

Background

The Uranium-233 Disposition Project is the Oak Ridge Office of Environmental Management's (OREM) highest priority project at the Oak Ridge National Laboratory (ORNL). Isotek Systems is OREM's contractor responsible for leading the project. Originally created in the 1950s and 1960s for potential use in reactors, uranium (U)-233 proved to be an unviable fuel source.

Eliminating the inventory of U-233 at ORNL is urgent because it is highly enriched fissile material stored in the world's oldest operating nuclear facility. This material presents risks and is costly to keep safe and secure.

A Two-Phase Approach: Direct Disposition and Processing

This project involves the disposition of nearly 1,100 canisters of fissile material. Approximately half of the inventory was in a form that could be transferred to other U.S. Department of Energy programs for reuse or immediately shipped and disposed off site, while the remainder of the inventory requires processing to convert it into a form that is safe for transportation and disposal off site.



Direct Disposition Campaign

OREM and Isotek conducted the first phase of the U-233 Disposition Project – the Direct Disposition Campaign – from 2011 until 2017. That work was completed 10 months ahead of schedule, saving approximately \$9 million.

Processing Campaign

Isotek began the Processing Campaign in 2019, and that work is expected to continue through 2028. The material addressed in this phase varies greatly. Employees began processing the lower-dose material in shielded gloveboxes in 2019 and initiated processing of the higher-dose material in hot cells in 2022. As Isotek progresses through the remaining



inventory, the contents of the canisters will present more challenges, such as a higher radiation dose or more difficulty in opening the canisters.

About the remaining inventory

The remaining canisters are very diverse in form and packaging. Together, they were packaged by 13 sites in the last 30-50 years, and they have 59 different packaging configurations.



From Cleanup to a Cure: How U-233 is Advancing Cancer Treatment Research

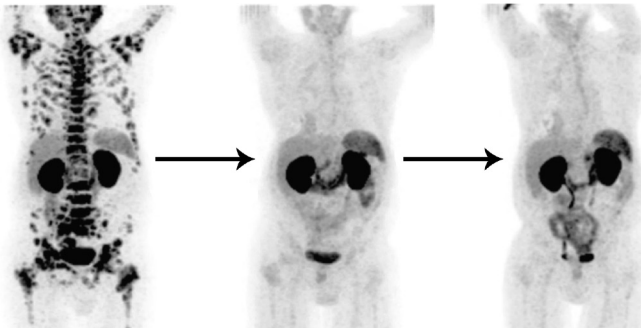
In 2018, OREM and Isotek entered an innovative public-private partnership agreement with TerraPower that is providing extremely rare isotopes to support next generation cancer treatment research. That agreement allows Isotek to extract thorium-229 from the U-233 material before it's processed and disposed of. The



thorium-229 is shipped to TerraPower where employees extract actinium-225, a medical isotope critical to a promising form of cancer treatment called targeted alpha therapy. Currently, this is the only source and means for obtaining actinium-225 in the world.

Actinium-225 is hundreds of times more potent than any other radioisotope available, giving it the power to kill cancer cells much more efficiently. In treatments, actinium-225 is attached to a molecule to selectively target and deliver the radionuclide to the cancer site, destroying the cancerous tissue with minimal damage to nearby healthy cells.

Ac-225 Treatment for Advanced Prostate Cancer



In 2024, TerraPower announced it distributed the first samples of actinium-225 to two pharmaceutical companies to support the development of the revolutionary cancer treatment and, later that year, the company announced it was producing the material at a commercial scale to support clinical trials across the globe. It will be used in drug trials for diseases such as breast, prostate, colon, and neuroendocrine cancers, melanoma, and lymphoma.

Once all thorium-229 has been extracted from the U-233 inventory over the next three years — an estimated 40 grams — 100 times more doses of this next-generation cancer treatment will be available annually than are currently available worldwide.

Global demand for actinium-225 is expected to increase as more treatments are developed, making the work performed by OREM and Isotek more vital and impactful.

U-233 Disposition Project Breakdown

Direct Disposition Campaign	
140 Containers COMPLETE	Transfer containers suitable for programmatic reuse to users
402 Canisters COMPLETE	Ship and dispose Consolidated Edison Uranium Solidification Project (CEUSP) material
Processing Campaign	
27 Canisters COMPLETE	Use gloveboxes in Building 2026 for processing
480 Canisters (2022-2028)	Use hot cells in Building 2026 for processing and downblending



Extracting thorium-229 from U-233 prior to processing and disposal