



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

# Audit Report

## Safety Aspects of Wet Storage of Spent Nuclear Fuel

OAS-L-13-11

July 2013



## Department of Energy

Washington, DC 20585

July 10, 2013

### MEMORANDUM FOR THE SENIOR ADVISOR FOR ENVIRONMENTAL MANAGEMENT

FROM: *Daniel M. Weeber*  
Daniel M. Weeber  
Assistant Inspector General  
for Audits and Administration  
Office of Inspector General

SUBJECT: INFORMATION: Audit Report on "Safety Aspects of Wet Storage of  
Spent Nuclear Fuel"

#### BACKGROUND

The Department of Energy (Department) is responsible for managing and storing spent nuclear fuel (SNF) generated by weapons and research programs and recovered through nonproliferation programs. The SNF consists of irradiated reactor fuel and cut up assemblies containing uranium, thorium and/or plutonium. The Department stores 34 metric tons of heavy metal SNF primarily in two wet storage basins located at the Savannah River Site and the Idaho National Laboratory (Idaho).

Wet storage requires operational vigilance and reliance on mechanical systems to ensure the safety of workers, the public and the environment. The risk associated with long-term wet storage of SNF is well-demonstrated by the recent disaster in Japan. Specifically, in 2011 an earthquake and subsequent tsunami at Japan's Fukushima Daiichi nuclear reactor complex (Fukushima) caused extensive damage to SNF cooling basins, allowing contaminated water to leak into the environment and exposing SNF to the atmosphere. While not subject to damage from tsunamis, environmental or mechanical issues are within the realm of possible damage scenarios faced by the Department's SNF storage facilities.

Considering these concerns, we initiated this audit to determine whether the Department was effectively managing the safety of its SNF wet storage basins.

#### RESULTS OF AUDIT

Because it lacks a clear disposition path, the Department had not developed definitive plans to dispose of its SNF. In Fiscal Year (FY) 2010, the Department withdrew its intent to develop a geological repository at Yucca Mountain, Nevada to dispose of SNF and high-level waste. Then in 2011, the Department deferred processing aluminum-clad SNF, some of which is in wet storage, until recommendations of the Blue Ribbon Commission on America's Nuclear Future

(Blue Ribbon Commission) 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 become available.

Given the lack of disposition paths, the Department is taking steps to manage the safety of its SNF wet storage basins, namely L-Basin at the Savannah River Site and CPP-666 at Idaho. Our review revealed that, as required by both Federal and Department regulations, program officials had analyzed the risks related to storage, documented these analyses, and concluded that the continued use of the wet storage facilities was appropriate. Also, we noted that the Department was actively responding to concerns generated by the Fukushima natural disaster and the anticipated extended interim wet storage of SNF. However, while the Savannah River Site has initiated activities designed to support the prolonged storage of SNF in L-Basin, completion of these activities is being deferred due to funding constraints.

### Safety Analysis

The Department had implemented orders, technical standards and guides to ensure the safety of its nuclear facilities, including SNF wet storage basins. Title 10 Code of Federal Regulations Part 830, *Nuclear Safety Management*, requires that a Documented Safety Analysis (DSA) be performed and updated annually for all Department-owned nuclear facilities. The Department directives provide detailed guidance for evaluating, documenting and approving a DSA. Approval of the DSA signifies that the Department has determined that there is reasonable assurance that the facility can be operated safely consistent with the design parameters for the facility and provides the basis for authorizing continued operation of the facility. We reviewed the approved DSAs for L-Basin and CPP-666 in effect for FY 2012 and found that the DSAs followed the format and content specified in the guidance. Specifically, the DSAs generally identified design basis accident scenarios along with postulated consequences and mitigating controls.

### Additional Safety Measures

In light of the natural disaster at Fukushima, the Department had taken additional measures to ensure that potential impacts of "beyond design basis events" are adequately evaluated. Beyond design basis events are accident sequences that, while possible, are not fully addressed in the design process of a facility because they are judged to be too unlikely. After reviewing the events at Fukushima, the U.S. Nuclear Regulatory Commission reported that the factors that directly impacted safety at Fukushima were beyond design basis events. In response to the U.S. Nuclear Regulatory Commission report and believing it prudent to evaluate similar vulnerabilities at Department-owned nuclear facilities, the Department required facility managers to review their safety analysis documents and report on existing beyond design basis analyses and mitigating controls.

In June 2011, a Department-sponsored workshop evaluated the results of these reviews and determined that although existing safety analysis already addressed beyond design basis events, Department guidance did not provide sufficient detailed criteria for implementation. At the time of our review, the Department was in the process of implementing the workshop

recommendations to revise guidance documents to improve the evaluation process and determine whether additional responses are warranted in relation to severe natural phenomena events. However, we determined that beyond design basis accident scenarios, including severe natural phenomena events, were generally addressed in the safety analysis documents for the SNF wet storage basins.

### Long-Term Interim Wet Storage

The Department is taking measures to ensure the safe management of its SNF wet storage basins in anticipation of extending the timeframe for long-term interim storage. The Blue Ribbon Commission's final report, issued in January 2012, recommended the development of one or more geologic repositories for final disposal of SNF and noted the need for extended interim storage while final disposition plans are developed. In January 2013, the Department issued a strategy for implementing the Blue Ribbon Commission's recommendations that states that the Administration intends to make a geologic repository available by 2048. This strategy is unlikely to result in an extension of long-term wet storage of SNF in CPP-666 basin at Idaho because, according to Departmental officials, it is already on track to have all the SNF now stored there transferred from wet to dry storage by 2023, in accordance with the existing 1995 Settlement Agreement. However, extended long-term interim wet storage of SNF is expected and being planned at the Savannah River Site's L-Basin.

In anticipation of the need for extended interim storage, the Department initiated actions to support the safe long-term storage of SNF in L-Basin. An April 2011 feasibility study concluded that SNF could be stored in L-Basin for an additional 50 years or more, contingent on continuation of existing fuel management activities and establishing augmented monitoring and assessment activities. At the direction of the Department, the management and operating contractor developed three plans for implementing the recommended activities. These plans include monitoring and assessing the aluminum fuel in standard storage configurations, isolation cans containing degraded/damaged fuels and the basin structural integrity. The Department will use the data obtained to establish a new baseline to support management decisions and update program activities for the extended L-Basin lifecycle. A broad range of estimated costs, \$4 million to \$8 million, was projected to ensure completion of the monitoring and assessment activities. Additionally, the contractor established a preliminary schedule for conducting the monitoring and assessment activities, but noted that it could be a flexible schedule to accommodate the availability of funding.

The Department initiated some of the monitoring and assessment activities outlined in the formal plans during FY 2012. Savannah River Site officials told us that there is no urgency to complete the remaining activities and indicated that this position is supported by the positive results from activities performed to date. Specifically, water sampled from inside bundled aluminum fuel tubes and ultrasonic testing performed on isolation cans returned results that were consistent with or better than those expected. While these positive results provide helpful information to support near term decisions, Savannah River Site officials stated that the results of each step in the monitoring and assessment evaluations determine the next steps to be completed and, ultimately, final decisions are contingent on completion of all monitoring and assessment activities.

Although the monitoring and assessment activities are deemed necessary to justify extending the use of L-Basin to store SNF, the Department has not specified when this needs to be completed, and has deferred going forward with the rest of the planned activities until at least FY 2014 due to funding constraints. For example, qualification of the video system to be used for visual examinations of the fuel and corrosion susceptibility evaluations of fuel in isolation cans has been deferred. Also, concrete core samples were obtained from a surrogate basin, but degradation analysis of the core samples has been deferred.

While Savannah River Site officials were generally positive regarding wet storage, a 2013 Defense Nuclear Facilities Safety Board technical report identified vulnerabilities associated with long-term storage of reactive metal SNF in L-Basin. Specifically, the Defense Nuclear Facilities Safety Board questioned the indefinite storage of damaged SNF stored inside isolation cans or bundles because the current internal condition of many of these items is unknown. The report notes that further attention to the disposition of such vulnerable fuels is warranted.

### SUGGESTED ACTION

Department officials are aware of the current status of the augmented monitoring and assessment activities and stated that deferral of these activities will have no immediate impact on the safety basis of L-Basin. Furthermore, we understand the need for some flexibility in the Department's schedule for implementing these activities due to funding constraints. However, the Department plans to store SNF at the Savannah River Site's L-Basin indefinitely and has determined that completion of certain monitoring and assessment activities are necessary in order to validate the technical basis for extending the use of L-Basin. In light of the need to eventually complete the activities deferred due to funding constraints, we suggest that the Department establish formal timeframes for completing these essential, augmented monitoring and assessment activities.

Attachment

cc: Deputy Secretary  
Chief of Staff  
Chief Health, Safety and Security Officer  
Manager, Savannah River Operations Office  
Manager, Idaho Operations Office

## **OBJECTIVE, SCOPE AND METHODOLOGY**

### **OBJECTIVE**

The objective of the audit was to determine whether the Department of Energy (Department) is effectively managing the safety of spent nuclear fuel (SNF) in wet storage basins.

### **SCOPE**

We performed the audit between February 2012 and May 2013. Work was conducted primarily at the Savannah River Site in Aiken, South Carolina, with additional information coming from the Office of Environmental Management and the Office of Health, Safety and Security in Washington, DC, as well as Idaho National Laboratory in Idaho Falls, Idaho. The audit included a review of safety aspects related to the long-term wet storage of SNF.

### **METHODOLOGY**

To accomplish the objective of this audit, we:

- Researched applicable Federal and Department regulations and guidance;
- Reviewed prior Office of Inspector General and Government Accountability Office reports related to the audit objective;
- Reviewed current Department plans related to storage and disposition of SNF;
- Reviewed safety analysis documents for the Department's cooling and storage basins; and
- Interviewed Department and/or contractor management personnel with responsibility over SNF.

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. 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 also assessed performance measures in accordance with the *GPR Modernization Act of 2010* and found that the Department had established performance measures related to SNF. We did not rely on computer-processed data to satisfy our audit objective.

An exit conference was held with the Office of Environmental Management on May 29, 2013.

## CUSTOMER RESPONSE FORM

The Office of Inspector General has a continuing interest in improving the usefulness of its products. We wish to make our reports as responsive as possible to our customers' requirements, and, therefore, ask that you consider sharing your thoughts with us. On the back of this form, you may suggest improvements to enhance the effectiveness of future reports. Please include answers to the following questions if applicable to you:

1. What additional background information about the selection, scheduling, scope, or procedures of the audit or inspection would have been helpful to the reader in understanding this report?
2. What additional information related to findings and recommendations could have been included in the report to assist management in implementing corrective actions?
3. What format, stylistic, or organizational changes might have made this report's overall message more clear to the reader?
4. What additional actions could the Office of Inspector General have taken on the issues discussed in this report that would have been helpful?
5. Please include your name and telephone number so that we may contact you should we have any questions about your comments.

Name \_\_\_\_\_ Date \_\_\_\_\_

Telephone \_\_\_\_\_ Organization \_\_\_\_\_

When you have completed this form, you may telefax it to the Office of Inspector General at (202) 586-0948, or you may mail it to:

Office of Inspector General (IG-1)  
Department of Energy  
Washington, DC 20585

ATTN: Customer Relations

If you wish to discuss this report or your comments with a staff member of the Office of Inspector General, please contact our office at (202) 253-2162.

This page intentionally left blank.

The Office of Inspector General wants to make the distribution of its reports as customer friendly and cost effective as possible. Therefore, this report will be available electronically through the Internet at the following address:

U.S. Department of Energy Office of Inspector General Home Page  
<http://energy.gov/ig>

Your comments would be appreciated and can be provided on the Customer Response Form attached to the report.