



## Orano Completes Industry-first Segmentation and Disposal of a U.S. BWR Reactor at Vermont Yankee and in Less Than Four Years on Accelerated Decommissioning Timeline

*Orano's precise engineering, skilled teams, and robust technology achieved this first segmentation and disposal of a U.S. boiling water reactor with an outstanding safety record and no regulatory issues.*

**BETHESDA, Md., December 13, 2022** – As part of the accelerated decommissioning of the Vermont Yankee nuclear energy facility, Orano successfully completed within four years the first segmentation of a U.S. boiling water reactor (BWR) and the packaging and transport for disposal of all irradiated reactor material, including the reactor pressure vessel and its internal components. The used nuclear fuel and Greater Than Class C radwaste remain onsite in secure dry storage.

Orano's expert project management achieved significant cost savings while reducing project risk – all done with an outstanding safety and compliance record. For example, the team achieved a 50 percent reduction in radwaste transports by optimizing the components' cutting, packing and transporting while coordinating the seamlessly compliant multi-jurisdictional transports.

"Completion of this complex segmentation of Vermont Yankee's reactor represents more than 280,000 hours of our Orano teams performing safely and professionally," said Amir Vexler, President and CEO of Orano USA. "For the waste transportation, our attention to detail and transparent, close coordination resulted in incident-free shipments and informed appreciation from a variety of stakeholders. The certainty that we bring to our projects is why we say that it's 'Decom done right.'"

Two of Orano's business units—Orano Decommissioning Services with the support of Orano TN Americas—were under contract with site owner NorthStar to dismantle and remove the reactor components as low-level radioactive waste items for disposal.

Since waste shipment options in the Vermont Yankee region were limited to rail and narrow, hilly roads, the Orano team determined that the optimal decommissioning strategy was a full segmentation of the reactor and its internals.

When a nuclear reactor is in operation, the nuclear reaction and steam generation occur within the reactor pressure vessel (RPV). This component is basically a very large steel cylinder with up to six-inch-thick walls and rounded lids bolted on top and welded on the bottom. The RPV is about as long as a normal semi-truck and trailer with an 18-foot diameter and total weight of about 400 tons. The reactor internals are all the components inside the reactor pressure vessel that controlled the nuclear reaction and the water/steam cycle, minus the used nuclear fuel, which was removed earlier.

Orano precisely planned and engineered every stage of the process. To access and perform the segmentation of these highly irradiated components in their complex configurations, the Orano team used a variety of robust technology oftentimes underwater with remote operators, such as large bandsaws, reciprocating saws, abrasive water jet systems, diamond wire saws, and thermal cutting. Some of the parts were first cut into large

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segments and then lifted by the reactor building's overhead crane to other work zones on the reactor refuel floor or into the water-filled but empty used fuel pool for further cutting into smaller pieces—all while fulfilling radiation protection and regulatory requirements for the safety of the workers, the public, and the environment.

“The Orano hallmarks of strong customized design, planning, and field operations derived from decades of experience delivered this complex first-of-a-kind BWR segmentation project safely and successfully for our customer NorthStar and the community,” said Geoff Wilde, President and CEO of Orano Decommissioning Services.

Once a piece was properly cut to size and shape, the segment was placed and eventually sealed inside either a custom package or a radwaste canister for transport and disposal.

Typically, a decommissioning project like this would generate about 100 radwaste shipments through the surrounding community. To reduce the regional impact, Orano minimized the number of offsite radwaste shipments by using large custom-built packaging boxes and Orano's new Type B NUHOMS® MP197HB transport cask, which is licensed for transporting radwaste and used nuclear fuel.

This first use of the MP197HB cask's 425 cubic-foot cavity volume and high-performance shielding with Orano's large radwaste disposal canisters (RWC) provided 4-times the typical disposal capacity for the most-irradiated components and helped reduce the overall number of shipments by more than 50 percent. In all, 630 metric tons of low-level radwaste were shipped from the site.

Transporting this low-level radioactive waste from the Vermont Yankee site to the disposal site in West Texas required developing and implementing a comprehensive, cooperative, and engaged process with the Nuclear Regulatory Commission, the Department of Transportation, the Federal Railroad Administration, 11 States, and a Tribal nation. Through our Movement Control Center, the radwaste shipments were tracked 24/7 with information available online in real-time to stakeholders. All seven MP197HB transports were completed safely and securely, and in compliance with all regulatory requirements for Category 1 and Category 2 Quantities of Radioactive Material.

This successful demonstration of Orano's radwaste process for loading, packaging, storing, transporting, tracking, and stakeholder coordination confirms the transportation-readiness of Orano's NUHOMS systems and equipment. This project also provided an overview of what transporting used nuclear fuel would look like through many of the same stages and processes, though other measures would also be required.

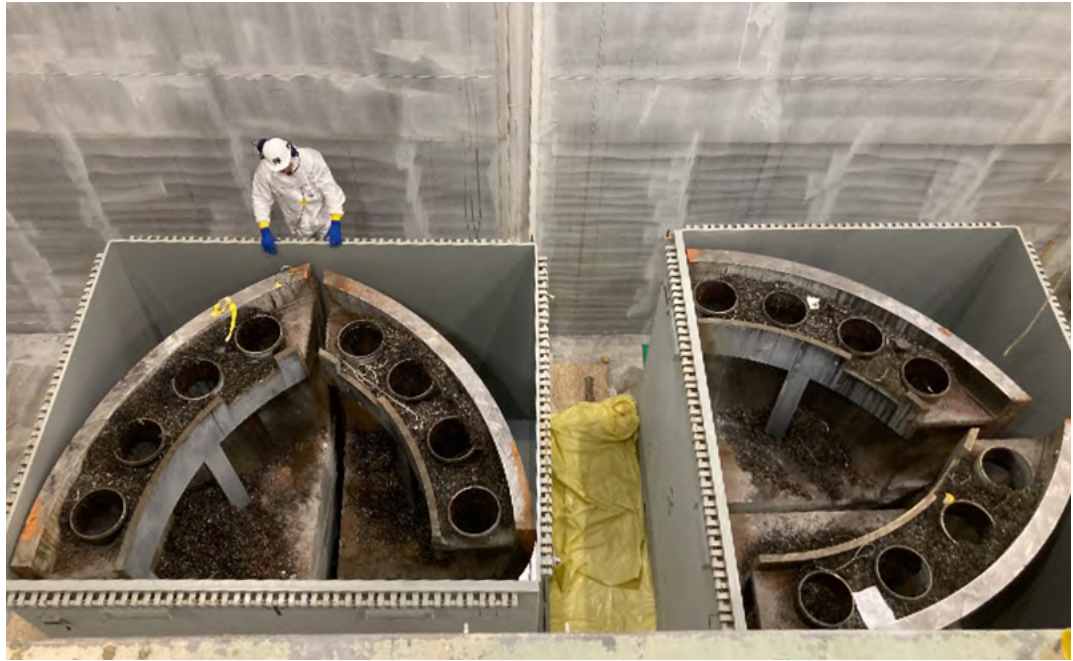
**VIDEO:** Orano segmenting, packaging, and transporting for disposal Vermont Yankee reactor components: <https://youtu.be/abgt58jUWAQ>



Looking down into the emptied Vermont Yankee reactor vessel with half of it segmented and removed.



Orano's MP197HB transport cask prepared for shipping segmented waste to disposal in West Texas.



Segmented Vermont Yankee reactor vessel pieces loaded in custom transport and disposal boxes.



Final disposal cask leaves the site with the last pieces of the segmented Vermont Yankee reactor.

**About Orano USA:** Orano USA is a key nuclear supplier of materials and services to the U.S. nuclear industry and the federal government, ranging from supplying nuclear fuel materials and in-house engineering to field service capabilities and applying decades of reactor decommissioning experience in dismantling, packaging, and transporting waste. Orano USA also provides the full suite of technologies and services for managing used



nuclear fuel. Orano USA, through its subsidiary Orano Med in Texas, is developing cancer treatments using targeted radio-immunotherapy.

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