

DOE disposing of uranium-233 waste stored at ORNL

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During training, workers removed a type of shipping cask that was expected to be used to transport 403 canisters of uranium-tainted waste from Oak Ridge National Laboratory to Nevada National Security Site northwest of Las Vegas. (File photo courtesy U.S. Department of Energy/Office of Environmental Management)

They haven't agreed on a final budget number, but the Trump administration and the U.S. House and Senate have proposed spending between about \$33 million and \$52 million in the next fiscal year to continue disposing of uranium-233 waste materials that are stored at Oak Ridge National Laboratory in a building that is the oldest continuously operating nuclear facility in the U.S. Department of Energy complex.

The uranium-233, or U-233, waste is now stored in secure vaults in Building 3019, which was built in the 1940s at ORNL. Removing the waste could allow ORNL to relax its overall security posture, which will reduce costs, eliminate nuclear safety issues, and make the campus more conducive to collaborative science, according to a U.S. Senate Appropriations Committee report published in July.

Some of the waste is from a 1960s research and development test in New York, and it is being shipped to the Nevada National Security Site, a former nuclear weapons proving ground about 65 miles northwest of Las Vegas. In interviews this summer, DOE officials in Oak Ridge declined to discuss the amount of that waste that has been shipped to Nevada or to say how long the shipments might continue. But they are making progress, said Jay Mullis, acting manager of DOE's Oak Ridge Office of Environmental Management.

Once all of those materials are shipped, the remaining U-233 at ORNL will be treated in "hot cell" facilities across the

street from Building 3019, at Building 2026. The DOE's Oak Ridge Office of Environmental Management owns both buildings.

Mullis said there is other U-233 waste stored in Building 3019, including from glovebox research at ORNL, from reactor plates, and from conglomerate materials.

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CEUSP waste

DOE started shipping the U-233 waste materials that originated in New York and are now stored in Oak Ridge to the Nevada National Security Site in May 2015 after “productive discussions” with the state of Nevada, said Ben Williams, spokesperson for DOE's Oak Ridge Office of Environmental Management.

That waste is from the Consolidated Edison Uranium Solidification Program, or CEUSP. It contains radioisotopes of uranium from a 1960s research and development test of thorium and uranium reactor fuel at the Consolidated Edison Indian Point-1 reactor in New York. The test was sponsored by the Atomic Energy Commission, a predecessor to the U.S. Department of Energy.

The research and development test was completed in late 1968, and Nuclear Fuel Services of **West Valley**, New York, recovered the uranium, which was then considered to be a reusable nuclear material. The uranium was separated from certain other isotopes, fission products, and other constituents common to reactor fuel, according to a [DOE analysis prepared in August 2014](#).

The extracted liquid uranium (8,000 liters of uranyl nitrate) was shipped to ORNL for storage and possible reuse, the DOE analysis said. The other constituents remained at **West Valley**.

Cadmium and gadolinium were added to the liquid uranium to prevent a criticality reaction because the extracted material contained several isotopes of uranium, including U-233 and U-235, which are both fissile materials that can sustain a nuclear criticality reaction, the DOE analysis said.

The material was then managed in ORNL's Building 3019 for possible reuse.

But a “near-term use” still hadn't been identified by the mid-1980s. So for safety and security reasons, DOE solidified all 8,000 liters of the liquid uranyl nitrate at high temperatures into 403 individual small, ceramic-like uranium oxide monoliths, the DOE analysis said. Each uranium oxide monolith was bonded to the inside of a steel canister measuring about 3.5 inches in diameter by about two feet long. Individual canisters contained just a few kilograms of uranium each, including some U-232.

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In its August 2014 analysis, the U.S. Department of Energy said it had not identified any need for the CEUSP materials, and Building 3019 at ORNL, where the waste has been stored, has serious challenges. It is difficult to maintain that building, which is now about seven decades old, and to ensure that its security systems are adequate, the analysis said. DOE cited the concerns of both the Defense Nuclear Facilities Safety Board and DOE's Office of Environmental Management.

In 1997, the Defense Nuclear Facilities Safety Board expressed its concern about the continued storage of the CEUSP low-level waste materials in Building 3019, and in 2010, the board reiterated that it does not consider long-term storage of this material in the “aging” building to be desirable. The Defense Nuclear Facilities Safety Board, or DNFSB, is an independent organization within the executive branch of the United States government.

Meanwhile, in 2007, DOE's Office of Environmental Management determined that the continued storage of U-233 in Building 3019 was a significant burden on safety, safeguards, security, and finances.

“Thus, DOE changed its management strategy for the CEUSP low-level waste material from one of storage for potential reuse to a search for an appropriate disposal location,” DOE said in its August 2014 analysis.

“The Department shares the concerns of the DNFSB that continued storage of this waste in Building 3019 cannot be a long-term solution for the disposition of this waste. After the CEUSP low-level waste material and other material are removed from Building 3019, the building can be decontaminated and decommissioned.”

Low-level waste typically consists of containers of debris, trash, soil, equipment, tools, and personal protective clothing. The CEUSP waste is managed as special nuclear material that requires stringent management controls and procedures for both material protection (assuring protection of the material from theft or diversions) and physical security.

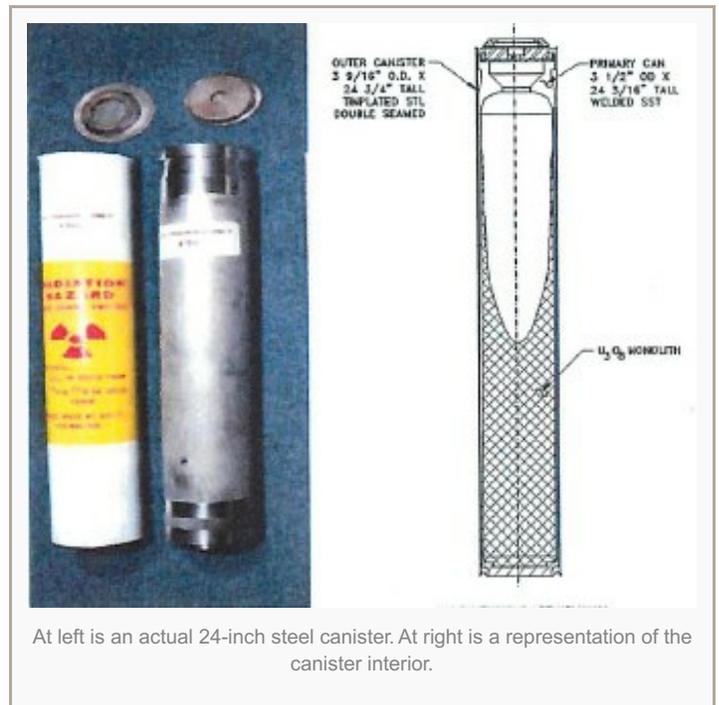
The Department of Energy has considered several locations for disposing of the waste, including at the Environmental Management Waste Management Facility, or EMWMF, on Bear Creek Road near the Y-12 National Security Complex. DOE also evaluated two commercial facilities that are licensed to dispose of low-level radioactive waste: Energy Solutions near Clive, Utah, and Waste Control Specialists in Andrews, Texas.

But other disposal locations were ruled out because of material protection and security requirements, the DOE analysis said. For example, the EMWMF in Oak Ridge does not have the right security to receive, unload, perform burial operations, or provide long-term surveillance of the CEUSP low-level waste, the analysis said. Also, among other negating factors, the EMWMF is categorized as a radiological facility and not as a certain category of nuclear facility, and disposing of the CEUSP low-level waste in Oak Ridge would “significantly exceed” the uranium isotope concentration limits for the Environmental Management Waste Management Facility.

The Nevada National Security Site is the only DOE or commercial site currently authorized to accept the CEUSP waste for disposal, the analysis said.

DOE considered downblending the CEUSP low-level waste materials before disposing of them. Downblending would have involved dissolving the low-level waste and mixing it with another waste or depleted uranium. That would lower the U-233 and U-235 concentrations, but it would increase the volume of the waste to be disposed from about 100 cubic feet to almost 30,000 cubic feet, the DOE analysis said.

“Downblending would require construction and operation of a new, heavily shielded processing facility,” the analysis said. “The downblending process would also increase worker exposure to radiological doses and require the expenditure of additional funds for structures and processes to minimize the health risks to workers associated with the increased exposures.”





Cargo container on a typical transport vehicle.

DOE had proposed shipping the waste from Oak Ridge in its existing ceramic-like form, encased in the stainless steel canisters and placed into rugged shipping casks designed to protect workers and the public from radioactivity. The casks would be loaded into steel cargo containers and secretly shipped 2,000 miles on flatbed trucks from ORNL to a 740-acre section of the Nevada National Security Site known as Area 5, where low-level radioactive waste has been disposed of since 1961. The waste would be buried 40 feet below the ground and covered with soil, other low-level waste, and capped by eight feet of soil.

“With the soil covering the disposal trench, the dose rate would be indistinguishable from background radiation,” DOE said in its analysis, which was approved August 7, 2014, by Mark Whitney, who was then the department’s acting assistant secretary for environmental management.

“Collectively, the approach of time, distance, and shielding would ensure that members of the public as well as DOE site and transportation workers would be protected during all phases of CEUSP low-level waste material loading, transportation, and emplacement in the disposal facility,” the analysis said. DOE would keep the waste shielded, maintain distance restrictions around the low-level waste, and limit the amount of time people are near the containers.

DOE agreed to have armed security personnel from its Office of Secure Transportation accompany the CEUSP low-level waste from Oak Ridge to Nevada. The Department of Energy said it had conducted extensive safety analyses to ensure the waste could be transported safely. The timing and routes of the shipments would not be disclosed.

With progress reported on the shipments, it’s not clear how many of the ceramic-like uranium oxide monoliths have been shipped from ORNL to Nevada.

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In 2010, the [DNFSB reported](#) that the CEUSP materials made up almost three-quarters of the U-233 inventory in Oak Ridge. That same year, the [safety board reported](#) that there were more than 1,000 containers “in the scope of the Uranium-233 Disposition Project” that stored several chemical forms of materials.

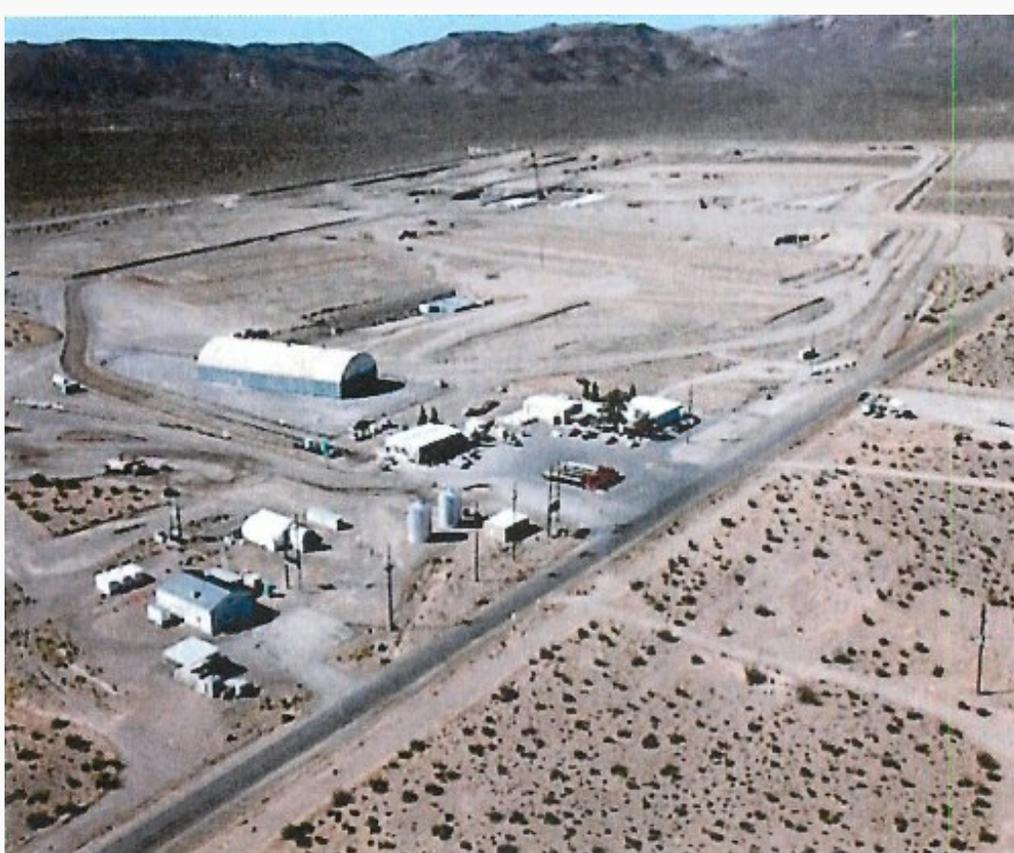
It’s not clear how those amounts and percentages have changed in the roughly seven years since.

Mullis said he can’t discuss amounts or how long it will take to treat and dispose of the U-233 waste at ORNL, but progress is being made.

It's not clear if the non-CEUSP waste will, like the CEUSP waste, also be shipped to Nevada.

Oak Ridge Today last [reported on the CEUSP waste in December 2014](#), when former Energy Secretary Ernest Moniz and Nevada Governor Brian Sandoval [announced a working group](#) to “advance shared interests” at the Nevada National Security Site. Among other topics, that group of state and federal workers was expected to discuss contentious waste-related issues that included concerns over shipping the low-level radioactive CEUSP waste from Oak Ridge to the federal landfill in Nevada. The working group was announced in a six-page agreement, a [memorandum of understanding](#) signed by Moniz and Sandoval.

Nevada had reportedly balked at the shipment plan in mid-2013, and Sandoval had expressed concerns about shipping the CEUSP waste to the 1,360-square-mile Nevada National Security Site in a June 2013 letter to Moniz. Among the concerns was categorizing the low-level waste by exception—essentially defining it by what it is not (high-level radioactive waste, transuranic waste, spent nuclear fuel, or by-product material). Nevada officials had reportedly grown concerned that the proposed uranium waste shipments might open the door for other exotic forms of nuclear waste. Nevada also reportedly had concerns with proposed transportation routes and methods, engagement with affected local governments and Native American tribes, worker health and safety, and environmental protection.



The Area 5 Radioactive Waste Management Site at the Nevada National Security Site northwest of Las Vegas is pictured above.

U-233 budget proposals

The budget submitted to Congress by the Trump administration in May requested roughly \$33.8 million for the U-233 disposition program in Oak Ridge in fiscal year 2018, which starts October 1 (see pages 13 and 167 [here](#)). That funding request, a decrease from fiscal years 2016 and 2017, was in part to continue the required surveillance and maintenance and other activities at Building 3019 to “maintain a safe and secure condition.” It was also to finish

disposing of the waste materials from New York and continue the planning and implementation of U-233 processing.

The president's budget request supports preparing Building 2026 at ORNL for the processing of U-233 materials from Building 3019, according to DOE's fiscal year 2018 congressional budget request for its Environmental Management program (see pages 11 and 17 [here](#)).

A few months after the president's budget request was released, a Senate energy and water appropriations bill recommended \$50.3 million for the cleanup of Building 3019 (see page 102 [here](#)).

"Removal of legacy material from this building, an aging facility in the heart of the Oak Ridge National Laboratory central campus, must remain a high priority for the Department (of Energy)," according to a report on the Senate appropriations bill. "Removal of the Uranium 233 will enable the overall security posture at the laboratory to be relaxed, which will reduce costs and eliminate nuclear safety issues, and make the campus more conducive to collaborative science. The (Senate Appropriations) Committee encourages the Department to seek opportunities to expedite cleanup of Building 3019, including public private partnerships that may reduce the overall cost of cleanup."

At about the same time, the House energy and water appropriations bill recommended \$52.3 million to "expedite plans to dispose of U233 at the Oak Ridge Reservation."

There was \$35.9 million for the U233 disposition program in Oak Ridge in fiscal year 2016 and \$43.3 million in fiscal year 2017, according to the DOE budget request for fiscal year 2018 and the U.S. House appropriations report (see page 167 [here](#) and page 140 [here](#)).

U.S. Senator Lamar Alexander, a Tennessee Republican, is chair of the Senate Energy and Water Development Subcommittee, and Representative Chuck Fleischmann, a Tennessee Republican whose district includes Oak Ridge, is vice chair of the House Energy and Water Subcommittee.

Pavement collapse near Building 3019B

In June, the DNFSB [reported a pavement collapse](#) near Building 3019. DOE said the pavement collapse was a significant distance from the area where the uranium-233 is stored.

The collapse of about 36 square feet of pavement was near Building 3019B, which is an inactive facility, according to the DOE Oak Ridge Office of Environmental Management.

The DNFSB said the area of the building that was affected is near a deactivated hot cell, but it is structurally separate from the part of the building where the legacy U-233 materials are stored. DOE said the hot cells in the facility were not affected, and they do not contain radioactive material.

"There were no immediate safety hazards to personnel, but as a precaution, the area was barricaded until crews made repairs," DOE said.

While the affected area was much smaller, a larger area, measuring approximately 50 feet by 25 feet, was excavated to provide a safe working area for repairs.

The DNFSB said the excavation work was done by workers from UT-Battelle, which manages ORNL for DOE's Office of Science.

UT-Battelle and Isotek Systems LLC, a contractor to DOE's Oak Ridge Office of Environmental Management, determined that the pavement collapse was caused by leaking sections of underground storm water and sewer lines that caused soil in the area to wash away.

"They also noted, via video taken by a subcontractor, that the impacted area extended some distance below the foundation of the facility," the DNFSB said.

DOE said the extent of erosion under the facility was approximately five feet by seven feet, and it did not extend under the hot cells in Building 3019B.

“The area was also a significant distance from the U-233 storage area,” DOE said.

Isotek management declared a potential inadequacy in a safety analysis due to the possible impact to the safety-significant hot cell structure and restricted access to the affected area of the facility, the DNFSB said.

In mid-June, Isotek workers filled the excavated space, including the areas under the Building 3019 facility, with grout.

“Isotek is also planning work to further stabilize the ground in the immediate vicinity of the facility,” the DNFSB said. “Isotek safety basis staff are developing the unreviewed safety question determination and the evaluation of safety of the situation.”

DOE said a safety evaluation is conducted as a normal procedure when a potential changed condition occurs at a nuclear facility.

“The evaluation determined no additional controls are required to maintain nuclear safety in the Building 3019 Complex,” DOE said in its response, which was provided by Williams, the spokesperson for DOE’s Oak Ridge Office of Environmental Management.

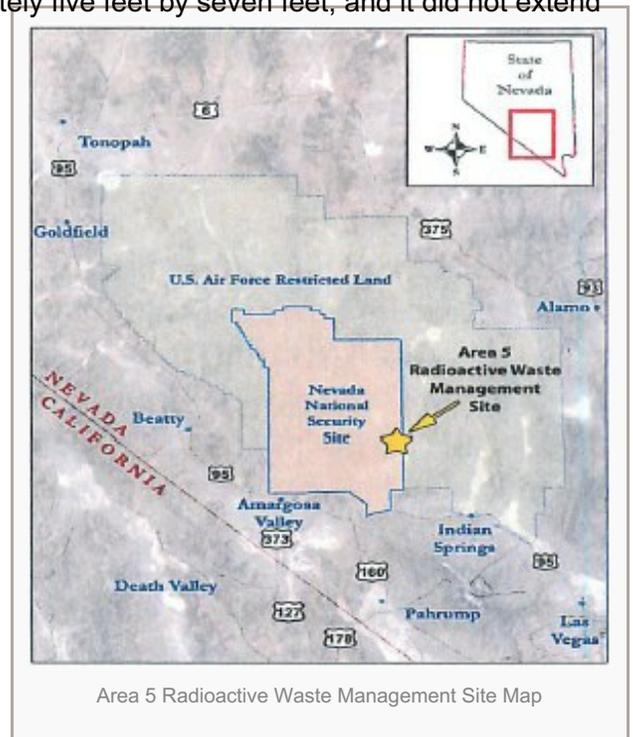
UT-Battelle replaced the storm water and sanitary sewer lines that collapsed, DOE said.

“The grout is the first step in the final repair, and follow-on restoration activities are being planned,” DOE said.

Uranium-233 is a radioactive isotope of uranium that does not exist in nature [but can be produced](#) by bombarding thorium-232 with neutrons.

You can see the August 2014 analysis [here](#). It is a supplement analysis related to a National Environmental Policy Act review and an environmental impact statement.

More information will be added as it becomes available.



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