U.S. Department of Energy
Office of Inspector General
Office of Audit Services

Audit Report

Refurbishment of the W80 — Weapon Type

DOE/IG-0590

March 2003

Department of Energy
Washington, DC 20585

March 13, 2003

MEMORANDUM FOR THE SECRETARY

FROM: Gregory H. Friedman
Inspector General

SUBJECT: INFORMATION: Audit Report on the "Refurbishment of the W80 -- Weapon Type"

BACKGROUND

The Department of Energy's national security mission, as managed by the National Nuclear Security Administration (NNSA), includes extending the life of the existing weapons in the nation's nuclear stockpile. In this regard, the W80 is one of the weapon types currently undergoing refurbishment. From design to final production, the project will involve three design laboratories and four production plants; and it is currently estimated to cost over $1 billion.

As noted in a number of earlier reports by the Office of Inspector General and others, the NNSA has faced significant challenges in managing and revitalizing the nation's nuclear stockpile. In 2002, for example, we reported that NNSA's ability to produce certified plutonium pits for a particular weapon system was at risk because it had not established an integrated critical path linking required work to appropriate milestones. In another report, we noted that the stockpile stewardship program had not met many of its internally generated milestones for flight, laboratory, and component tests. The U.S. General Accounting Office has also described problems with stockpile stewardship efforts, including a 2001 finding that a key milestone for refurbishment of the W87, another weapon system, had been delayed two years and the project experienced cost increases of $300 million.

In light of these and other reports, we conducted an audit to determine whether, under NNSA's current operating approach, the W80 will be refurbished within established scope, schedule, and cost parameters.

RESULTS OF AUDIT

Our audit disclosed that it is unlikely that NNSA's W80 refurbishment project will meet scope, schedule, and cost milestones established in the W80 NNSA Project Plan. Specifically, Lawrence Livermore and Sandia National Laboratories had cancelled and delayed testing, weapon component completion, and, support facility renovation activities, without notifying NNSA or updating project plans. Further, key management

controls to oversee the project were not in place or operating as intended. In our judgment, had such controls been fully operational, they would have provided an early warning system alerting both NNSA and laboratory officials that laboratory-initiated changes could impact the long-term success of the project.

From our perspective, a more effective control system is needed to provide the NNSA program manager with the proper authority to:

- Establish complete and accurate project plans;
- Implement change controls;
- Estimate and track costs at the weapon and component levels; and,
- Ensure peer reviews were performed as scheduled.

Changes of this type will facilitate the refurbishment of the W80 weapons system before aging-related changes jeopardize warhead safety or reliability.

MANAGEMENT REACTION

Management agreed with the report and recommendations, and noted that corrective actions have already been initiated. NNSA officials also indicated that implementation of the audit recommendations could benefit the management of the other nuclear weapon system refurbishments.

Attachment

cc: Deputy Secretary
Administrator, National Nuclear Security Administration
Director, Policy and Internal Controls Management, NA-66

REFURBISHMENT OF THE W80 -- WEAPON TYPE

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W80 REFURBISHMENT PROJECT

Background

Starting in September 1998, Los Alamos National Laboratory (Los Alamos) initiated a project to refurbish the W80. In January 2001, to balance the workload between Lawrence Livermore National Laboratory (Livermore) and Los Alamos, NNSA transferred the responsibility of refurbishing and certifying the W80 nuclear weapon components to Livermore. Sandia National Laboratories (Sandia) was given the responsibility to design specific weapon components and perform the non-nuclear certification, and Los Alamos was to perform the peer review function. NNSA plans to complete the refurbishment of its first production unit by 2006.

At the beginning of the W80 refurbishment project, NNSA established a management process to overcome previously identified problems such as missed milestones and increased costs. This process, referred to as 6.X, was designed to control refurbishment activities for existing weapons from start to finish. Based on this process, NNSA developed the W80 NNSA Project Plan (Project Plan) to manage the scope, schedule, and cost for the W80 refurbishment and define the inter-dependencies between the participating laboratories and production plants. The Project Plan milestones provided the foundation for detailed schedules to be developed by the laboratories. We conducted the audit to determine whether NNSA will be able to refurbish the W80 according to the scope, schedule, and cost set forth in its Project Plan.

Scope, Schedule, and Cost

The audit disclosed that changes had been made in the scope, schedule, and cost of components; and the tasks scheduled for completion in the Project Plan were not being met. Specifically, scheduled milestones within the Project Plan relating to testing, designing of major components, and renovating support facilities were often cancelled or delayed. Such delays can ultimately increase project cost, as noted in a GAO audit of the W87 where project cost increased by $300 million.

Testing

For example, an ambient hydrodynamic test, conducted to help understand the performance of a primary and validate physics models, was cancelled; and three other hydrodynamic tests were delayed. These tests, the most extensive system tests that can be performed on a weapon, were cancelled or delayed by Livermore because the renovation of the facilities needed to perform the tests was behind schedule and/or over budget. Livermore chose to rely instead on data obtained from a Los Alamos test performed in January 1997, almost four years earlier. The prior test, however, was performed at a different photographic resolution and with different technology.

Likewise, certain scheduled system engineering tests were cancelled. Such tests assess the ability of the W80 to survive environmental conditions such as heat, cold, and vibration. Livermore cancelled these tests because the facilities needed in support of these tests were unavailable. Instead, Livermore planned to use information from other similar tests. However, NNSA documents state that caution should be taken because subtle differences may change the test outcomes. Livermore was not able to present any analysis to show that the substitute tests will meet NNSA's requirements.

Weapons Components

Several tasks involving the refurbishment of the weapons components were delayed. For instance, Sandia delayed a conceptual design for a new Weapons Electrical System Housing (Housing) platform by three months because the original design would have interfered with a spring that Livermore was to install in the weapon. Sandia completed the revised conceptual design effort in August 2001 rather than the scheduled date of May 2001. This effort, in turn, delayed the Housing's prototype design review by over ten months. These postponements subsequently impacted refurbishment milestones in other W80 components including the weapon electrical system subassembly and the firing set.

Further, Sandia delayed eight other scheduled tasks involved in the refurbishment of W80 components. One delay could be attributed to Sandia's decision to redesign a part for the neutron generator. The redesign required the part to go through a re-certification process and this caused a delay that was not foreseen in the Project Plan.

Support Facilities

The renovations of support facilities, needed for refurbishment activities, were cancelled or delayed by Livermore. For example, the scheduled renovation of two rooms at Livermore's plutonium handling facility was cancelled because Livermore underestimated the costs. One room would have been used to disassemble war reserve weapons and obtain parts for testing, and the second room was to be used for disassembly of weapons that were tested with the original war reserve plutonium pit. Although Livermore compensated for not renovating the first room by arranging to obtain sufficient parts from another NNSA site, its weapon-testing program was adversely impacted when it had to cancel the system engineering tests on weapons that were to be disassembled in the second room.

Renovation activities were also cancelled or delayed in two rooms in the HiBay Building. Livermore cancelled the renovation of one room because the cost to seal it to prevent hazardous material release was more than planned. Management stated that this should not impact the W80 schedule but noted that the disassembly process will be more difficult and possibly more time consuming. In addition, the renovated room is still needed for other weapon refurbishment according to Livermore. The second room was to be refurbished by November 2001; however, it has been delayed until FY 2003. The rescheduled support facilities were necessary to meet FY 2002 budget constraints but each delayed or cancelled project affected numerous other activities. Many of these changes were not reflected in the Project Plan.

Implementation of Established Management Controls

Although both the Life Extension Program Management Plan and the Project Plan were developed at the inception of the development engineering phase of the W80 refurbishment effort, the established scope, schedule, and cost milestones were not met because management controls were not effectively implemented. In 1999, a Departmental Review Committee stated that a multi-laboratory collaborative effort required an experienced individual with authority to direct all aspects of a project. Such an individual has not been granted the authority to direct the W80 refurbishment. In fact, since responsibility for the W80 project was transferred to Livermore in January 2001, three different managers have been assigned to direct the project without such authority.

We also found that the October 2001 version of the Project Plan still showed a conceptual design milestone completion date of May 2001 even though conceptual design was not complete. In fact, 37 percent of Livermore's detailed project schedule dates showed arbitrary placeholder dates instead of actual completion dates. Further, when two detailed projects were cancelled, Livermore did not update the Project Plan and could not determine how much money was saved or reprogrammed. The Project Plan is an important management control tool that must be updated to be effective. It should be continually updated to reflect revisions in the scope, schedule, and cost.

In addition, Livermore and Sandia detailed plans and the Project Plan were not fully integrated. The laboratories' detailed plan dates, in many instances, were inconsistent with the Project Plan. Our reconciliation of the Project Plan to the laboratories' detailed plans revealed that the detailed plans did not include 29 Project Plan milestones. For example, the Project Plan listed milestones for performance requirements

reviews, engineering system releases, and the establishment of baselines that were not found in the Sandia or Livermore detailed project plans. In addition, we found 23 instances where detailed project plans included the Project Plan milestones but the completion dates in the detailed plans were set after their corresponding Project Plan milestone dates. For example, the Project Plan required that a first fully functional part be available by April 1, 2003. However, the Sandia detailed plan did not require the same part until November 13, 2003. Project Plan milestones provide the foundation for more detailed project plans at the laboratories. In turn, the detailed plans permit tighter control over each aspect of the project.

NNSA also did not require scheduled milestones to be resource loaded – a tool used to gather and appraise required resources. Instead, costs were budgeted and tracked at a high level. The project management software package that NNSA used was, in fact, incapable of resource loading specific tasks. The Management Plan specifies that detailed costs be identified and estimated at the lowest levels of the project. This requirement, along with the Project Plan, is a device used to control costs.

Further, NNSA had not instituted a change control process even though one was drafted in August 2001. Thus, the NNSA W80 Project Manager did not know that Livermore cancelled baseline tests that were scheduled in the Project Plan. The new 6.X Process established by NNSA was designed to control a project by tracking and managing scope, schedule, and cost changes by using a change control process.

Finally, Los Alamos was to conduct the first peer review in September 2002; however, it was delayed until early 2004. In addition, two scheduled annual peer review workshops were not completed. These peer reviews were scheduled to assure that the project was advancing within scope, schedule, and cost.

Certification of the Refurbished W80

Since no new weapons are being designed or developed and the existing stockpile will need to be retained well beyond its intended design life, the need to refurbish the existing weapon stockpile in a timely manner is critical. A Los Alamos official stated that although its peer review team has not been able to perform the scheduled peer reviews, the team is aware of the design decisions being made by Livermore and Sandia and has developed significant concerns about the ability of NNSA to certify the refurbished W80 weapon by 2006. Since Los Alamos has not been able to formally assess the progress that is being made, potential problems may go uncorrected and further impact the scope,

schedule, and cost of the program. Additional delays in this process will adversely affect future workload of production plants and the timely replacement of expired components.

RECOMMENDATIONS

We recommend that the Administrator, National Nuclear Security Administration:

1. Establish a clear management authority to enforce management controls;

2. Establish and maintain a complete and accurate Project Plan which is fully integrated with the laboratories' and production facilities' detailed project plans;

3. Ensure that the Project Plan is resource loaded;

4. Implement a project change control process; and,

5. Ensure that peer reviews are performed as scheduled in the Project Plan.

MANAGEMENT COMMENTS

NNSA agreed with the report and recommendations, stating that all recommendations have either been implemented or are being implemented. Specifically, a program manager will be formally designated by name. A complete, accurate, fully integrated and manageable Project Plan is being developed and will be completed as part of the current rebaselining effort with the site-specific detailed project plans consistent with the Project Plan. The project cost for the W80 refurbishment will also be developed at the completion of the rebaselining effort and will be based on each site's cost to conduct the refurbishment activities in their detailed site-specific project plans and the Project Plan. A formal change control process will be implemented at the completion of the rebaselining effort. Finally, peer reviews will be scheduled and conducted in accordance with the guidelines specified by NNSA.

However, management stated that the report omitted key facts that affected the report's context. Specifically, management stated that shortly after the W80 NNSA Project Plan was published, Congress halted the majority of program activities from December 2001 to June 2002, which precluded completion of the Project Plan updates. The audit was conducted from March 2002 through November 2002, which

covered program activities during the period of the congressional restriction. In addition, NNSA stated that there were also significant issues regarding Air Force support of the W80 refurbishment program that impacted the management's ability to plan higher-level joint activities and milestones. Management's comments are included in their entirety as Appendix 3.

AUDITOR COMMENTS

Management's proposed actions should satisfy the intent of our recommendations. We recognized and compensated for the congressional funding hold and the delayed Air Force support. Specifically, we reviewed the detailed project plans as of December 1, 2001, which was the date the congressional hold went into effect. Therefore, we conducted tests on the project as it stood prior to the congressional hold. For example, the Weapons Components section of the report cites an example that occurred in May and August 2001. In some cases, examples were cited after the congressional hold was released. In these instances, we only used examples that involved circumstances outside of the Congressional hold. For example, some hydrodynamic tests were delayed because a support facility was not completed on time. This facility was delayed due to hazardous material release issues and not by the funding hold. Likewise, we avoided criticizing NNSA for any milestones directly impacted by the lack or delay in Air Force support.

Appendix 1

RELATED REPORTS

Office of Inspector General

- *National Nuclear Security Administration's Test Readiness Program* (DOE/IG-0566, September 2002). The Department's ability to conduct an underground nuclear test within established parameters is a risk. The Department did not have a comprehensive plan or methodology in place to address its most significant test-related concerns. Specifically, plans were insufficient to fill key and critical positions; validate aging assets; incorporate technology advances; and, update Nuclear Explosive Safety Studies. Unless these challenges are addressed, the Department risks losing its ability to restart underground testing on a timely basis, should the need arise.

- *The Department of Energy's Pit Production Project* (DOE/IG-0551, April 2002). The Department lost the capability to make plutonium pits, a key component of nuclear weapons systems, when its Rocky Flats Plant ceased production in 1989. NNSA is currently working to reestablish the Department's production capability so that pits removed from weapons stockpile for testing or other purposes can be replaced. However, the Department's ability to produce certified plutonium pits is at risk because it lacked a robust critical path linking required work to project milestones.

- *Management of the Stockpile Surveillance Program's Significant Finding Investigations* (DOE/IG-0535, December 2001). The Directors of the three Department nuclear weapons laboratories annually assess and report the condition of the weapons systems for which their laboratories are responsible. A critical event in this process is the identification of a weapon defect or malfunction during surveillance testing. The Department had not been meeting internally established timeframes for initiating and conducting investigations of defects and malfunctions in nuclear weapons.

- *Stockpile Surveillance Testing* (DOE/IG-0528, October 2001). The Department had not met many of its flight, laboratory, and component testing milestones. This resulted in a significant testing backlog that was projected to continue for several years. When tests are delayed or are not completed, the Department lacks critical information on the reliability of the specific weapons involved. Without needed test data, the Department's ability to assign valid reliability levels to some weapon systems is at risk.

General Accounting Office

- *NNSA Nuclear Weapon Reports Need to Be More Detailed and Comprehensive* (GAO-02-889R, July 2002). NNSA's Nuclear Weapon Acquisition Reports were not comparable to the Department of Defense Selected Acquisition Reports that the Congress directed NNSA to use as a model for weapon acquisition reporting. As a result, the Congress did not have complete information on the costs of each life extension.

- *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.

Other

- *FY 2000 Report to Congress of the Panel to Assess the Reliability, Safety and Security of the United States Nuclear Stockpile* (February 2001). This congressionally established panel found a disturbing gap between the nation's declaratory policy of maintenance of a safe and reliable nuclear stockpile and the actions taken to support this policy. The report stated that certification is judgmental in nature and that the nation needs the strongest possible processes for designing, assessing, certifying, and manufacturing our nuclear warheads. Among its recommendations the panel emphasized the need for stronger, better-documented interlaboratory peer review, clear identification of costs at the weapon level, and clear roles and responsibilities of NNSA staff.

Appendix 2

SCOPE

The audit was performed from March 2002 to November 2002, at NNSA Headquarters, Lawrence Livermore National Laboratory, Sandia National Laboratories, Los Alamos National Laboratory, and the Pantex Plant.

METHODOLOGY

To accomplish the audit objective, we:

- Reviewed budget and cost reports, including the W80 Nuclear Weapons Acquisition Report;
- Interviewed personnel from NNSA Headquarters, Albuquerque, Livermore, Sandia, Los Alamos, and Pantex Plant;
- Reviewed the Project Plan, Life Extension Program Management Plan, Livermore and Sandia detailed project plans;
- Reconciled the Project Plan schedule to the Livermore and Sandia detailed project plan schedules;
- Sampled and tested detailed tasks for completion and adherence to the Project Plan schedule; and,
- Examined prior Office of Inspector General, General Accounting Office, and Congressional mandated assessments.

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. We tested controls with respect to NNSA's W80 Life Extension 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. We performed limited tests designed to assess the reliability of computer-processed data and found that the Project Plans were not reliable or current.

NNSA waived the exit conference.

Appendix 3

Department of Energy
National Nuclear Security Administration
Washington, DC 20585

FEB 21 2003

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

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

SUBJECT: Comments on IG Draft Report on W80 Refurbishment

The National Nuclear Security Administration (NNSA) has reviewed the Inspector General's (IG) draft report, "Refurbishment of the W80." We understand that the IG wanted to determine whether NNSA will be able to refurbish the W80 within established plans for scope, schedule, and costs. The IG believes NNSA's W80 refurbishment project is at risk of not meeting scope, schedule, and cost milestones established in the W80 NNSA Project Plan. The IG states that more effective management controls would have provided the program manager with proper authority to establish complete and accurate project plans, implement change controls, estimate and track costs at the weapon and component levels, and ensure peer reviews were performed as scheduled. The IG recommended a series of actions to assist NNSA in implementing management controls.

The NNSA agrees with the report and recommendations. The recommendations represent good business practices that are required to effectively manage the W80 refurbishment program. All of the recommendations have either been implemented or are being implemented in the W80 refurbishment program.

However, the report omitted some key facts that affect the report's context.

- The report does not identify what time period during the W80 refurbishment program the audit was conducted nor does it address some of the significant challenges the program was encountering during that timeframe and shortly thereafter. The audit was conducted from March 2002 through November 2002 using the October 2001 version of the W80 refurbishment Project Plan and the program management controls in place during that timeframe. When the initial Project Plan was published in October 2001, it was recognized by the NNSA W80 refurbishment team that deficiencies existed in the Project Plan and improvements were required particularly in the area of program integration. However, in October 2001, FY 2002 Congressional language pertaining to the W80 refurbishment program was issued which halted the majority of program

activities from December 2001 to June 2002 and precluded the completion of planned refurbishment program Project Plan updates.

- During the same timeframe there were significant issues regarding Air Force support of the W80 refurbishment program due to Air Force funding issues. This resulted in the inability to accurately plan for required NNSA and Air Force joint test activities and milestones, and subsequently impacted the ability to plan and conduct the NNSA-specific activities and milestones required to support the higher-level joint activities and milestones.

The addition of these facts should be incorporated into the report to provide additional clarification and context and establish the program baseline upon which the audit was conducted.

The W80 refurbishment program is currently being rebaselined to incorporate the FY 2002 Congressional language impacts and to develop a joint refurbishment program with the Air Force (the Air Force has recently programmed FY 2003-2009 funding for the W80 refurbishment program). The rebaselining of the refurbishment program is planned to be completed by May 2003. All of the recommendations made in the audit report will be implemented in the rebaselined W80 refurbishment program.

Specific comments pertaining to the recommendations made in the report and their implementation in the W80 refurbishment program are attachment.

NNSA appreciates the opportunity to have reviewed the IG's draft report. If you have any questions, please call Richard Speidel at 586-5009.

cc: Deputy Administrator for Defense Programs, NA-10

IG Report No.: DOE/IG-0590

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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 which would have been helpful?

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