



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

AUDIT REPORT

Followup on Sandia National Laboratories'
Nuclear Weapons Safety Program

OAI-M-16-16

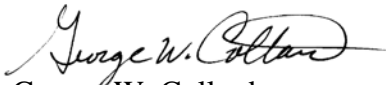
August 2016



Department of Energy
Washington, DC 20585

August 17, 2016

MEMORANDUM FOR THE ADMINISTRATOR, NATIONAL NUCLEAR SECURITY
ADMINISTRATION

FROM: 
George W. Collard
Deputy Inspector General
for Audits and Inspections
Office of Inspector General

SUBJECT: INFORMATION: Audit Report for the "Followup on Sandia National
Laboratories' Nuclear Weapons Safety Program"

BACKGROUND

As part of its nuclear explosive and weapon surety program, the National Nuclear Security Administration (NNSA) is required to incorporate design features that minimize the possibility of accidental or inadvertent nuclear explosive detonation. At NNSA's Sandia National Laboratories (Sandia), the responsibility for nuclear safety design and assurance rests with the Weapon Systems Engineering (Systems Engineering) organization. Sandia's Surety Assessment, Engineering, and Analysis Center (Safety Assessment) performs assurance and independent assessment of nuclear weapons safety and reports the assessment results to Sandia's executive management to support risk-informed decisions. According to Sandia, weapon systems have deviations from an ideal nuclear safety design and/or implementation. These deviations, termed "nuclear safety soft spots," can be associated with nuclear safety-related design or implementation attributes, or with the technical basis underlying these attributes based on Sandia's principle-based approach to assured nuclear safety design. Using this approach ensures that weapon systems meet NNSA and Department of Defense nuclear safety requirements.

In July 2008, the Office of Inspector General reported that Sandia's Safety Assessment had identified 23 high priority nuclear weapons safety issues, now called nuclear safety soft spots, for which there were either no plans to resolve the issues or plans were incomplete (*Sandia National Laboratories Nuclear Weapons Safety Program*, DOE/IG-0799). The report also found that Sandia management had not resolved disagreements between Safety Assessment and Systems Engineering on the need to address the identified soft spots. Furthermore, Sandia did not have a formal tracking system identifying actions taken, or planned, to address the soft spots or provide the rationale for opting not to address them. We initiated a followup audit to determine whether Sandia was effectively managing nuclear weapons safety issues.

RESULTS OF AUDIT

Sandia officials had taken action to improve the management of nuclear weapons safety soft spots. In particular, Sandia had developed a process for tracking all soft spots using general

engineering (GE) documents that contain the agreed-upon prioritized soft spots and their dispositions for each weapon system. The GE documents are maintained as part of the warhead design definition. In addition, Sandia had formalized its process to resolve disagreements related to nuclear weapons safety. We also found that Sandia management had considered soft spots in the design and development activities for the B61-12 Life Extension Program (LEP) and W88 Alteration (ALT) 370 and had plans to mitigate or eliminate a number of the soft spots associated with the legacy B61 and W88 systems. Sandia continues to work on addressing soft spots by gaining new knowledge through studies, tests, and analyses. Results are reported to Sandia executive management through the Annual Stockpile Assessment process. However, we noted an issue that warrants management's attention. We found that Sandia had not fully implemented its formal tracking system for soft spots.

The issue we identified occurred primarily because the project that Sandia established in 2011 to improve the formal tracking system has languished for several years without a defined scope or firm completion date. Sandia officials postponed any updates to the tracking system until the improvement project is complete. As a result, the information that is needed to make informed decisions about safety improvements in future weapon refurbishment programs may not be readily accessible to Sandia management and weapon system engineers in the formal tracking system. In addition, concerns about employee turnover and the resulting loss of institutional knowledge further highlight the importance of maintaining this information for stockpile management activities.

Formal Tracking System

Sandia had not fully implemented its formal tracking system for nuclear safety soft spots. Specifically, the tracking system did not always reflect the latest information regarding the soft spots and did not include all weapon systems. In 2008, Sandia management established a soft spot GE document containing the agreed-upon, prioritized soft spots and their dispositions for each active weapon system, including the dispositions for the 23 high priority soft spots identified in our prior report. However, as of April 2016, Sandia management had not updated the GE documents since 2011. The GE document is designed to be a work in progress that is regularly updated to reflect the current state of knowledge, the current state of investigation and discussion, and the plans for further investigation and retirement of nuclear safety soft spots. Because the documents were not current, we collected information from each weapon system to determine the current status of actions taken or planned to address the soft spots. To this end, we reviewed 85 of the 143 soft spots documented in the formal tracking system. Based on the information provided by Systems Engineering, we found that Sandia had gained new knowledge from studies, tests, and other activities that was not reflected in the soft spot GE documents for at least 36 soft spots. For example:

- Lightning tests performed during fiscal years 2013 and 2014 revealed new information to further characterize a soft spot common to at least four weapon systems.
- Results of studies involving thermal environments documented in various Sandia reports in 2011, 2012, and 2013 further characterized a soft spot common to at least two weapon systems.

Safety Assessment and Systems Engineering officials were generally satisfied with the process for resolving differing professional opinions that was formalized subsequent to our prior report. In addition, the officials told us that the relationship between the two organizations has improved since our prior report and that escalation of disagreements through the formal process is rare. However, we found that Sandia did not always update the soft spot GE documents with the results from its differing opinion process.¹ We reviewed six disagreements concerning nuclear weapons safety that were escalated through this process and noted that Sandia had not added a newly identified soft spot to the corresponding soft spot GE documents and had not included all required corrective actions in the GE document to address another soft spot. Specifically:

- Systems Engineering and Safety Assessment were unable to agree on the system safety impact of a component vulnerability common to three weapon systems. In June 2013, based on a review of facts and analyses, Sandia senior managers concluded that, while the vulnerability did not prevent the weapon systems from meeting their nuclear safety requirements, it was a deviation that reduced confidence in assured safety and they required specific actions to be taken in 2014. One of the actions was to update the soft spot GE documents to include this new soft spot. We found that, as of April 2016, the GE documents did not include this soft spot. A Sandia senior manager informed us that he and the other senior managers had failed to follow through on this action, and he had directed that the soft spot be included in the next revision of the GE documents for the three weapon systems.
- The GE document for another weapon system did not discuss all of the corrective actions that Sandia management was taking to address and characterize a soft spot. Differences in professional opinion existed regarding the implications of a soft spot on a component being produced for an LEP and whether that component should be deployed to the stockpile. In 2009, based on the facts, opinions, and analyses presented by all parties, a Sandia executive manager concluded that it was reasonable to deploy the components that passed a screening process. However, the executive manager also required additional testing, component design modification to eliminate the vulnerability, and replacement of the screened components that were deployed to the stockpile with redesigned components, as practical. We found that, while the GE document identified the design modification, it did not discuss the ongoing component testing and replacement. Instead, the GE document stated that the soft spot would be retired in the next document revision, which according to Sandia's procedure would indicate the soft spot has been corrected, fully characterized, or all affected units have been dismantled. However, affected units remain in the stockpile and, according to a Sandia official, the corrective action should be reflected in the GE document because it helps to characterize the soft spot for informed decision making.

Finally, we noted that one retired weapon system did not have a soft spot GE document. Our prior report recommendation to document the disposition of soft spots encompassed all active, inactive, and retired weapon systems. Moreover, Sandia's internal procedure required soft spot

¹ This process is used to resolve technical differences of opinion within Sandia throughout the nuclear weapons lifecycle including issues related to nuclear safety during weapon design, development, and stockpile assessment activities.

GE documents for all active, inactive, and retired weapon systems. In April 2016, Sandia officials informed us that a draft version was in progress, but it had not yet been finalized and released. Although this is a retired weapon system, a Sandia official informed us that it would be valuable to have a soft spot GE document due to uncertain dismantlement complexities and timeframes.

Soft Spot Improvement Project

The tracking system issue we identified occurred primarily because Sandia's project to improve the formal tracking system languished for several years without a defined scope or firm completion date. Factors contributing to Sandia not completing the project include the lack of a formal project plan, the scope changing during the course of the project, and the project being a low priority due to the emphasis on LEPs and ALTs. Safety Assessment and Systems Engineering agreed to postpone any updates to the GE documents until Safety Assessment completes the improvement project. Examples of planned improvements include categorizing soft spots according to nuclear safety design principles, as well as simplifying the prioritization scheme.

In 2010, an independent review team made up of experts from Sandia and NNSA's other design laboratories issued a challenge to Sandia, stating that the lists of soft spots contained in the GE documents were incomplete and inconsistent across weapon systems. In response to the challenge, Safety Assessment has been working on the improvement project since at least 2011. However, Sandia officials told us there was no formal project plan and that the project scope has increased over time from reviewing the existing GE documents for validation and consistency to revising the document structure, including new soft spot categorization and prioritization schemes. In addition, the officials stated that Safety Assessment's priority is the ongoing weapon refurbishment programs, such as the B61-12 LEP and W88 ALT 370. A September 2015 soft spot improvement project status update anticipated mature GE document drafts during 2016 with finalization to be determined on a per system basis. As of April 2016, Sandia had not issued the updated GE documents. However, Sandia officials informed us that, in March 2016, Safety Assessment provided Systems Engineering with draft GE documents implementing the updated features for three weapon systems for Systems Engineering's review. The officials also informed us that the draft of the updated GE documents for the remaining weapon systems will be released for Systems Engineering's review by the end of FY 2016.

Informed Decision Making and Institutional Knowledge

As a result of not fully implementing the formal tracking system for nuclear safety soft spots, all the information that is needed to make informed decisions about safety improvements in future weapon refurbishment programs and other stockpile management activities may not be readily available in the formal tracking system for Sandia management and weapon engineers to quickly and easily access. We understand that Sandia has prioritized the current weapon refurbishment programs over other projects; however, a fully implemented and well maintained soft spot tracking system will help ensure previous design weaknesses are fully understood and, when appropriate, addressed in LEPs. In addition, future engineers may have difficulty finding the latest information on soft spots if Sandia does not maintain its tracking system, which is significant because a Sandia senior manager expressed concern about turnover of laboratory

employees and the resulting loss of institutional knowledge. This concern is further supported by NNSA's FY 2016 Stockpile Stewardship and Management Plan, which stated that approximately 36 percent of Sandia employees have less than 5 years of service and approximately 21 percent are retirement eligible. A fully implemented and maintained soft spot tracking system can mitigate the effects of potential loss of knowledge by serving as a single configuration-managed repository for all the information related to the soft spots for each weapon system.

RECOMMENDATION

To promote continued improvement in nuclear weapons safety, we recommend that the Manager, Sandia Field Office:

1. Ensure that Sandia formalizes a project plan and establishes a firm completion date for the soft spot GE document improvement project in order to issue revised documents in a timely manner and resume regular updates to the formal tracking system for nuclear safety soft spots.

MANAGEMENT RESPONSE

Management concurred with the report recommendation and stated that Sandia will develop a formal project plan to issue updated GE documents for all weapon systems and resume regular updates to the tracking system. Management noted that the report findings did not indicate that weapon systems have unaddressed safety concerns or that nuclear safety requirements are not met and stated that Sandia will continue to take action to identify and address soft spot issues until the GE document improvement efforts are completed.

AUDITOR COMMENTS

We consider management's comments and planned corrective action to be responsive to our findings and recommendation. Management's formal comments are included in Attachment 3.

Attachments

cc: Deputy Secretary
Chief of Staff

OBJECTIVE, SCOPE, AND METHODOLOGY

OBJECTIVE

The objective of this audit was to determine whether Sandia National Laboratories was effectively managing nuclear weapons safety issues.

SCOPE

This audit was performed between May 2015 and August 2016 in Albuquerque, New Mexico, at the National Nuclear Security Administration's Albuquerque Complex, the Sandia Field Office, and Sandia National Laboratories (Sandia). We also interviewed and requested information from officials at Sandia National Laboratories in Livermore, California. The scope of the audit included reviewing actions Sandia had taken in response to the prior 2008 Office of Inspector General (OIG) audit to identify, track, resolve, and report on nuclear weapons safety issues. The audit was conducted under OIG project number A15AL003.

METHODOLOGY

To accomplish the audit objective, we:

- Reviewed applicable laws, regulations, and Department of Energy policies related to nuclear weapons safety;
- Reviewed nuclear weapons safety policies and procedures in effect at Sandia;
- Obtained the most recent versions of Sandia's soft spot general engineering documents for all weapon systems in the active stockpile and reviewed a judgmental sample of 85 of the 143 soft spots documented across all weapon systems to determine the current status of actions taken to address the soft spots;
- Reviewed documentation related to nuclear weapons safety issues escalated through Sandia's formal Assert, Challenge, Conclude Methodology for Nuclear Weapons Product Realization and the Differing Professional Opinion Resolution process;
- Analyzed documentation from the B61-12 and W88 weapon refurbishment programs to determine if, and how, those programs considered mitigating or eliminating known soft spots; and
- Interviewed key Department and Sandia personnel.

For our judgmental sample of the soft spots, we selected all (100 percent) soft spots that were previously identified as having a status of "under study" or "further study," which totaled 67 soft spots. In addition, from the remaining 76 soft spots with a status other than "under study" or "further study," we selected 18 soft spots with previously documented action plans, indicators

that a study was needed or ongoing, and others that were of interest to the OIG. We did not use statistical samples during the course of this audit. As a result, we could not project the results of our analysis to the population.

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 the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objective. The audit included tests of controls and compliance with laws and regulations to the extent necessary to satisfy the objective. We assessed the implementation of the *GPRA Modernization Act of 2010* as necessary to accomplish the objective, and determined that performance measures related to nuclear weapons safety were established. 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 did not rely on computer-processed data to achieve our audit objective and therefore did not conduct a data reliability assessment.

Management waived an exit conference on July 19, 2016.

PRIOR REPORT

Audit Report on [*Sandia National Laboratories Nuclear Weapons Safety Program*](#) (DOE/IG-0799, July 2008). The Office of Inspector General reported that Sandia National Laboratories (Sandia) had identified 23 serious safety subsystem issues, many of which were first identified in the early 1990s and which had been identified on multiple subsequent occasions. However, Sandia had not developed plans to resolve 16 of the 23 issues and Sandia's plans to address the remaining 7 issues were incomplete. Additionally, Sandia had not fully resolved internal disagreements between Sandia's Nuclear Safety Assessment organization and its Weapons Management organization on the need to address the issues. Sandia asserted that such disagreements were documented so that they could be considered by the Director of the laboratories; however, Sandia could not provide any formal documentation explaining the risk posed by safety issues and the basis for accepting or mitigating those risks. Furthermore, Sandia did not have a formal tracking system identifying actions taken or planned to address the safety issues or the rationale for opting not to address them.

MANAGEMENT COMMENTS



Department of Energy
Under Secretary for Nuclear Security
Administrator, National Nuclear Security Administration
Washington, DC 20585



July 18, 2016

MEMORANDUM FOR RICKEY R. HASS
ACTING INSPECTOR GENERAL

FROM: FRANK G. KLOTZ *FKL 7/18/2016*

SUBJECT: Comments on the Office of Inspector General Draft Report
Titled *Follow-up Audit on Sandia National Laboratories' Nuclear Weapons Safety Program (2014-02424/A15AL003)*

Thank you for the opportunity to review and comment on the subject draft report. We appreciate the auditors' recognition of the actions Sandia National Laboratories (Sandia) has taken to improve the management of nuclear weapons safety "soft spots." We agree with the recommendation to develop a formal project plan for the soft spot General Engineering (GE) document improvement project and resume regular updates to the formal tracking system for nuclear safety soft spots. Sandia will develop a project plan by July 30, 2016, to issue updated GE documents for all weapons systems and resume regular updates to the tracking system.

We would like to emphasize, however, that the issues identified in the report primarily involve ease of access to and centralization of tracking and reporting on soft spots. They do *not* indicate that weapons systems have unaddressed safety concerns or that nuclear safety requirements are not met. While we agree that it is most efficient to update and track the soft spots in a central tracking system, Sandia continues to take action to identify and address soft spot issues until the GE document improvement efforts are completed. For example, Sandia continually gains new knowledge from studies, tests, and analyses, and reports these results to management through the Annual Stockpile Assessment Process. As noted in the report, Sandia management has also effectively considered soft spot information in the design and development activities for the B61-12 Life Extension Program and the W88 Alteration 370.

Technical and general comments have been provided separately to enhance the clarity and accuracy of the report. If you have any questions regarding this response, please contact Mr. Dean Childs, Director, Audit Coordination and Internal Affairs, at (301) 903-1341.



FEEDBACK

The Office of Inspector General has a continuing interest in improving the usefulness of its products. We aim to make our reports as responsive as possible and ask you to consider sharing your thoughts with us.

Please send your comments, suggestions, and feedback to OIG.Reports@hq.doe.gov and include your name, contact information, and the report number. You may also mail comments to:

Office of Inspector General (IG-12)
Department of Energy
Washington, DC 20585

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