



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

# Audit Report

## Management of Tritium within the National Nuclear Security Administration

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November 2013



**Department of Energy**  
Washington, DC 20585

November 18, 2013

MEMORANDUM FOR THE DIRECTOR, NUCLEAR MATERIALS DIVISION, OFFICE  
OF STOCKPILE MATERIALS

FROM: *Daniel M. Weeber*  
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SUBJECT: INFORMATION: Audit Report on "Management of Tritium within the  
National Nuclear Security Administration"

BACKGROUND

The National Nuclear Security Administration (NNSA) is responsible for producing tritium, a key component necessary for maintaining the Nation's nuclear weapons stockpile. NNSA's nuclear weapons Readiness Campaign coordinates with the Department of Defense to determine stockpile requirements and provide annual updates on tritium production and inventory status. The Tritium Readiness subprogram provides the capability for producing tritium needed for the Nation's nuclear weapons mission.

Currently, the only new source for tritium is to irradiate tritium-producing burnable absorber rods (TPBARs) in one or more nuclear power reactors operated by the Tennessee Valley Authority (TVA). After completion of the 18-month reactor cycle, the TPBARs are removed from the reactor and cooled for approximately 6 months prior to shipment to the Savannah River Site where the tritium is extracted at the Tritium Extraction Facility and added to inventory.

Considering the importance of tritium for the nuclear weapons mission, we initiated this audit to determine whether NNSA was effectively managing tritium supplies to meet nuclear weapons needs.

RESULTS OF AUDIT

Based on our review, we determined that NNSA is effectively managing tritium supplies to meet nuclear weapons needs. NNSA currently maintains tritium supply levels slightly above demand levels and projects that future supplies will be maintained at similar levels. At the time of our review, NNSA had developed plans to increase the number of TPBARs irradiated per reactor cycle as the demand for tritium increases. NNSA plans called for a steady increase in the number of TPBARs irradiated per reactor cycle to a maximum of 2,000 TPBARs in 1 reactor. Should future demands require more than 2,500 TPBARs per reactor cycle, TVA will have to use more than 1 reactor to irradiate the TPBARs.

NNSA tracks and assesses future tritium supply and demand levels through the use of a Master Nuclear Schedule database application, which includes a tritium simulation module that models the demand for and supply of tritium. NNSA also holds Tritium Readiness Quarterly Management meetings to discuss emerging and ongoing issues concerning design, fabrication, irradiation, transportation and extraction of TPBARs. These meetings generally include representatives from NNSA and various contractors responsible for each area of tritium production.

While NNSA is effectively managing tritium supplies to meet nuclear weapons needs in the near term, we found that several key actions should be completed to ensure that future tritium supplies are not disrupted.

### Supplemental Environmental Impact Statement

NNSA experienced delays in completing a Supplemental Environmental Impact Statement which TVA plans to use in pursuing its upcoming license amendment request to the Nuclear Regulatory Commission. The amendment is necessary to permit TVA to increase the quantity of tritium generated or the number of TPBARs irradiated per reactor cycle in one reactor. The Supplemental Environmental Impact Statement would analyze the increased levels of tritium that are expected to permeate into the reactor coolant water as a result of the increase in the number of TPBARs irradiated. NNSA published a Notice of Intent in September 2011, to prepare a Supplemental Environmental Impact Statement that was to be completed and approved by the summer of 2013. NNSA currently anticipates that the Supplemental Environmental Impact Statement will be completed and approved no sooner than March 2014. Additionally, TVA's work on the license amendment request was halted due to NNSA's inability to provide TVA with the \$800,000 in funding necessary to complete an analysis on a new reactor core design to support the increase in the number of TPBARs per reactor cycle.

The Supplemental Environmental Impact Statement and the license amendment request it supports are critical to meet future tritium demands, which are expected to exceed Nuclear Regulatory Commission permitted amounts by October 2015. To increase the current reactor safety limits by January 2015, NNSA had established a management challenge to complete the Supplemental Environmental Impact Statement. If the license amendment is not approved by October 2015, TVA will be forced to produce less tritium than required by current NNSA plans. If the resulting shortfall cannot be recovered in future reactor cycles it may become necessary for TVA to use an additional reactor, which would be very costly to NNSA. NNSA estimated that it would take 4 years and a minimum of \$20 million dollars to prepare an additional reactor to meet its tritium production requirements. All associated costs would be borne by NNSA.

The Supplemental Environmental Impact Statement is also needed to address changes observed at the TVA reactor. NNSA and TVA noted increases in tritium permeation levels when TVA increased the number of TPBARs from 240 to 368 per reactor cycle in September 2009. The Council on Environmental Quality's implementing regulations for the *National Environmental Policy Act* and the Department of Energy's implementing regulations require the preparation of a supplement to an environmental impact statement when there are substantial changes to a proposal or when there are significant new circumstances or information relevant to environmental concerns. Pursuant to this requirement, the Supplemental Environmental Impact

Statement is needed to update tritium permeation assumptions made in the *Final Environmental Impact Statement for the Production of Tritium in a Commercial Light Water Reactor* (DOE/EIS-0288, March 1999).

### TPBAR Parts

We also noted that parts used to assemble new TPBARs are nearly exhausted and procurement actions for several key parts should be started without further delay to ensure that parts are available to support the future needs for tritium production. NNSA contracted with WesDyne International, LLC (WesDyne) to assemble TPBARs to support each reactor cycle. In the past, NNSA procured TPBAR parts and provided them to WesDyne for assembly. WesDyne then provided the assembled TPBARs to TVA for irradiation. NNSA is currently considering modifying WesDyne's contract to include procurement responsibilities. However, at the time of our review, NNSA was undecided as to whether to continue to provide the parts to WesDyne.

In September 2012, WesDyne reported to NNSA that some parts used to assemble TPBARs would be exhausted as early as Fiscal Year (FY) 2016. WesDyne requested that NNSA provide direction concerning the quantity of TPBARs that are anticipated for future reactor cycles and make a determination regarding the level of enrichment that will be necessary. WesDyne also suggested that NNSA maintain the same TPBAR design until 2020, to facilitate timely replenishment of TPBAR parts with minimal changes. NNSA provided the direction that WesDyne requested regarding quantity of TPBARs and enrichment levels. However, NNSA decided not to freeze the TPBAR design at this time. Management indicated that freezing the design might foster resistance to potential design changes in the future because parts had already been purchased.

Furthermore, NNSA has not initiated the procurement process for the two key TPBAR parts expected to be exhausted in FY 2016. To avoid a disruption to assembly, WesDyne estimated that the procurement process for these parts should begin during FY 2013. However, due to budget constraints, as of October 2013, the implementation of this procurement process had not occurred. Additionally, the current supply of another key TPBAR part is expected to be exhausted in FY 2017, and WesDyne estimated that the procurement process for this part will need to begin during FY 2014. NNSA also has not initiated the procurement process for this additional part. Should NNSA decide to have WesDyne procure the necessary TPBAR parts directly, this action must occur in time for WesDyne to identify potential vendors to fabricate the parts. Timely NNSA action is critical to enable WesDyne to provide the potential vendors with quantities and specifications for the preparation of their bids.

### SUGGESTED ACTIONS

NNSA officials have initiated actions to complete the Supplemental Environmental Impact Statement and ensure the assembly of an adequate number of TPBARs needed to meet tritium production requirements. NNSA should complete the actions necessary to ensure the long-term supply of tritium for the Nation's nuclear weapons mission. Accordingly, we suggest that the Director, Nuclear Materials Division, Office of Stockpile Materials:

1. Work with TVA to ensure that necessary license amendment requests are made to the Nuclear Regulatory Commission;

2. Complete the Supplemental Environmental Impact Statement as soon as practicable; and
3. Make a timely decision regarding the responsibility for procuring TPBAR parts to ensure that TPBARs are available to meet future tritium production requirements.

Attachment

cc: Deputy Secretary  
Acting Administrator, National Nuclear Security Administration  
Chief of Staff

## **OBJECTIVE, SCOPE AND METHODOLOGY**

### **OBJECTIVE**

The objective of the audit was to determine whether the National Nuclear Security Administration (NNSA) was effectively managing tritium supplies to meet nuclear weapons needs.

### **SCOPE**

We performed the audit between May 2012 and November 2013. Work was conducted primarily at the Savannah River Site in Aiken, South Carolina, with additional information coming from the NNSA offices in Washington, DC and Albuquerque, New Mexico. The audit included a review of current and future tritium supply and demand forecasts.

### **METHODOLOGY**

To accomplish the objective of this audit, we:

- Reviewed applicable Federal and Department of Energy regulations and guidance;
- Reviewed prior Office of Inspector General and U.S. Government Accountability Office reports related to the audit objective;
- Reviewed current and future NNSA forecasts related to tritium supply and demand; and
- Interviewed NNSA and contractor personnel with responsibility over tritium production.

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. The audit included test of controls and compliance with laws and regulations to the extent necessary to satisfy the audit objective. In particular, we assessed the implementation of the *GPRA Modernization Act of 2010* and found that the Department had established performance measures related to the management of the tritium program. 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. Finally, we relied upon computer-processed data to a limited extent to accomplish our audit objective and performed appropriate tests to validate the results.

An exit conference was waived by NNSA management on November 7, 2013.

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