

DOE/IG-0570

AUDIT  
REPORT

DEPLETED URANIUM OPERATIONS  
AT THE Y-12 NATIONAL SECURITY  
COMPLEX



SEPTEMBER 2002

U.S. DEPARTMENT OF ENERGY  
OFFICE OF INSPECTOR GENERAL  
OFFICE OF AUDIT SERVICES



U. S. DEPARTMENT OF ENERGY  
Washington, DC 20585

September 25, 2002

MEMORANDUM FOR THE SECRETARY

FROM: Gregory H. Friedman  
Inspector General

SUBJECT: INFORMATION: Audit Report on "Depleted Uranium Operations at the Y-12 National Security Complex"

BACKGROUND

As part of its program to ensure the performance of the nation's inventory of nuclear weapons, the Department of Energy must maintain the capability to manufacture nuclear weapons "secondaries." Secondaries contain the fusion stage of modern nuclear weapons and create most of the explosive yield.

Currently, the Y-12 National Security Complex in Oak Ridge, Tennessee, is the only site capable of manufacturing and remanufacturing certain unique components necessary for assembling the secondaries. Many of these components are produced at Y-12's Depleted Uranium and Binary Metal Cycle Operations facility, the sole producer of several of the key components. We conducted this audit to determine if the National Nuclear Security Administration (NNSA) can ensure the facility's reliability.

RESULTS OF AUDIT

Y-12's depleted uranium facility is currently producing needed components, but it relies on production equipment that, in many cases, is outdated, damaged, or beyond repair. Our analysis of the condition status of this equipment suggests that NNSA's ability to manufacture needed parts in the future may be in jeopardy. We found, for example, that a 42-year old hydraulic press, used to forge virtually all parts manufactured at the facility, had significant damage and that this damage is so serious that it will ultimately lead to failure of the press. We were surprised to find that a replacement press, on site for well over a year, had not been installed because Y-12 had not budgeted for its installation. Similarly, six of seven specialized furnaces used to melt uranium had failed, yet Y-12 had not installed an available replacement. We noted other examples of production equipment that had exceeded its useful life, required significant maintenance, or was put in place as a temporary substitute or stopgap measure for original equipment.

The audit disclosed that Y-12 had not followed through on a number of initiatives intended to address these problems. Additionally, NNSA had not established useful performance metrics and contract incentives to ensure program performance. If the Depleted Uranium process fails, NNSA may not be able to meet its weapons stockpile requirements. Furthermore, excessive maintenance costs were being incurred and prior investments in new equipment were at risk. We recommended that NNSA and Y-12 undertake a series of immediate actions to enhance maintenance procedures and ensure continued depleted uranium operations.

The Office of Inspector General has identified Stockpile Stewardship as one of the most significant challenges the Department and NNSA face. Several of our recent reports, including *National Nuclear Security Administration's Test Readiness Program* (DOE/IG-0566, September 2002), *The Department of Energy's Pit Production Project* (DOE/IG-0551, April 2002), and *Stockpile Surveillance Testing* (DOE/IG-0528, October 2001), emphasized the need for prompt action to address various factors with the potential to affect stockpile reliability. Our current findings regarding depleted uranium operations at Y-12 are consistent with our earlier observations.

#### MANAGEMENT REACTION

Management concurred with our findings and recommendations, but was concerned that our report over-simplified the reliability and vulnerability of depleted uranium operations, noting that no one could assure a zero risk of failure.

We agree that a zero risk is not possible, but our report identifies much that can be done to reduce the likelihood that equipment failures will interrupt depleted uranium operations.

#### Attachment

cc: Chief of Staff  
Acting Administrator, National Nuclear Security Administration  
Under Secretary for Energy, Science, and Environment

# DEPLETED URANIUM OPERATIONS AT THE Y-12 NATIONAL SECURITY COMPLEX

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# **OVERVIEW**

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## **INTRODUCTION AND OBJECTIVE**

The Department of Energy (Department) is responsible for maintaining the safety, reliability, and performance of the nuclear weapons in the Nation's stockpile. Since the moratorium on underground testing in 1992, these responsibilities have been met through the Stockpile Stewardship Program. This program, managed by the National Nuclear Security Administration (NNSA), outlines the activities necessary to sustain and refurbish all of the nuclear weapons in the active and inactive stockpile. These activities include providing the required production capability to refurbish weapons on schedule and sustaining production competence to support production needs.

The Y-12 National Security Complex (Y-12) is an integral part of this production process. Specifically, Y-12 is the only site capable of manufacturing and remanufacturing the unique components necessary for assembling nuclear weapon secondaries. Many of these components are produced at Y-12's Depleted Uranium and Binary Metal Cycle Operations (Depleted Uranium) facility. Because the Depleted Uranium facility is the sole producer of these key components, we conducted the audit to determine if NNSA can ensure its reliability.

## **CONCLUSIONS AND OBSERVATIONS**

Although the Depleted Uranium facility is currently able to manufacture components, NNSA cannot ensure the continued reliability of its process. Much of the production equipment presently in use has exceeded its useful life, has required significant maintenance, or was added as a substitute for the original equipment. Further, while some new equipment had been purchased, it had not been installed and had begun to degrade. This occurred because Y-12 had not completed a previous consolidation effort, had placed key projects on hold, and had not established useful performance-based incentives. If the depleted uranium process fails, NNSA may not be able to meet its weapons stockpile requirements. Furthermore, increased maintenance costs were being incurred and prior investments in new equipment were at risk.

In our opinion, the matters discussed in this report represent material internal control weaknesses that should be considered when preparing the year-end assurance memorandum on internal controls.

\_\_\_\_\_(Signed)\_\_\_\_\_  
Office of Inspector General

## Depleted Uranium Operations Process

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### **Production Equipment Reliability**

At present, the Depleted Uranium facility is capable of producing weapons components; however, the future reliability of the process is not assured.

#### Equipment Maintenance and Operation

Y-12 began manufacturing weapons components from depleted uranium in the 1950's, and, in some cases, is still relying on machinery installed at that time. One particular piece of equipment we observed, a 7500-ton hydraulic press, had been operating for over 42 years. Generally, each weapons part processed at the Depleted Uranium facility must be forged through this press. Despite the fact that this press had sustained, documented, irreparable damage that would ultimately lead to its failure, the Y-12 plant had no contingency capability for forging operations. If the press suffers a catastrophic failure, production of depleted uranium parts will be interrupted until a replacement press is put into full production mode.

Another part of the production process requires the use of Vacuum Induction Melt (VIM) furnaces. For Y-12 to produce one certified component part, metals, including uranium, must be melted in the VIM furnaces during three separate stages. Yet, Y-12 has only one of its seven VIM furnaces operating. Since 1998, the Department has planned to restart two of the other VIM furnaces. However, due to the low priority placed on these projects, Y-12 has yet to complete these actions.

While the hydraulic press and the one VIM furnace have not yet completely failed, other pieces of equipment have, forcing Y-12 to perform vital processes using alternative methods. For example, an abrasive saw, used in conjunction with the melting process, was shut down in 1999. Since that time, machine tools have been used to saw the material. Although this method has worked, it has slowed production time significantly. Cutting the material with a machine tool takes hours; the abrasive saw, in contrast, cuts the material in a matter of minutes.

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### New Equipment Procurement

Several new pieces of equipment have been purchased to replace or support existing equipment; however, these components have not been put into operation and have begun to degrade in place. For example, a 3500-ton press, procured to replace the 7500-ton press, has been sitting idle at Y-12 for more than a year. The new press was fabricated in 1999 with specific design requirements to enhance reliability and reduce health and safety concerns. After sitting at the manufacturer's factory for over a year, the press was assembled at Y-12 in March 2001. It has been sitting untested and inoperable since that time. Y-12 project managers estimate that it could take up to two years to bring the new press online. A new abrasive saw was also procured as part of the Fiscal Year (FY) 1998 Stockpile Management Restructuring Initiative (SMRI) project, but as of May 2002, the saw remained at the vendor's factory.

Other tasks of the 1998 SMRI included the replacement of one VIM furnace and the refurbishment of another. At the time of our audit, however, the replacement furnace had not been installed and the other furnace had not been refurbished. According to project managers, once the installation and refurbishment are completed, it will take at least two years before the furnaces are fully operational.

### **Maintaining Weapons Capabilities**

The 1994 Nuclear Posture Review required NNSA to maintain the capability to design, fabricate, and certify new warheads, and demonstrate the capability to refabricate and certify weapon types in the enduring stockpile. The latest production and planning directives require NNSA and Y-12 to maintain and/or provide capabilities to meet stockpile maintenance requirements for weapon systems. Because many of these systems require processing through the Depleted Uranium facility, it is imperative that NNSA maintain the equipment in accordance with Departmental requirements.

Departmental orders require that the Department and its contractors plan, acquire, operate, maintain and dispose of physical assets in a manner to meet Departmental missions. Specifically, Order 430.1A, *Life Cycle Asset Management*, requires: (1) the establishment of requirements, budgets, and a work management system to maintain physical assets in a condition suitable for their intended use; and (2) the preventative, predictive, and corrective maintenance to ensure physical asset availability for planned use and/or proper disposition. Further, Departmental Order 433.1, *Maintenance Management Program for DOE Nuclear Facilities*, requires periodic inspections of structures,

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systems, components, and equipment to determine whether degradation or technical obsolescence threatens performance and/or safety.

## **Program and Project Management**

Problems with the Depleted Uranium facility's production equipment occurred because Y-12 had not completed an earlier consolidation effort, had placed key projects on hold, and had not established useful performance-based incentives.

### Consolidation Efforts

The reliability of depleted uranium operations was compromised by a consolidation effort that was never completed. In 1992, the Department began efforts to consolidate equipment into a centralized area to enhance operations and to reduce the depleted uranium operations footprint. The Department moved the best of its duplicate equipment while continuing operations with backup equipment. Since the consolidation effort was never completed, Y-12 has been relying on the backup equipment. Some of the moved equipment, left inoperable for more than a decade, has degraded to the point that it must be replaced. For example, a relatively new oven was moved to the consolidation site in 1992. The oven had been reliable up to that point, but it had not been operated or maintained since it was moved. Due in part to its poor physical condition, Y-12 is planning to procure a new oven as part of a current consolidation effort.

Certain depleted uranium material must also be put through a process called shearing. The machine designed to perform this operation was moved in the earlier consolidation effort and has been inoperable ever since. Consequently, Y-12 had been using another type of shear. While this alternative method meets current production requirements, it will not work on material needed for future requirements.

### Projects on Hold

In February 2001, NNSA placed key projects on hold due to project management concerns. In response to these concerns, Y-12 submitted a Baseline Change Proposal for the 3500-ton press in September 2001. To date, Headquarters has not approved the change proposal and the project remains on hold. Further, the project had received no funding in FY 2002, and no funding was requested in the FY 2003 budget. As an alternate approach, the Y-12 Area Office is working with Headquarters to reprogram funds from other projects.



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NNSA also placed the SMRI project, which includes the VIM furnaces and abrasive saw, on hold in February 2001. Although NNSA has funds available to complete the project, Headquarters has not yet approved a change proposal. Headquarters will not approve the Baseline Change Proposal until all subtasks in the SMRI are more clearly defined.

#### Performance Metrics

While NNSA developed measures to ensure that maintenance activities protected process equipment, the metrics and incentives were insufficient. In fact, in March 2001, the Defense Nuclear Facilities Safety Board (DNFSB) reported that Y-12's established performance-based metrics and award fee milestones contained few incentives for corrective action and did not define explicit, measurable end results. A follow-up DNFSB report issued in November 2001, noted that the maintenance metrics still were not adequate.

Weaknesses in metrics were especially noticeable in the equipment for the Depleted Uranium facility. For instance, in FY 2001, Y-12 had a performance metric to complete at least 85 percent of scheduled preventive maintenance work. However, the metric did not establish minimum requirements for scheduling preventive maintenance, nor did it define what activities were considered to be preventive. Although Y-12 has implemented a new preventative maintenance pilot program, we noted that the program does not include Depleted Uranium facility equipment.

#### **Future Stockpile Requirements**

Without fully functioning depleted uranium operations, NNSA cannot ensure that it will have the capabilities and capacities needed to meet its future production requirements. Refurbishments of some weapon systems require components from the Depleted Uranium facility, and, if the 7500-ton press or the remaining VIM furnace become inoperable, Y-12 will not be able to produce required parts. The failure of this press alone could halt depleted uranium operations for up to two years.

Additionally, NNSA is spending \$10 million a year in maintenance costs on the old process buildings. NNSA had planned to consolidate depleted uranium operations into a smaller, safer area. However, until equipment such as the new 3500-ton press is operational, NNSA is forced to maintain the old process buildings, including one that houses the damaged 7500-ton press.

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NNSA's investment in the 3500-ton press is also at risk. To date, NNSA has spent \$18 million, and is planning to spend another \$10 million to make the press operational. Even so, NNSA and the press manufacturer are concerned about the degradation of the press. The power supply has not been installed, and the press has not been exercised to prevent the seals from deteriorating, or the lubricant protected parts from rusting. In December 2001, NNSA directed Y-12 to take steps to protect the press, but it took another 5 months before Y-12 began protective measures. While the factory warranty is good through June 2003, it will most likely expire before the press is even tested, much less put into operation.

Finally, the risk of exposing plant workers to health and safety hazards remains at an increased level as long as depleted uranium operations continue in the old process buildings. In the FY 1997 budget request, Y-12 managers stated that: (1) process building ventilation systems average 50 percent availability, (2) half or less of the supply and exhaust fans work, (3) inlet screens were choked with debris, and (4) filters were completely plugged<sup>1</sup>. The managers further stated that there were significant problems with the electrical distribution systems and that cooling water systems were badly corroded.

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<sup>1</sup> Y-12 management stated that the problems with the inlet screens and plugged filters have been corrected as a result of actions taken in February 2002, such as changing out 1,000 filters.

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**RECOMMENDATIONS**

We recommend that the Deputy Administrator for Defense Programs ensure that Y-12 has the capabilities and capacities to meet its current and future stockpile requirements by:

1. Reviewing Baseline Change Proposals in a timely manner to ensure that Depleted Uranium projects are not delayed unnecessarily; and,
2. Requesting adequate funding necessary to complete key projects.

We recommend that the Manager, Y-12 Site Office, direct BWXT Y-12, LLC to:

3. Immediately begin preventative maintenance on all Depleted Uranium equipment in use or planned to be in use;
4. Establish and implement the contingency plan for preserving the 3500-ton press; and,
5. Develop and implement performance-based incentives and a comprehensive maintenance implementation plan.

**MANAGEMENT REACTION**

Management concurred with our finding and recommendations but did not provide a corrective action plan. Management believed that our report over-simplified the reliability and vulnerability of depleted uranium operations, and that no one could assure a zero risk of failure. NNSA stated that it invests resources based on a risk analysis of all its production capabilities, including depleted uranium processes. Management believes that its Facilities and Infrastructure Replacement Initiative will reduce the risks of production processes.

Management comments are included in their entirety as Appendix 3.

**AUDITOR COMMENT**

We do not expect NNSA to assure a zero risk of failure in production equipment, but we believe that much can be done to reduce risks, such as performing routine preventive maintenance activities. The Facilities and Infrastructure Replacement Initiative may aid in reducing some building risks, but it currently does not address the risks in depleted uranium equipment.

## Appendix 1

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### SCOPE

This audit was performed from January 9, 2002, through June 20, 2002, at the Y-12 National Security Complex (Y-12) in Oak Ridge, Tennessee. The audit included Depleted Uranium operations at Y-12 from 1992 through June 2002.

### METHODOLOGY

To accomplish the audit objective, we:

- Interviewed NNSA and contractor personnel responsible for Depleted Uranium operations;
- Reviewed production and planning directives and program control documents;
- Reviewed the *Y-12 Depleted Uranium Operations Plan* dated August 2001;
- Analyzed the condition of equipment currently used in the Depleted Uranium facility as well as planned upgrades;
- Reviewed maintenance operations, records and reports;
- Evaluated plans for consolidating the Depleted Uranium operations; and,
- Reviewed NNSA's planned capital project improvements for Depleted Uranium operations.

The audit was performed in accordance with generally accepted government auditing standards for performance audits and included tests of internal controls and compliance with laws and regulations to the extent necessary to satisfy the 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 did not rely on computer-generated data to achieve our objective. Management waived an exit conference.

## Appendix 2

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### RELATED AUDIT REPORTS

#### Office of Inspector General

- *National Nuclear Security Administration's Test Readiness Program*, (DOE/IG-0566, September 9, 2002). The report determined that Nevada's ability to conduct an underground nuclear test within the specified timeframe was at risk. Specifically, key aspects of the Department's testing process and infrastructure had experienced significant degradations in the last decade, including a decline in the number of employees with testing experience; the deterioration of necessary systems and equipment; the inability to keep pace with new technology; and, delays in updating required safety studies.
- *Management of the Stockpile Surveillance Program's Significant Finding Investigations* (DOE/IG-0535, December 2001). We found that the Department has not been meeting internally established timeframes for initiating and conducting investigations of defects and malfunctions in nuclear weapons. If these delays continue the Department may not be in a position to unconditionally certify the aging nuclear weapons stockpile.
- *Stockpile Surveillance Testing* (DOE/IG-0528, October 2001). The audit revealed that since at least 1996, the Department has not met many of its internally generated milestones for flight laboratory and component tests. Without needed test data, the Department's ability to assign valid reliability levels to some weapons systems is at risk.
- *Management of the Nuclear Weapons Production Infrastructure* (DOE/IG-0484, September 2000). This report stated that the nuclear weapons production infrastructure has not been adequately maintained. As a result current and future goals of the stockpile stewardship program are at risk.

#### General Accounting Office

- *Nuclear Weapons Key Nuclear Weapons Component Issues Are Unresolved* (GAO/RCED-99-1, November 1998). The review found that although the Department is responsible for managing the nation's stockpile of nuclear weapons, it lacks the capability to produce a key nuclear weapons component for use in the stockpile.
- *Nuclear Weapons Improved Management Needed to Implement Stockpile Stewardship Program Effectively* (GAO-01-48, December 2000). Although the Office of Defense Programs had taken steps to address principal challenges facing the Stockpile Stewardship Program, additional improvements were needed. Specifically, improvements were needed in order to (1) remedy weaknesses in the program's planning process, (2) ensure that required budget information for effective cost management was available, (3) correct organizational and leadership deficiencies, and (4) develop an effective management process for overseeing the life extension program for nuclear weapons.



**Department of Energy**  
**National Nuclear Security Administration**  
Washington, DC 20585

AUG 29 2002

MEMORANDUM FOR Frederick D. Doggett  
Deputy Assistant Inspector General  
for Audit Services

FROM: Anthony R. Lane *Anthony R. Lane*  
Associate Administrator for  
Management and Administration

SUBJECT: Comments on IG Draft Report, on Y-12 Depleted  
Uranium Operations

The National Nuclear Security Administration (NNSA) has reviewed the Inspector General's draft report "Depleted Uranium Operations at the Y-12 National Security Complex." We understand that the IG wanted to determine if NNSA can ensure the reliability of Y-12's Depleted Uranium and Binary Metal Cycle Operations facility. The IG's premise is that NNSA Headquarters outlines activity necessary to sustain and refurbish all of the nuclear weapons in the active and inactive stockpile. This includes providing the required production capability to refurbish weapons on schedule and sustaining production competence to support production needs.

We agree with the IG, that the Y-12 National Security Complex is an integral part of the production process necessary for manufacturing and re-manufacturing the unique components in nuclear weapons' secondaries including depleted uranium parts. However, we believe that the report over simplifies the situation regarding the reliability/vulnerability of the depleted uranium operations. No one can assure the unequivocal reliability (zero risk of failure) of any process indefinitely into the future. Consequently we have to make risk versus cost versus benefit tradeoffs on all of our capabilities, including depleted uranium, in order to meet mission priorities within the resources available to us. Short-term priorities can outweigh long-term needs temporarily but a balanced investment strategy must be implemented to maintain reliability. We believe that the Facilities and Infrastructure Replacement Initiative at all NNSA sites including Y-12 will allow us to substantially reduce the reliability risks of our production processes, including depleted uranium operations.



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## Appendix 3 (continued)

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If there are any questions about these comments, please contact Richard Speidel, Director, Policy and Internal Controls Management at 586-5009.

cc: Deputy Administrator for Defense Programs, NA-10  
Assistant Deputy Administrator for Military Application  
and Stockpile Operations, NA-12  
Associate Administrator for Facilities and Operations, NA-50

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