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January 21, 2010

The Honorable Michael R. Turner
United States House of Representatives
1740 Longworth House Office Building
Washington, DC 20515

Subject: Response to Request Regarding JASON Report on Life Extension Options for the U.S. Nuclear Weapons Stockpile, letter dated 12/9/09

Dear Representative Turner:

I am responding to your letter of December 9, 2009 requesting our views on the JASON report on "Life Extension Options for the U.S. Nuclear Weapons Stockpile." Thank you for the opportunity to provide Sandia's perspectives on this report in view of our vital role in assuring the reliability, safety, and security of our nuclear deterrent. We appreciate your interest and engagement in the critical discussion regarding the future of our stockpile.

The attachment to this letter, entitled "SNL Perspectives on JASON Report, Life Extension Options for the U.S. Nuclear Weapons Stockpile," summarizes our views and comments.

Our primary concern with the JASON report is that the findings and recommendations are generally stated as if they apply to the entire warhead, whereas the focus is actually on the nuclear explosive package. A full warhead system analysis that considers the tightly coupled requirements and performance of the nuclear explosive package and non-nuclear components is required to determine the appropriate scope and schedule of an LEP. Furthermore, the strategies required to address aging and technology obsolescence of non-nuclear components are different than those required for the nuclear explosive package. The nation's nuclear deterrent is best served by the development and production of new non-nuclear components and subsystems.

We would be pleased to work with you to provide any needed clarifications and to explain issues in further detail.

Sincerely,

Thomas O. Hunter

Enclosure

Copy to (w/enclosure):
Thomas P. D'Agostino, DOE/NNSA/NA-1
George H. Miller, Lawrence Livermore National Laboratory
Michael R. Anastasio, Los Alamos National Laboratory

SNL Perspectives on JASON Report,
"Life Extension Options for the U.S. Nuclear Weapons Stockpile"

Overview

The JASON report underscores the importance of understanding the benefits of life extension options from a full systems perspective. The findings and recommendations of the JASON report are generally stated as if they apply to the entire warhead, whereas the focus is actually on the nuclear explosive package[1]. With respect to the nuclear explosive package, the JASON report reinforces many of the conclusions of tri-lab forums in which Sandia has participated during the last year. However, Sandia is concerned that the important interplay and interdependence between the nuclear and non-nuclear components and differences between nuclear and non-nuclear components were not fully considered in the report. For this reason, Sandia believes the findings and recommendations are not necessarily extensible to the non-nuclear components or the warhead system. Further, we are concerned that some may conclude that the JASON comments might apply to warhead systems.

A full warhead system analysis that considers the tightly coupled requirements and performance of the nuclear explosive package and non-nuclear components is required to determine the appropriate scope and schedule of an LEP. It is important to recognize that issues with non-nuclear components often drive life extension program (LEP) requirements and schedules, just as in the case of the B61LEP. However, replacement of non-nuclear components cannot be accomplished in isolation because they impact the requirements and performance of other components in the warhead system, including the nuclear explosive package. The applicability of the JASON report findings to the nuclear explosive package, the non-nuclear components, and, most importantly, the warhead *system* should be considered in this light.

Comments on Specific Findings and Recommendations

This section provides more detailed comments on the specific findings in the report. The findings are shown verbatim from the report in bold type and are grouped just as in the JASON report.

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[1] The nuclear explosive package is just one element in the system of systems that constitutes our nuclear deterrent. Other important elements of that system of systems include non-nuclear components, command and control, delivery systems, physical security, production capability, arms control treaties and agreements, and non-proliferation efforts. Sandia's primary responsibilities with respect to the nuclear deterrent are for warhead system integration and non-nuclear component design and production.

Since the recommendations are tightly coupled to the findings, Sandia's comments on the findings also apply to the recommendations.

Impacts of Aging and LEPs

JASON finds no evidence that accumulation of changes incurred from aging and LEPs have increased risk to certification of today's deployed nuclear warheads.

Lifetimes of today's nuclear warheads could be extended for decades, with no anticipated loss in confidence, by using approaches similar to those employed in LEPs to date.

Sandia does not believe that the first finding in the executive summary of the JASON report is applicable to non-nuclear components or the warhead system. Specifically, the accumulation of changes in stockpile systems due to aging and changes to original design can be a significant factor for non-nuclear components and does affect confidence in these components and ultimately overall warhead performance. For non-nuclear components, the framework and path forward for life extension options must be considered from a different perspective. Concerns about aging and technology obsolescence for non-nuclear components are most effectively addressed with modern technologies[2]. These modern technologies would also enable Sandia to positively impact warhead reliability, safety, and security. Sandia can confidently execute initial qualification and lifetime assessment of modern non-nuclear components using our suite of engineering tools. Consequently, for any weapons upgrades, Sandia's preferred approach is the development and production of modern non-nuclear components and subsystems. Without the development and introduction of modern non-nuclear components and subsystems to replace the aging and obsolete non-nuclear parts in the stockpile, Sandia does not believe the stockpile can be sustained for decades into the future. In addition, the JASON report points out that we have relaxed requirements that impact DoD nuclear weapon operations to fit existing performance, which Sandia does not believe to be a sustainable or optimal approach. As a note, we are concerned over the understanding of "certification" versus "assessment." The latter allows a judgment of the true state of a stockpile system. The former implies meeting specified requirements and acceptable levels of confidence. Under a clear definition of certification, the JASON conclusion would need to be evaluated further.

Surety Features

Further scientific research and engineering development is required for some proposed surety systems.

Implementation of intrinsic surety features in today's re-entry systems, using the technologies proposed to date, would require reuse or replacement LEP options.

All proposed surety features for today's air-carried systems could be implemented through reuse LEP options.

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[2] Because modern technologies are paramount, the lexicon of "refurbish, reuse, and replace" is generally not relevant for non-nuclear components.

Implementation of intrinsic surety features across the entire stockpile would require more than a decade to complete.

Weapon security should be approached from a systems viewpoint that includes all life cycle configurations and venues[3]. Sandia believes that near term improvements in weapon security using existing technologies should be pursued immediately and can be accomplished under all LEP scenarios including refurbishment, reuse or replacement of the nuclear explosive package. In parallel with near term improvements, a long term vision of intrinsic security[4,5] should be developed as part of a full range of options based on joint Sandia, Los Alamos and Lawrence Livermore National Laboratories input. Sandia also believes that a broad systems approach should be applied to safety issues, which like security, would require greater integration and coordination between the three nuclear weapons laboratories.

Assessment Methods

The basis for assessment and certification is linkage to underground test data, scientific understanding, and results from experiment.

Quantification of Margins and Uncertainties (QMU) provides a suitable framework for assessment and certification.

Increased scientific understanding enables reduced reliance on calibration, enhanced predictive capability, and improved quantification of margins and uncertainties.

We believe these conclusions are valid for all aspects of the warhead system. They should be viewed as a clear endorsement for science-based stockpile stewardship at all three laboratories. Further, they properly put underground testing into a framework of a broader program to assess and certify the stockpile. QMU and predictive capability are important tools for assessment of non-nuclear components although the specific application is different than that for the nuclear explosive package. It is essential for the all three labs to work together to integrate assessments of non-nuclear components and the nuclear explosive package into overall warhead assessments.

Certification challenges

Assessment and certification challenges depend on design details and associated margins and uncertainties, not simply on whether the LEP is primarily based on refurbishment, reuse, or replacement.

Sandia concurs and has no additional comment on this finding.

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[3] Configurations refers to the warhead state, i.e. fully assembled, partially disassembled, mated with the delivery platform; venues refers to the location of the warhead, i.e., transportation, storage, or deployment.

[4] As defined in the JASON report, the term "intrinsic" refers to "inside the nuclear explosive package."

[5] Sandia agrees that implementation of intrinsic surety features across the entire stockpile will take a significant amount of time to accomplish. Sandia believes that the timeline for implementation of the full range of security options, including intrinsic security, is on the order of thirty years, although this timeline could be shortened given a significant increase in resources throughout the Nuclear Weapons Enterprise.

Overall balance

Certification of certain reuse or replacement options would require improved understanding of boost.

Continued success of stockpile stewardship is threatened by lack of program stability, placing any LEP strategy at risk.

Sandia has no additional comment on the first of these two findings. Sandia strongly agrees with the second finding. In fact, stewardship of the stockpile requires program stability guided by clarity of the nation's policy on the nuclear deterrent, an effective decision-making structure between the Congress and Executive Branch, and a commitment to effective governance, management, and oversight structure for the Laboratories. The next section of this document, which contains Sandia's amplifying comments, provides additional remarks regarding program stability.

Surveillance

The surveillance program is becoming inadequate. Continued success of stockpile stewardship requires implementation of a revised surveillance program.

A robust surveillance program is required to maintain confidence in the deterrent in the absence of underground nuclear testing. However, surveillance needs and opportunities for non-nuclear components are different than those for the nuclear explosive package. Historically, surveillance of non-nuclear components has been focused on pass-fail testing to identify design or production defects and assess current reliability. The program going forward must combine margin testing, failure analysis, materials aging research, and computer simulation to predict reliability and also safety and security performance into the future. Funding shortfalls in the surveillance program jeopardize the nuclear deterrent annual assessment process. Hence, the JASON conclusion is valid and can be applied broadly across the stockpile.

Amplifying Comments

As Sandia considers its responsibility for weapon system integration and the design and production of non-nuclear components, the key factors for succeeding in any lifetime extension option include:

Technology maturation—Any weapon modification requires significant development work for non-nuclear components. Stockpile management requires up-front investment in

technology maturation to take full advantage of opportunities to address aging issues, technology obsolescence, and enhance safety and security[6].

Expertise of workforce—It is imperative to maintain a highly competent NW workforce that supports our entire deterrent now and in the future, including science, engineering, design and production capability. Sandia sees a need for more formalism in how competencies are tracked and managed, including structured programs to support competency sustainment and development, and the establishment of learning environments where the different experience and knowledge represented by staff can be effectively passed between generations.

Capabilities—Facilities, equipment and qualified staff provide the tools and technical data that inform QMU and predictive capability and provide confidence in the design, qualification and annual assessment of non-nuclear components.

Program stability—Program stability enables robust competencies and capabilities. As stated in the JASON report, "Low-levels of intermittent new production work are not conducive to efficient and effective operations". The Nuclear Weapons Enterprise must have the foresight to continuously invest in workforce and capabilities that, even if not immediately needed, will be required for future LEPs[7]. The "only what is needed today" approach has proved to be ineffective when development is actually called for and serves to subsequently undermine the vitality of the deterrent.

Surveillance—A robust surveillance program is needed for non-nuclear components. Increased emphasis on detecting and characterizing aging mechanisms is critical to understanding how margins and uncertainties are changing over time and impacting confidence in the stockpile. In addition, a fully-funded surveillance program helps to identify technology maturation needs, sustain a highly competent workforce, and fully utilize capabilities.

Summary

In closing, it is important to recognize that nuclear explosive package, non-nuclear component and warhead system considerations are essential to a comprehensive strategy for sustaining and modernizing the stockpile. Replacement of non-nuclear components with modern technologies will enable Sandia to enhance the safety and security of our deterrent and at the same time strengthen our confidence in the performance of warheads. The nation is best served by a balanced, stable, enduring program that supports stockpile management through an energized, creative workforce challenged to develop and apply tools and technologies and supported by

[6] To address the anticipated B61LEP, significant and sustained investment in technologies must be realized immediately to meet schedules for the first production unit and commitments to our allies. In hindsight, this could have been done more efficiently and effectively with a more sustained, stable investment in technology maturation leading up to the LEP. This is a lesson that must be applied through all the stockpile management efforts.

[7] For example, while the need for strategically radiation hardened electronics and the full suite of supporting design, testing and analysis are not required for the B61 LEP, these capabilities must be maintained at a sufficient level such that they can be brought to bear on future reentry system LEPs.

world-class facilities and equipment. This environment will enable us to maintain and enhance the safety, security, and effectiveness of the nation’s nuclear deterrent.