of new elements



In 2018, it was announced that ORNL will produce actinium-227 to meet the demand for Xofigo, a highly effective prostate cancer drug, as part of a 10-year agreement between the DOE Isotope Program and Bayer.



Current Isotope Production

Californium-252	Detects impurities in coal and cement, determines potential productivity of oil wells, calibrates radiation detection instruments in port security operations. ORNL is the only US producer of the intense neutron source.
Plutonium-238	Full-scale production—expected by 2025—will provide electrical and thermal energy for NASA's deep space missions such as the New Horizons Pluto probe.
Actinium-225	Promising clinical trials show actinium-225 as a possible treatment for leukemia and glioblastoma.
Actinium-227	Actinium-227 is the source for Bayer's FDA-approved treatment for metastasized prostate cancer, Xofigo . ORNL is the only near-term production site for actinium-227.
Berkelium-249	A by-product of californium-252 production, berkelium-249 was essential in the discovery of tennessine, one of four new elements on the periodic table.
Selenium-75	Selenium-75 is a gamma emitter used by industry for weld inspections and other nondestructive tests.
Nickel-63	Explosives detectors at airports and narcotics detectors use nickel-63.
Tungsten-188	Researchers continue to use tungsten-188 in numerous clinical trials, with promising treatments for bone pain and lung and liver cancers.



Researchers pictured at left work with medical radioisotopes produced in HFIR, which was constructed in the mid-1960s to fulfill a need for the production of transuranic isotopes (i.e., "heavy" elements such as plutonium and curium). Over the last 20 years, ORNL has worked closely with the medical community to investigate a cancer treatment known as targeted alpha therapy, where an isotope is attached to special antibodies to attack cancerous cells.



The Radiochemical Engineering Development Center is the largest hot cell facility at ORNL, with 15 hot cells for scientists to safely handle radioactive materials for processing, testing, recovery, and purification. ORNL's hot cells are constructed of high-density concrete and include specialized glass windows and various manipulators. At left, researchers work with materials inside a hot cell to develop radioisotopes.

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