U.S. Department of Energy
Office of Inspector General
Office of Audits and Inspections

Audit Report

Long-Term Storage of Cesium and Strontium at the Hanford Site

OAS-L-14-04

March 2014

Department of Energy
Washington, DC 20585

March 26, 2014

MEMORANDUM FOR THE MANAGER, RICHLAND OPERATIONS OFFICE

FROM: David Sedillo, Director
Western Audits Division
Office of Inspector General

SUBJECT: INFORMATION: Audit Report on "Long-Term Storage of Cesium and Strontium at the Hanford Site"

BACKGROUND

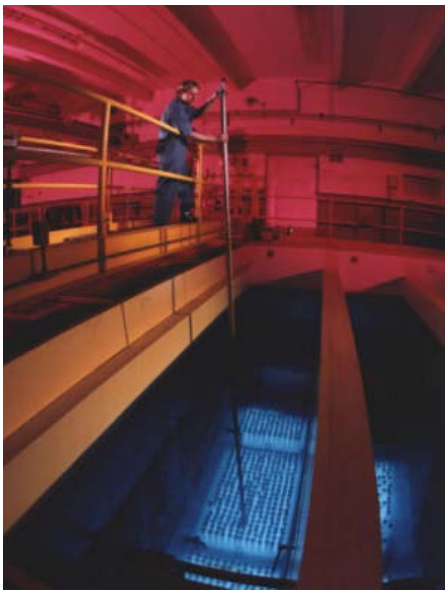
One of the many significant cleanup challenges faced by the Department of Energy (Department) is the ongoing management of stored cesium and strontium capsules at the Hanford Site's Waste Encapsulation and Storage Facility (WESF). From 1974 to 1985, cesium and strontium were recovered from high-level waste storage tanks at the Hanford Site, packed in corrosion-resistant capsules, and placed in underwater storage at WESF. Currently 1,936 capsules of radioactive cesium and strontium containing 53 million curies are stored at WESF. The Richland Operations Office's (Richland) baseline plan for disposing of the capsules, completed in 2007, calls for "direct disposal" of the capsules at Yucca Mountain. However, in Fiscal Year 2010, the Department withdrew its intent to develop a geological repository at Yucca Mountain. The Department's new goal, as of January 2013, is to have a repository sited by 2026 and to begin operations by 2048. Therefore, long-term stewardship of the capsules will require interim storage until final disposal can be achieved, no earlier than 35 years from now.

The March 2011 tsunami and subsequent events at the Fukushima Dai-Ichi Nuclear Power Plant in Okuma and Futaba, Japan highlighted the vulnerabilities to nuclear facilities from possible seismic and natural disasters that are more severe than the facilities' original design, or "beyond design threats." One possible threat is a severe earthquake that may result in loss of power and/or loss of water in the WESF pool. The Department's Office of Environmental Management considers WESF its largest "beyond design threat" facility, and has identified movement of the capsules to dry storage as a potential interim measure to mitigate the risk posed by these threats. Given these risks, we initiated this audit to determine whether the Department is effectively managing the long-term storage of cesium and strontium capsules.

RESULTS OF AUDIT

Richland has initiated action to begin to address some of the challenges posed by continued storage of cesium and strontium capsules in the WESF. Such action appears prudent in that

continued storage of the capsules in WESF is not cost effective and may pose additional risks to the environment associated with beyond design threats at the Hanford Site. While Richland is considering options for dry storage, there are no definitive plans to move the capsules to a safer and more cost effective storage system.



Capsules in WESF pool cells

Costly Wet Storage

We found that the continued storage of the capsules in "wet-storage" at WESF resulted in a higher operating cost than the "dry storage" alternative under consideration. According to information prepared by the Richland contractor, CH2M HILL Plateau Remediation Company (CHPRC), it would cost approximately $83 million to $136 million to move the capsules from WESF into a dry storage facility. Once in dry storage, operating costs would be about $1 million annually. Currently, Richland spends approximately $7.2 million per year for operations at WESF. Therefore, each year Richland delays moving the capsules into dry storage it misses an opportunity to realize cost savings of about $6.2 million, the difference between the costs to operate "wet" and "dry" storage. It is important to note that the cost to construct an interim dry storage facility must be incurred at some point, so the earlier this occurs, the more operating costs can be saved.

Degrading Facility

We noted that WESF is more than 9 years past its design life, and has experienced degradation of key structures and systems relied on for safety. Specifically, the facility began operations in 1974 with a design life of 30 years, but has now been in service for more than 39 years. Also, the concrete in the WESF pool cells has begun to deteriorate due to years of radiation exposure, according to a recent Safety Evaluation Report conducted by Richland. Weakened concrete in the walls of the pool increases the risk that a beyond design earthquake would breach the walls, resulting in loss of fluid, and thus, loss of shielding for the capsules. Richland officials informed us that the pools walls were still safe despite the damage, citing various design elements in the facility.

Richland has taken some actions to mitigate the beyond design threats at WESF. Richland required CHPRC to annually update its nuclear safety basis documents which include the Documented Safety Analysis and Hazards Analysis. Also, Richland officials approved a WESF Unresolved Safety Question regarding radiation degradation of pool cell concrete. This led to CHPRC adjusting the placement of the capsules within each pool cell in a configuration to reduce radiation exposure to the pool cell concrete, reducing heat, and increasing the amount of time it would take for capsules to fail in a beyond design event where pool cell water is lost and the capsules are uncovered. Richland officials also responded to the Assistant Secretary for Environmental Management regarding the Secretary's March 23, 2011 Safety Bulletin No. 2011-

01, *Events Beyond Design Safety Basis Analysis.* In that response, CHPRC indicated that it would add water to the storage facility pools from tanker trucks if a loss of pool cell water occurs. Finally, we found that CHPRC had conducted emergency preparedness drills for Beyond Design Seismic events. It is important to reiterate that beyond design scenarios are, by nature, extremely improbable.

Dry Storage Strategy

In addition to savings opportunities, movement of the capsules to a dry storage facility would allow the capsules to be more safely stored for a longer period of time, action that is crucial given that a permanent repository will not be available until the year 2048. Mindful of this, management has initiated a number of preliminary actions to define its approach to dry storage. One of the actions begun by Richland includes requesting that the contractor, CHPRC, to develop a *Mission Needs Statement* to fully document the need for long-term interim dry storage. However we noted that this process was not yet complete. The second major action taken by management occurred in August 2013 when, at the direction of Richland, CHPRC issued a request for information to prospective engineering firms to better estimate the cost and feasibility of a dry storage option.

Richland management expressed support for constructing a dry storage facility; however, management stated that it does not currently have the funding to do so due to other pressing funding priorities at Hanford. Further, management stated that the existing structure is safe, can withstand design basis threats, and there are contingency plans in place for events beyond design basis. Accordingly, management stated that its present priority is to meet "minimum safety" requirements for the existing facility, while driving to meet regulatory milestones. Given funding constraints, we did not find this perspective to be unreasonable.

As noted in our *Special Report: Management Challenges at the Department of Energy* (DOE/IG-0858, November 2011), the Department's current strategy of meeting facility agreement such as the Tri-Party Agreement with states and regulators may not be sustainable if the Department's remediation budget suffers major reductions. Accordingly, we suggested that the Department consider revising its current remediation strategy and instead address environmental concerns on a national, complex-wide risk basis. This would result in a form of environmental remediation triage. Looking at the program holistically, funds would be provided to high risk activities that threaten health and safety or further environmental degradation. As previously discussed, WESF is beyond its design life and the Office of Environmental Management considers it to be the largest "beyond design threat" facility, that is WESF is at the greatest risk of any facility to the threat of a natural event occurring that is beyond its design capacity to sustain.

PATH FORWARD

The Department is aware of the current safety conditions associated with the storage of cesium and strontium capsules at WESF and has taken actions to mitigate any risks associated with WESF. Furthermore, we acknowledge the budgetary challenges facing the Department, and its impact on moving the capsules into dry storage. Therefore, we are not making any formal

recommendations. However, we suggest that the Manager, Richland Operations Office, expeditiously proceed with its plans to pursue a dry storage alternative to support transfer of the capsules out of WESF at the earliest possible timeframe.

Attachment

cc: Deputy Secretary
Senior Advisor for Environmental Management
Chief of Staff

OBJECTIVE, SCOPE AND METHODOLOGY

OBJECTIVE

The objective of this audit was to determine whether the Department of Energy (Department) is effectively managing the long-term storage of cesium and strontium capsules at the Hanford site.

SCOPE

The audit was performed from April 2013 to March 2014, at the Richland Operations Office, the Waste Encapsulation Storage Facility (WESF), and the CH2M HILL Plateau Remediation Company (CHPRC) in Richland, Washington. The audit was conducted under Office of Inspector General Project Number A13RL028.

METHODOLOGY

To accomplish the audit objective, we:

- Researched and reviewed Federal regulations and Department guidance related to long-term storage of cesium and strontium capsules;
- Toured WESF to gain an understanding of how the cesium and strontium capsules are currently stored;
- Analyzed CHPRC cost and budgeting reports for WESF;
- Reviewed studies and reports related to Beyond Design Basis Events, concrete degradation, and exhaust ventilation system issues at WESF;
- Analyzed the *Hanford Federal Facility Agreement and Consent Order* milestones related to WESF;
- Reviewed the Draft *Mission Needs Statement* for the Management of Cesium and Strontium Capsules;
- Analyzed the Documented Safety Analysis and Hazard Analysis for WESF;
- Reviewed documents and reports related to the Departments long-term storage strategy of cesium and strontium capsules at WESF; and
- Held discussions with Department officials from the Office of Environmental Management, the Richland Operations Office, and CHPRC.

We conducted this performance audit in accordance with generally accepted Government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions

based on our audit objective. We believe that the evidence obtained provides a reasonable basis for our conclusions based on our audit objective. Accordingly, we assessed significant internal controls and compliance with laws and regulations necessary to satisfy the audit objective. In particular, we assessed the Department's implementation of the *GPRA Modernization Act of 2010* as it relates to our audit objective and found that the Department had established performance measures applicable to relocating cesium and strontium capsules from WESF into dry storage.

Because our review was limited, it would not necessarily have disclosed all internal control deficiencies that may have existed at the time of our audit. We did not rely on computer-processed data to achieve the objective of our audit.

Management waived an exit conference.

PRIOR REPORTS

- Audit Report on *Management Controls over Cesium and Strontium Capsule Disposition at the Hanford Site*, (OAS-M-06-06, August 2006). The audit found Richland Operations Office's preferred approach of direct disposal of the capsules in the Yucca Mountain Repository may not be the most viable or cost-effective approach to disposal. Although Richland was focusing its efforts solely on the direct disposal alternative, it had not completed studies recommended by several internal and external reviewers so that it could make an informed decision on the most appropriate path forward to disposing of the capsules; and it had not performed a formal cost analysis of the various options to disposal.

- Audit Report on *Safety Aspects Wet of Storage of Spent Nuclear Fuel*, (OAS-L-13-11, July 2013). The audit found that due to a lack of a clear disposition path, the Department of Energy (Department) had not developed definite plans to dispose of its spent nuclear fuel (SNF). In FY 2010, the Department withdrew its intent to develop a geological repository at Yucca Mountain, Nevada to dispose of SNF. In 2011, the Department deferred processing SNF, some of which is in wet storage, until recommendations of the Blue Ribbon Commission on America's Nuclear Future were issued and evaluated. As a consequence, the Department determined it must maintain interim SNF wet storage facilities longer than planned and until disposition options became available.

IG Report No. OAS-L-14-04

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