ASSESSMENT REPORT FOR DESIGN AGENCY IMPLEMENTATION OF DOE-NA-STD-3016-2006: *HAZARD ANALYSIS REPORTS FOR NUCLEAR EXPLOSIVE OPERATIONS*

National Nuclear Security Administration

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DECEMBER 2007

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EXECUTIVE SUMMMARY

This report describes the results of a review of the implementation of DOE standard DOE-NA-STD-3016-2006, *Hazard Analysis Reports for Nuclear Explosive Operations,* at the three nuclear weapon design laboratories referred to as the Design Agencies (DAs). NNSA Federal employees from Headquarters and the field performed the review. The team developed four, high-level objectives that were further clarified through several criteria (fourteen criteria in total) as the basis for determination of compliance with the requirements of the standard. Evaluation results were characterized as strengths or noteworthy practices; findings – which indicate noncompliance with some aspect of the standard and require corrective action on the part of the DA; or observations – which identify issues the DA should consider for action but do not require a formal response.

The team does not attach any significance to the *number* of findings that were identified; rather, it is the content of the findings and associated discussions that are significant.

The objectives against which the procedures were reviewed were designed to indicate the adequacy of the procedures when compared to the expectations established in DOE-NA-STD-3016-2006. All DAs adequately completed initial measures to implement their procedures. While all DA procedures exhibited both strengths and weaknesses, the LLNL and LANL procedures were both reasonably thorough in defining adequate processes to support the development of weapon response and bases documents. All three sets of DA procedures require additional work before they meet NNSA expectations, however. The findings in the report identify areas where the review team determined the DA procedures did not meet the criteria established in the Standard.

There are two areas where all of the DA procedures deviated from the expected performance:

- DA procedures did not adequately identify expected training and qualification requirements for weapon response analysts, reviewers, and those involved in expert elicitation.

- DA procedures did not adequately specify their expectations for documentation of weapon response information, particularly with respect to the use of expert judgment.

These areas are discussed in more detail in the body of this report and in the assessment forms.

The team recommends that NNSA forward this report to the DAs to address the identified findings. NNSA should review corrective actions and their effectiveness.

1.0 Introduction

The National Nuclear Security Administration (NNSA) of the Department of Energy (DOE) issued DOE standard DOE-NA-STD-3016-2006, *Hazard Analysis Reports for Nuclear Explosive Operations,* in May of 2006 (Reference 1). This standard is a successor document to an earlier version, DOE-DP-STD-3016-1999, which is listed in 10 CFR 830, *Nuclear Safety Management,* as providing an acceptable methodology for developing Documented Safety Analyses for nuclear explosive operations. The standard was revised to provide further clarification for performing hazard and accident analyses using a tailored approach to DOE-STD-3009-94, Change Notice 2. The revised standard introduces procedural and technical requirements that affect the generation of weapon response (WR) information by the Design Agencies (DAs). DAs are the three national laboratories that have weapon design responsibilities: Lawrence Livermore National Laboratory (LLNL), Los Alamos National Laboratory (LANL), and Sandia National Laboratories (SNL).

The new standard introduces expectations for a more formal approach in a number of areas involved in generating weapon responses. The increased formality is expected to improve the transparency, traceability, reproducibility, and rigor of the overall process, and to help ensure that the quality with which the DAs produce weapon responses is maintained.

This report documents a review of the DA implementation of the revised standard, and focuses solely on the processes the DAs utilize for developing and documenting WR information to the Production Plant Contractor (PPC). This focus is consistent with commitments that the NNSA made to the Defense Nuclear Facilities Safety Board (DNFSB – References 2 and 3) to ensure that the high-level requirements of the revised standard would be implemented with adequate detail.

2.0 Scope

DOE-NA-STD-3016-2006 provides a safe harbor methodology that may be followed during the development of a Hazard Analysis Report (HAR). For nuclear explosive operations, the standard provides clarification for performing hazard and accident analyses in accordance with DOE-STD-3009-94, Change Notice 2. The methodology requires the interaction between multiple DAs and the PPC to determine how weapons respond to potential hazard and accident scenarios during operations at a production plant. The objective of this review is to ensure that the DAs have the mechanisms in place that are required to fulfill their roles in a manner that complies with the standard.

The methodology in the standard provides the DAs with considerable flexibility with respect to the processes that they follow, and many of the details of implementation are situation specific. However, the standard includes some key process requirements that must be developed, approved and available for a DA to comply with the overall methodology. The objectives and criteria in this document focus on those key process requirements.

The mechanics of the exchange of information between the DAs and the PPC is at their own discretion and is not covered as part of this review. The governing document for those

procedures/processes is TBP-908, *Technical Business Practice for Hazards Analysis and Weapon Response*. TBP-908 is produced and maintained as a result of a cooperative effort between the DAs and the PPC.

Field validation of whether weapon responses are being produced to comply with DA procedures is not within the scope of this review. It is anticipated that the normal HAR review processes performed by both the PPC and the Site Office(s), or other NNSA or field element oversight activities will identify potential areas of non-compliance with respect to developing weapon responses in accordance with the requirements of the revised standard.

3.0 Objectives and Criteria

The objectives of the review are in Attachment 1. The first two objectives apply in general to the DA weapon response procedures. The third and fourth objectives cover specific requirements on those procedures with regard to expert judgment and peer review.

Each objective is further defined through specific criteria, as appropriate.

4.0 Team Composition and Assignments

Kamiar Jamali	NNSA HQ – NA-12, Team Lead
Karl Waltzer	Pantex Site Office (PXSO), Lead for Objective 1
Jim Winter	NNSA HQ – NA-173, Lead for Objective 2
Don Nichols	NNSA HQ – NA-2.1, Lead for Objective 3
William (Ike) White	NNSA HQ – NA-2.1, Lead for Objective 4
Les Winfield	Nevada Site Office
Anita Leivo	Los Alamos Site Office, Quality Assurance for Los Alamos review
Lisa Dancy	Livermore Site Office, Quality Assurance for Livermore review
Dan Pellegrino	Sandia Site Office, Quality Assurance for Sandia review

5.0 Approach

The assessment team held a workshop in July of 2007 with full DA participation to clarify NNSA expectations on the contents of DA implementing procedures and to allow the review team to develop some understanding of the commonality and the differences among DA procedures and processes for generating WR information.

The assessment team reviewed procedures and documentation provided by the DAs against the objectives and criteria in this document. As mentioned earlier, the adequacy of weapon responses developed using these procedures was not reviewed because the procedures are too new for a representative sample of weapons responses to have been developed according to the procedures. The same is true of documentation developed to support the responses. These process outputs will be reviewed as part of future, routine Headquarters and field element

oversight activities.

The team leader assigned the Objectives to Objective Team Leaders. Each Objective Team Leader assigned one or more criteria to the individual members of his team. Team members developed lines of inquiry as appropriate based on the assigned criteria. Team members were asked to discuss questions or obtain clarifying information from the DA points of contact as needed during the review.

The results of the review activities for each objective are included as Attachments 2-4. The final assessment report was concurred upon by all of the team members. There were no minority opinions. The DAs were given an opportunity to provide input to the factual accuracy of the report.

The results of evaluations of the criteria are characterized as strengths or noteworthy practices; findings – which indicate noncompliance with some aspect of the standard and require corrective action on the part of the DA; or observations – which identify issues the DA should consider for action but do not require a formal response.

The DA procedures were delivered to the review team during the month of October. The review team performed its assessment during November and shared the results with the DAs in December. Assessments were based on determinations of whether DA procedures met the criteria described in Attachment 1. The criteria were developed from the key weapon response process requirements articulated in the revised standard.

6.0 RESULTS

The detailed results of the review are documented in the assessment forms in Attachments 2-4 and findings are summarized briefly below.

The objectives against which the procedures were reviewed were designed to indicate the adequacy of the procedures when compared to the expectations established in DOE-NA-STD-3016-2006. DA performance with respect to specific objectives was mixed. All DAs adequately completed initial measures to implement their procedures (Objective 2). The LLNL and LANL procedures both defined adequate processes to support the development of weapon response and bases documents (Objective 1). However, the SNL procedure generally lacked sufficient depth to serve as an effective quality assurance tool, and none of the procedures provided adequate details on the specific types of technical information that must be documented with relying on expert judgment. Although the LLNL and LANL submittals demonstrated a reasonably thorough set of procedures, and were notable for their thorough treatment of expert elicitation, all three sets of DA procedures require additional work before they meet NNSA expectations for compliance with DOE-NA-STD-3016-2006.

There were three areas in which all three DAs fell short of NNSA's expectations, as discussed in the following paragraphs.

NNSA expected the DA procedures to establish requirements for formal education, experience level, and functional area training, such as how to develop weapon response information including expert judgment and expert elicitation processes. In general, the DA procedures established a minimum set of training, such as required reading with regard to weapon response development, but did not set requirements regarding professional background and experience. In one case, the level of experience and knowledge for many of the technical areas was identified as a 'familiarity level;' this term was not defined, but the meaning in common usage of this term is inconsistent with actual practice at the specific DA and is inconsistent with NNSA expectations. The term 'familiarity level' has been used in NNSA (for example, in NNSA qualification programs) to mean basic knowledge of or exposure to the subject or process adequate to discuss the subject or process with individuals of greater knowledge. This level of knowledge would generally be inadequate where this term is used in the DA procedure.

NNSA expected the DA procedures to establish a minimum set of requirements for the type of technical information that must be documented in developing weapon responses including when expert judgment is employed. In general, the DA procedures required the documentation to be complete and traceable, but did not set a standard for what constituted a complete and traceable data set. An acceptable standard could have provided examples of the types of information that must be recorded, based on past experience, or employed some other mechanism to ensure that expectations for a consistent and complete record set were defined.

Finally, although two of the DA procedures included fairly complete treatment of expert elicitation, NNSA noted an absence of training requirements on the common errors that experts make when developing or relying on expert judgment, particularly when that judgment is developed and used outside of an expert elicitation process.

6.1 Specific Findings

This section lists the specific findings associated with each of the DA procedure sets. The team does not attach any significance to the number of findings identified in this report; rather, it is the content of the findings and associated discussions that are significant. The listing provided here is only a summary; addressing the issues requires a review of the complete assessment forms for each of the DAs. The assessment forms include more detailed discussion, additional observations, and also note some strengths of the various DA approaches that were employed.

LLNL

- The procedure lacks specificity regarding expectations or requirements for qualification of those involved in weapon response analysis including expert judgment and expert elicitation.
- The LLNL procedure does not specify specific technical details or examples of the types of technical information that should be documented in order to meet the performance required by STD-3016.
- The unique aspects of expert judgment and the technical aspects of the process and its pitfalls are not discussed in the LLNL procedure.

- The LLNL weapon response procedure does not specify what the training and qualification requirements should be for peer reviewers, beyond the minimal required reading list.
- The LLNL weapon response procedure provides no definition, clarification, or specific criteria for independence of peer reviewers, beyond the simple assertion that they will be independent subject matter experts.

LANL

- The entry-level and final qualification requirements for weapon response analysts are not adequately specified and the responsibility for identifying those qualified as weapon response analysts is unclear.
- The LANL procedure does not specify specific details as to the type of information that must be retained to ensure that the required performance is met for documenting the use of expert judgment.
- The unique aspects of expert judgment and the technical aspects of the process and its pitfalls are not discussed in W-10-AD-0002U, Method for Documenting and Reviewing Expert Judgment.
- There is no identification of key considerations and related training needs for the experts, either in an expert judgment or in an expert elicitation process, to ensure experts' familiarization with the requisite knowledge base regarding probability encoding.
- The LANL weapon response process allows for a graded approach to peer review without providing an adequate definition of when the graded approach is allowed, and without providing an adequate description of the allowed approach to grading the peer review process.
- The LANL weapon response procedures do not establish training and qualification requirements for peer reviewers.

SNL

- SNL procedure *Pantex Weapon Response Data Preparation and Review* does not adequately describe the processes needed to prepare and document screening and weapon response information.
- It is not clear in the procedure that the definition of expert judgment, and the associated documentation requirements, take precedence over the notional definition of engineering judgment; the broad definition of engineering judgment would appear in practice to overlap many instances that would meet the definition of expert judgment as used in the DOE Standard.
- The treatment of informal expert judgment improperly bypasses the expert elicitation process requirements without specifying adequate documentation requirements when informal expert judgment is used.
- SNL procedures do not adequately define what must be documented with respect to the exercise of expert judgment and expert elicitation. There are two general deficiencies in this regard. The procedures do not establish the expected utility of the documentation (such as an expectation to provide sufficient detail so that a qualified analyst could reproduce the outcome); and, the procedures do not establish concrete guidance as to technical details that

must be documented in order to create the desired utility (as could be done, for example, by providing examples of adequate documentation for certain types of analyses or elicitations).

- The SNL procedure for expert elicitation does not say which information generated in the elicitation process (such as expert answers to open ended questions, peer review feedback and resolution, etc.) is to be captured and retained with the records of the elicitation process.
- There is no discussion of potential pitfalls in application of expert judgment/elicitation processes, such as biases, tendency to underestimate uncertainties, issues in converting phenomenological knowledge into probabilities, number of factors that can be handled simultaneously, factors that may impact consistency, level of detail, difference between a screened weapon response and a low probability of response, etc.
- The SNL weapon response procedure does not clearly define the required scope of the peer review for weapon response information.
- The SNL procedure does not define a clear approach or process for conducting the peer review.
- The training and qualification programs for weapon response analysts and for independent assessors do not capture all of the necessary core competencies in a way that would ensure an appropriate level of knowledge of the SNL weapon response and peer review process.

7.0 PATH FORWARD

The review team recommends that NNSA forward this report to the DAs to address the identified findings. Corrective actions and the effectiveness of those actions should be reviewed by NNSA.

8.0 REFERENCES

1. DOE-NA-STD-3016-2006, *Hazard Analysis Reports for Nuclear Explosive Operations,* May 2006.
2. Letter from NNSA Acting Administrator, William C. Ostendorff, to DNFSB Chairman, A.J. Eggenberger, dated June 19, 2007.
3. Letter from NNSA Principal Deputy Administrator, William C. Ostendorff, to DNFSB Chairman, A.J. Eggenberger, dated November 23, 2007.

ATTACHMENT 1

Review Objectives

Objective 1: The DA has developed and approved a DA procedure (or procedures) that define the DA processes supporting the development of weapon response and weapon response bases documents.

Criterion 1.1: The procedure(s) define the processes, roles and responsibilities within the DA for developing weapon response and the associated documentation.

Criterion 1.2: The procedure(s) require(s) the basis for weapon response to be documented with a level of detail that would permit a knowledgeable reviewer to trace weapon response and screening conclusions back to the underlying source data, calculations, analytical methods, and judgments. The documentation requirements are sufficient to allow an adequate peer review.

Criterion 1.3: The procedure(s) include provisions to ensure that the information used within or supporting weapon response basis documentation is preserved and available to support the NNSA Hazard Analysis Report (HAR) review.

Criterion 1.4: The procedure(s) establish criteria for qualification of persons involved in the development of weapon response, and identify training requirements with respect to understanding Quality Assurance Programs (QAPs) and DA Weapon Response Procedures.

Objective 2: Initial measures required to implement the DA procedure have been completed.

Criterion 2.1: The procedure(s) have been made available to DA personnel who develop weapon response.

Criterion 2.2: Training of weapon response development personnel on the procedures has been documented. As a minimum, documentation certifies that the weapon response personnel have read and understand the procedures and included requirements.

Objective 3: The DA weapon response development procedure(s) define the process for using expert judgment and expert elicitation where needed for developing specific responses.

Criterion 3.1: The procedure(s) establish the circumstances that warrant consideration of the use of expert judgment and expert elicitation.

Criterion 3.2: The procedure(s) establish the documentation requirements associated with the use of expert judgment and expert elicitation.

Criterion 3.3: The procedure(s) establish key considerations that guide the development and application of expert judgment and expert elicitation in order to guard against the potential pitfalls associated with their use.

Criterion 3.4: The procedure(s) have been included in the approved DA QAP (procedures may be included by reference).

Objective 4: The DA weapon response development procedure(s) define a process for conducting peer reviews of all relevant weapon response documents.

Criterion 4.1: The procedure(s) define the situations in which internal and/or external peer reviews of weapon response information are required, and the associated scope of the review(s).

Criterion 4.2: The procedure(s) establish criteria for independence, training and qualification of persons participating in peer reviews of weapon response information.

Criterion 4.3: The procedure(s) establish the documentation requirements associated with peer review deliberations and comment resolution.

Criterion 4.4: The procedure(s) have been included in the approved DA QAP (procedures may be included by reference).

ATTACHMENT 2

Lawrence Livermore National Laboratory
Assessment Reports

Objective 1

The Design Agency (DA) has developed and approved a DA procedure (or procedures) that define the DA processes supporting the development of weapon response and weapon response bases documents.

Criterion 1.1

The procedure(s) define the processes, roles and responsibilities within the DA for developing weapon response and the associated documentation.

Approach/Lines of Inquiry

The evaluation was conducted by reviewing the Lawrence Livermore National Laboratory procedure *W Program Procedure for Weapon Response Documents: Development, Review and Approval*, NWP-QIP-001, dated September 28, 2007. The format and content of the LLNL procedures was compared to the criteria established by the Review Plan and the requirements of STD-3016.

The procedure was evaluated to determine whether processes, roles and responsibilities had been identified for the development of screening criteria and weapon responses including producing summary and bases documents (with important assumptions and/or initial conditions); transmitting information to production agencies; coordinating weapon responses with other design agencies when required; and ensuring the traceability of information/results and maintaining bases information in accordance with an NNSA approved quality assurance program.

The procedure was also evaluated to determine whether processes, roles and responsibilities had been adequately established and/or identified for conducting expert elicitation and peer review activities and for the characterization of probabilities and uncertainties for weapon response estimates.

Discussion of Results

The weapon response process procedure adequately establishes the roles and responsibilities for the preparation and documentation of weapon responses. The process used to develop weapon response information is also described; however, the format and documentation of the actual response information do not appear to be established. Processes for transmitting information to other design agencies and production agencies are described. Requirements for creating summary and bases information are established. Requirements to characterize and document the derivation of probabilities and uncertainties are established.

A process for conducting expert judgments and expert elicitation is established including identification of roles and responsibilities, a description of entry conditions, descriptions for judgment and elicitation processes, and requirements for documentation and review.

Conclusion

The criterion is met.

Observation
The procedure does not establish format and content requirements or expectations for weapon response summary or bases documents or for screening tables including "rules", assumptions and initial conditions. Practical examples are absent from the procedure.

Objective 1

The Design Agency (DA) has developed and approved a DA procedure (or procedures) that define the DA processes supporting the development of weapon response and weapon response bases documents.

Criterion 1.2

The procedure(s) require(s) the basis for weapon response to be documented with a level of detail that would permit a knowledgeable reviewer to trace weapon response and screening conclusions back to the underlying source data, calculations, analytical methods, and judgments. The documentation requirements are sufficient to allow an adequate peer review.

Approach/Lines of Inquiry

The evaluation was conducted by reviewing the Lawrence Livermore National Laboratory procedure *W Program Procedure for Weapon Response Documents: Development, Review and Approval*, NWP-QIP-001, dated September 28, 2007. The format and content of the LLNL procedures was compared to the criteria established by the Review Plan and the requirements of STD-3016.

The procedure was evaluated to determine whether processes have been established to assure a knowledgeable reviewer could trace weapon response and screening conclusions back to the underlying source data, calculations, analytical methods, and judgments.

Discussion of Results

The procedure contained adequate instructions to ensure documentation of information related to assumptions and initial conditions relied upon to develop weapon responses (including information from expert judgment and expert elicitation processes); however, only general reference was made to documenting the information necessary to trace screening and weapon response conclusions e.g., source data, calculations, analytical methods, etc.

Conclusion

The criterion is met.

<u>Observation</u>
The procedure did not specify the type information necessary to trace screening and weapon response conclusions e.g., source data, calculations, analytical methods, assumptions, etc.

Objective 1

The Design Agency (DA) has developed and approved a DA procedure (or procedures) that define the DA processes supporting the development of weapon response and weapon response bases documents.

Criterion 1.3

The procedure(s) include provisions to ensure that the information used within or supporting weapon response basis documentation is preserved and available to support the NNSA Hazard Analysis Report (HAR) review.

Approach/Lines of Inquiry

The evaluation was conducted by reviewing the Lawrence Livermore National Laboratory procedure *W Program Procedure for Weapon Response Documents: Development, Review and Approval*, NWP-QIP-001, dated September 28, 2007. The format and content of the LLNL procedures was compared to the criteria established by the Review Plan and the requirements of STD-3016.

The procedure was reviewed to determine the expectations/direction regarding the development and documentation of information used to create weapon response bases information.

Discussion of Results

The procedure contained instructions to develop weapon responses bases (including information from expert judgment and expert elicitation processes); however, only general reference was made to documenting the information necessary to trace development of screening and weapon responses e.g., source data, calculations, analytical methods, etc.

Conclusion

The criterion is met.

<u>Observation</u>
The procedure did not specify the type information necessary to trace development of screening and weapon responses e.g., source data, calculations, analytical methods, assumptions, etc.

Objective 1

The Design Agency (DA) has developed and approved a DA procedure (or procedures) that define the DA processes supporting the development of weapon response and weapon response bases documents.

Criterion 1.4

The procedure(s) establish criteria for qualification of persons involved in the development of weapon response, and identify training requirements with respect to understanding QAP and DA Weapon Response Procedures.

Approach/Lines of Inquiry

The evaluation was conducted by reviewing the Lawrence Livermore National Laboratory procedure *W Program Procedure for Weapon Response Documents: Development, Review and Approval*, NWP-QIP-001, dated September 28, 2007. The format and content of the LLNL procedures was compared to the criteria established by the Review Plan and the requirements of STD-3016.

Specifically, the procedure was evaluated to determine whether sufficient criteria have been established for training and qualification of personnel generating weapon response and screening information.

Discussion of Results

The LLNL procedure discusses training for personnel involved in the development and production of weapon response information. However, the weapon response procedure training requirements are general with no specific objectives established, and qualification requirements are not discussed.

The procedures for expert judgment and expert elicitation require all participants involved in judgment or elicitation activities to complete training that covers five topical areas key to a judgment/elicitation process; however, qualification requirements are not discussed.

Conclusion

The criterion is not met.

<u>Finding</u>
The procedure lacks specificity regarding expectations or requirements for qualification of those involved in weapon response analysis including expert judgment and expert elicitation.

Objective 2

Initial measures required to implement the DA procedure have been completed.

Criterion 2.1

The procedure(s) have been made available to DA personnel who develop weapon response.

Approach/Lines of Inquiry

Document Reviewed:

- NWP-QIP-001, *W Program Procedure for Weapon Response Documents: Development, Review & Approval,* 09/28/07
- NWP-QAP, *LLNL Nuclear Weapons Program Quality Management Policy and Quality Assurance Plan,* Revision 2, 9/10/07
- LLNL e-mail, LLNL W Associate Program Leader, Stockpile Management to DA Personnel, *Training Requirements for Weapons Response Procedures,* 10/5/07

Discussion of Results

The LLNL weapon response procedure (NWP-QIP-001) was approved on 9/28/07 and released to the entire laboratory within the weapon quality assurance plan (NWP-QAP) and made available electronically within the LLNL NWP system of implementing guides and implementing procedures. Additionally, the W Associate Program Leader for Stockpile Management informed all of the DA personnel responsible for performing weapons response of this revised procedure and provided instructions for completing required reading of the new Quality Implementing Procedure, but also, STD-3016 and the NUREG discussing conducting Expert Elicitation.

Conclusion

The criterion is met.

Objective 2

Initial measures required to implement the DA procedure have been completed.

Criterion 2.2

Training of weapon response development personnel on the procedures has been documented. As a minimum, documentation certifies that the weapon response personnel have read and understand the procedures and included requirements.

Approach/Lines of Inquiry

Document Reviewed:

- NWP-QIP-001, *W Program Procedure for Weapon Response Documents: Development, Review & Approval,* 09/28/07
- LLNL e-mail, LLNL Associate Program Leader, Stockpile Management to DA Personnel, *Training Requirements for Weapons Response Procedures,* 10/5/07

Discussion of Results

As part of the instruction in the W Associate Program Leader for Stockpile Management e-mail, the personnel involved in WR activities were to review the document and reply (thereby providing a record) that they completed the review and that they understand the requirements for Weapon Response. The LLNL W Program Associate Program Leader for Stockpile Management is collecting these responses as certification of meeting the training requirement. Replies are also sent to administrative and Quality Assurance personnel to provide back up of the training records. A majority of DA weapons response personnel had documented completion of the required training during the assessment.

Conclusion

The criterion is met.

Objective 3

The DA weapon response development procedure(s) define the process for using expert judgment and expert elicitation where needed for developing specific responses.

Criterion 3.1

The procedure(s) establish the circumstances that warrant consideration of the use of expert judgment and expert elicitation.

Approach/Lines of Inquiry

Document Reviewed:

- NWP-QIP-001, *W Program Procedure for Weapon Response Documents: Development, Review & Approval,* 09/28/07

Discussion of Results

The LLNL procedure states that expert judgment is generally used throughout the process. Examples provided include assessing qualified data, types of applicable analysis and in determining reasonable extrapolation of the existing data. Section 7.3.4 of the LLNL procedure discusses expert judgment and elicitation in some detail, and notes that while use of expert judgment is endemic to their process, expert elicitation is not the standard process but may be appropriate in certain circumstances.

The LLNL procedure states that the use of expert elicitation should be considered when one or more of the conditions cited in STD-3016 are met. Appendix A to the LLNL procedure repeats these considerations. Neither body nor the Appendix of the procedure expands upon the areas of consideration listed in the Standard, or provides examples of situations where expert elicitation is warranted.

The LLNL procedures could be more thorough regarding the use of expert judgment, by including more detail on defining or selecting the scope of the problem, refining the problem, and mental processes at arriving at a solution (e.g., assumptions, definitions, decomposition into parts). Even when the response is based on a significant amount of statistical data (note that there is always stochastic uncertainty, and data-, modeling-, and completeness-type uncertainties are also usually present), expert judgment is often necessary in converting the available information into probability of response (so-called probability encoding) and representation of its uncertainty (to provide the basis for 'reasonably conservative' point-estimates).

Examples, based on many years of providing weapon responses, of examples of circumstances that involve exercise of expert judgment and those that may warrant use of the expert elicitation processes would be useful.

Conclusion

The criterion is met.

The LLNL procedure establishes high level circumstances that warrant consideration of the use of expert judgment and expert elicitation, but does not provide sufficient detail to be of practical impact. The LLNL procedure does not expand upon the areas of consideration listed in the Standard, or provide examples of situations where expert elicitation is warranted.

Observations

- Additional description and/or examples of the circumstances that warrant the use of expert judgment would be useful
- Discussion of situations in which expert judgment is equivalent to a self-elicitation process and should follow the documentation requirements for expert elicitation would be useful.
- Additional description and/or examples of the circumstances that warrant the use of the expert elicitation process would be useful

Objective 3

The DA weapon response development procedure(s) define the process for using expert judgment and expert elicitation where needed for developing specific responses.

Criterion 3.2

The procedure(s) establish the documentation requirements associated with the use of expert judgment and expert elicitation.

Approach/Lines of Inquiry

Document Reviewed:

- NWP-QIP-001, *W Program Procedure for Weapon Response Documents: Development, Review & Approval,* 09/28/07

Discussion of Results

The LLNL procedure provides a good discussion of expert elicitation process and includes documentation requirements for the key information that is generated during the process. This information is required to be included in the final report for the expert elicitation, and would appear to capture the full scope of the considerations that factored into the use of expert elicitation. However, some detail on specific supporting information necessary depending on the type of judgment exercised would be useful if expert elicitation is ever used at LLNL for developing weapons responses. Information in the base procedure on individual expert judgment could be useful in that regard. In addition, it would be useful to discuss the limiting case where the expert being elicited is the weapon responder, to address documentation requirements for the situation where the distinction between expert elicitation and expert judgment becomes blurred.

With regard to expert judgment, Section 16, *Documentation*, of the LLNL procedure states that the weapon response and technical basis will be formally documented, and that the Master Record List must list all the records that were used to produce the weapon response and bases summary documents package and the information necessary to locate the archival copies. Some of the documents to be included are listed. However, the LLNL procedure essentially repeats the performance-based documentation requirements from the Standard, and does not discuss the need to document specific technical details to ensure that the required performance is met. The details of documentation will vary by situation, but some specifics could be provided by describing the typical analyses that are performed and describing the documentation requirements when those types of analyses are performed.

For example, the procedure could include generic statements that apply when the condition described exists, such as: "When modeling is used to provide insight into the situation, as a minimum the nature of the model, the input parameters, and the output must be included in the report. If used, modeling must include a sensitivity analysis to ensure the stability of the outcome, and the report must discuss this analysis." Another example might be: "When test data is used to predict the outcome of an event, but the test did not replicate the actual event, the

method and assumptions used to apply the test data to the actual situation must be recorded and included in the report, together with the supporting rationale. If extrapolation or interpolation is necessary, the method used to perform the extrapolation or interpolation must be included."

The primary value of the procedure is in the degree to which the DA has captured what it typically does when it creates a weapons response, and specified how the basis information must be documented for each of the situations that are encountered. Such an analysis is necessary to ensure consistent, high-quality documentation.

Conclusion

The criterion is not met.

Although an appropriate discussion of documentation requirements with respect to a general expert elicitation process was provided, that process is generally not used at LLNL to develop weapons responses. For the more usual case when an individual expert applies judgment is used, the documentation requirements are not sufficiently detailed to ensure a high quality record is developed and maintained.

Finding
The LLNL procedure does not specify specific technical details or examples of the types of technical information that should be documented in order to meet the performance required by STD-3016.

Objective 3

The DA weapon response development procedure(s) define the process for using expert judgment and expert elicitation where needed for developing specific responses.

Criterion 3.3

The procedure(s) establish key considerations that guide the development and application of expert judgment and expert elicitation in order to guard against the potential pitfalls associated with their use.

Approach/Lines of Inquiry

Document Reviewed:

- NWP-QIP-001, W *Program Procedure for Weapon Response Documents: Development, Review & Approval*, 09/28/07

Discussion of Results

Although the LLNL procedures discuss expert elicitation in relative detail, additional discussion could be useful with respect to guarding against pitfalls of the process, including a discussion of key considerations and related training needs for the experts, either in an expert judgment or in an expert elicitation process, to ensure experts' familiarization with the requisite knowledge base in regards to probability encoding.

In comparison to expert elicitation, there is little discussion of potential pitfalls in application of expert judgment. Many of the same issues, such as biases, tendency to underestimate uncertainties, issues in converting phenomenological knowledge into probabilities, number of factors that can be handled simultaneously, factors that may impact consistency, level of detail, etc., apply equally to expert judgment and should be discussed. A brief discussion of these areas, used in conjunction with required reading for more detail, could improve the procedures. Section 8.0 of the LLNL procedure discusses "Characterization of Probabilities and Uncertainties." This section, and its associated Appendix B, meet the intent of this criterion in providing discussions of some of the key considerations in its area of coverage, but could be improved regarding the basis for the approach suggested in Section 8.0 of the standard. The model provided in Appendix B is only applicable to a particular type of weapon response, and the basis for the recommended approach in Section 8.0 of the standard goes beyond this narrow area of application.

Conclusion

The criterion is not met.

The procedure(s) establish key considerations to guard against the potential pitfalls of expert elicitation; however, the application of those considerations to expert judgment is not adequate.

Finding

The unique aspects of expert judgment and the technical aspects of the process and its pitfalls are not discussed in the LLNL procedure.

Observation

The discussion of key technical considerations and pitfalls in the areas of expert judgment and expert elicitation could be improved by including required references for training purposes that discuss these pitfalls in greater detail.

Objective 3

The DA weapon response development procedure(s) define the process for using expert judgment and expert elicitation where needed for developing specific responses.

Criterion 3.4

The procedure(s) have been included in the approved DA Quality Assurance Programs - QAPs (procedures may be included by reference).

Approach/Lines of Inquiry

The LLNL Quality Implementing Procedure (QIP) entitled "LLNL W Program Procedure for Weapon Response Documents: Development, Review and Approval" and the "LLNL Nuclear Weapons Program Quality Management Policy and Quality Assurance Plan, Revision 2" were reviewed to complete the evaluation of the criteria.

Discussion of Results

LLNL included its QIP, "LLNL W Program Procedure for Weapon Response Documents: Development, Review and Approval," in its "LLNL Nuclear Weapons Program Quality Management Policy and Quality Assurance Plan, Revision 2 (LLNL NWP QAP)." The NWP QAP was approved on September 28, 2007. Section 3.0 Basic Requirements of the LLNL NWP QAP specifically lists DOE-NA-STD-3016-2006 as a requirement which is addressed in QIP-001 "W-Program Procedure for Weapon Response Documents: Development, Review and Approval."

Conclusion

The criterion is met.

Objective 4

The DA weapon response development procedure(s) define a process for conducting peer reviews of all relevant weapon response documents.

Criterion 4.1

The procedure(s) define the situations in which internal and/or external peer reviews of weapon response information are required, and the associated scope of the review(s).

Approach/Lines of Inquiry

Documents Reviewed:

- NWP-QIP-001, *W Program Procedure for Weapon Response Documents: Development, Review and Approval*, September 28, 2007

Discussion of Results

Lawrence Livermore National Laboratory (LLNL) defines its peer review process in procedure NWP-QIP-001, *W Program Procedure for Weapon Response Documents: Development, Review and Approval*. Section 9 of this procedure includes requirements for peer review of weapons response information. The LLNL procedure requires peer review prior to the final approval and release of all technical basis documents for weapon response. The procedure allows for significant flexibility with respect to the process for conducting the peer review and the manner in which the review is to be documented.

LLNL procedures also provide a limited framework for roles and responsibilities associated with multi-lab peer reviews. Providing for the concept of a multi-lab peer review within the weapon response procedure is a noteworthy practice by LLNL.

As an opportunity for improvement, LLNL should consider providing more guidance on the process and expectations for resolving minority opinions. In any system that relies heavily on expert judgment, it would seem like that experts will, from time to time, disagree. In those cases there should be a defined process for resolving differences in opinion and for documenting any minority or dissenting opinions associated with the weapon response. It would be useful if the LLNL procedure provided a link to the appropriate LLNL process for resolving minority opinions or differing professional opinions.

Conclusion

The criterion is met.

LLNL procedures establish that peer review is required for all weapon response technical basis documents.

Strength

LLNL procedures provide a framework for roles and responsibilities associated with multi-lab peer reviews.

Observation

LLNL should consider providing more guidance on the process and expectations for resolving minority opinions.

Objective 4

The DA weapon response development procedure(s) define a process for conducting peer reviews of all relevant weapon response documents.

Criterion 4.2

The procedure(s) establish criteria for independence, training, and qualification of persons participating in peer reviews of weapon response information.

Approach/Lines of Inquiry

Documents Reviewed:

- NWP-QIP-001, *W Program Procedure for Weapon Response Documents: Development, Review and Approval*, September 28, 2007

Discussion of Results

The LLNL procedure notes that the peer review chairman and team are "independent" subject matter experts. However, the LLNL weapon response procedure provides no definition, clarification, or specific criteria for independence of peer reviews, beyond the simple assertion that they will be independent subject matter experts.

The LLNL procedure notes that the APL-SM is responsible for determining training requirements for reviews of weapon response information and for ensuring that training records are maintained and available. The procedure (section 15.0) also notes that STD-3016 and the LLNL weapon response procedure are required reading. However, the LLNL weapon response procedure does not specify what the training and qualification requirements should be for peer reviewers, beyond the minimal required reading list.

Conclusion

The criterion is not met.

The LLNL procedure does not adequately address the requirement for independence of peer reviewers, nor does it establish specific training and qualification requirements for peer reviewers.

<u>Findings</u>

- The LLNL weapon response procedure does not specify what the training and qualification requirements should be for peer reviewers, beyond the minimal required reading list.
- The LLNL weapon response procedure provides no definition, clarification, or specific criteria for independence of peer reviewers, beyond the simple assertion that they will be independent subject matter experts.

Objective 4

The DA weapon response development procedure(s) define a process for conducting peer reviews of all relevant weapon response documents.

Criterion 4.3

The procedure(s) establish the documentation requirements associated with peer review deliberations and comment resolution.

Approach/Lines of Inquiry

Documents Reviewed:

- NWP-QIP-001, *W Program Procedure for Weapon Response Documents: Development, Review and Approval*, September 28, 2007

Discussion of Results

Section 9.0 of the LLNL procedure for weapon response process requires the documentation of weapon response peer reviews and provides guidance on what should be documented. Although this guidance is limited, particularly with respect to the level of detailed documentation expected for comment resolution, it is probably sufficient for the purposes of documenting peer review. As an opportunity for improvement LLNL might wish to consider providing a template for the peer review documentation and more specific expectations for the documentation of comment resolution.

Conclusion

The criterion is met.

The LLNL procedure establishes requirements for documenting peer review of weapon response information.

<u>Observation</u>
LLNL might wish to consider providing a template for the peer review documentation and more specific expectations for the documentation of comment resolution.

Objective 4

The DA weapon response development procedure(s) define a process for conducting peer reviews of all relevant weapon response documents.

Criterion 4.4

The procedure(s) have been included in the approved DA QAPs (procedures may be included by reference).

Approach/Lines of Inquiry

Documents Reviewed:

- NWP-QIP-001, *W Program Procedure for Weapon Response Documents: Development, Review and Approval*, September 28, 2007
- LLNL NWP Quality Management Policy and Quality Assurance Plan

Discussion of Results

The LLNL NWP Quality Management Policy and Quality Assurance Plan, Section 2.0, Purpose and Scope, specifically lists the DOE-NA-STD-3016, *Hazards Analysis Reports for Nuclear Explosive Operations,* as a DOE/NNSA requirement. Section 3.0, Basic Requirements, lists the quality implementing procedure, NWP-QIP-001 *W-Program Procedure for Weapon Response Documents: Development, Review and Approval*, which "describes the process for development of weapon responses, performing peer reviews and formal expert elicitations, and lists the requirements for generating Weapon Response Documents for Hazard Analysis Reports." In Section 3.0 of the NWP QAP, LLNL Personnel are referred to the internal LLNL website for more information regarding QIP-001 and other related documents.

Conclusion

The criterion is met.

ATTACHMENT 3

Los Alamos National Laboratory
Assessment Reports

Objective 1

The Design Agency (DA) has developed and approved a DA procedure (or procedures) that define the DA processes supporting the development of weapon response and weapon response bases documents.

Criterion 1.1

The procedure(s) define the processes, roles and responsibilities within the DA for developing weapon response and the associated documentation.

Approach/Lines of Inquiry

The evaluation was conducted by reviewing the Los Alamos National Laboratory procedures *Los Alamos National Laboratory (LANL) Weapons Response Process*, W-SE-0023U, dated September 27, 2007; *Uses of Expert Judgment Elicitation to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide*, W-10-07-0054U, dated August 2007; *Method for Performing Expert Elicitations*, W-10-AD-0001U, dated September 25, 2007; and *Method for Documenting and Reviewing Expert Judgments*, W-10-AD-0002U, dated September 25, 2007. The format and content of the LANL procedures was compared to the criteria established by the Review Plan and the requirements of STD-3016.

The procedures were evaluated to determine whether processes, roles and responsibilities had been identified for the development of screening criteria and weapon responses including producing summary and bases documents (with important assumptions and/or initial conditions); transmitting information to production agencies; coordinating weapon responses with other design agencies when required; and ensuring the traceability of information/results and maintaining bases information in accordance with an NNSA approved quality assurance program.

The procedures were also evaluated to determine whether processes, roles and responsibilities had been adequately established and/or identified for conducting expert elicitation and peer review activities and for the characterization of probabilities and uncertainties for weapon response estimates.

Discussion of Results

The weapon response process procedure adequately establishes the roles and responsibilities for the preparation and documentation of weapon responses. The process used to develop and document weapon response information is also adequately described. Processes for transmitting information to other design agencies and production agencies are described. Requirements for ensuring traceability of results and creating summary and bases information are established.

Requirements to characterize and document the derivation of probabilities and uncertainties are established however it was noted some information contained in W-10-07-0054 related to scenario evaluation and binning may be beneficial for the weapon response procedure (W-SE-0023).

Process for conducting expert judgments and expert elicitation is established including identification of roles and responsibilities, a description of entry conditions, descriptions for judgment and elicitation processes, and requirements for documentation and review.

The weapon response procedure (W-SE-0023) differentiates technical review of weapon response information as either a major or minor review. Major reviews are required when information has the potential for major impact upon safety of nuclear explosive operations. The procedure implies, but is not clear, that the decision for conducting a major or minor review is made by the W-10 Surety and Weapons Response Group Leader. Additionally, there is no guidance to aid in the identification of information that has the potential for major impact to the safety of nuclear explosive operations.

Conclusion

The criterion is met.

Observations

- The technical review instructions of the weapon response procedure (W-SE-0023) lack guidance for differentiating between major and minor technical reviews.
- The format and content requirements for screening criteria and weapon responses including "rules" is not described.

Objective 1

The Design Agency (DA) has developed and approved a DA procedure (or procedures) that define the DA processes supporting the development of weapon response and weapon response bases documents.

Criterion 1.2

The procedure(s) require(s) the basis for weapon response to be documented with a level of detail that would permit a knowledgeable reviewer to trace weapon response and screening conclusions back to the underlying source data, calculations, analytical methods, and judgments. The documentation requirements are sufficient to allow an adequate peer review.

Approach/Lines of Inquiry

The evaluation was conducted by reviewing the Los Alamos National Laboratory procedures *Los Alamos National Laboratory (LANL) Weapons Response Process*, W-SE-0023U, dated September 27, 2007; *Uses of Expert Judgment Elicitation to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide*, W-10-07-0054U, dated August 2007; *Method for Performing Expert Elicitations*, W-10-AD-0001U, dated September 25, 2007; and *Method for Documenting and Reviewing Expert Judgments*, W-10-AD-0002U, dated September 25, 2007. The format and content of the LANL procedures was compared to the criteria established by the Review Plan and the requirements of STD-3016.

The procedures were evaluated to determine whether processes have been established to assure a knowledgeable reviewer could trace weapon response and screening conclusions back to the underlying source data, calculations, analytical methods, and judgments.

Discussion of Results

All procedures contained adequate instructions to ensure the information relied upon to develop weapon responses (including information from expert judgment and expert elicitation processes) is documented. This information includes methods, assumptions, results, etc.

Conclusion

The criterion is met.

Objective 1

The Design Agency (DA) has developed and approved a DA procedure (or procedures) that define the DA processes supporting the development of weapon response and weapon response bases documents.

Criterion 1.3

The procedure(s) include provisions to ensure that the information used within or supporting weapon response basis documentation is preserved and available to support the NNSA Hazard Analysis Report (HAR) review.

Approach/Lines of Inquiry

The evaluation was conducted by reviewing the Los Alamos National Laboratory procedures *Los Alamos National Laboratory (LANL) Weapons Response Process*, W-SE-0023U, dated September 27, 2007; *Uses of Expert Judgment Elicitation to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide*, W-10-07-0054U, dated August 2007; *Method for Performing Expert Elicitations*, W-10-AD-0001U, dated September 25, 2007; and *Method for Documenting and Reviewing Expert Judgments*, W-10-AD-0002U, dated September 25, 2007. The format and content of the LANL procedures was compared to the criteria established by the Review Plan and the requirements of STD-3016.

The procedures were reviewed to determine the expectations/direction regarding the development and documentation of information used to create weapon response bases information.

Discussion of Results

All procedures contained adequate instructions to ensure the information relied upon to develop weapon responses bases (including information from expert judgment and expert elicitation processes) is documented. This information includes methods, assumptions, results, etc.

Conclusion

The criterion is met.

Objective 1

The Design Agency (DA) has developed and approved a DA procedure (or procedures) that define the DA processes supporting the development of weapon response and weapon response bases documents.

Criterion 1.4

The procedure(s) establish criteria for qualification of persons involved in the development of weapon response, and identify training requirements with respect to understanding QAP and DA Weapon Response Procedures.

Approach/Lines of Inquiry

The evaluation was conducted by reviewing the Los Alamos National Laboratory procedures *Los Alamos National Laboratory (LANL) Weapons Response Process*, W-SE-0023U, dated September 27, 2007; *Uses of Expert Judgment Elicitation to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide*, W-10-07-0054U, dated August 2007; *Method for Performing Expert Elicitations*, W-10-AD-0001U, dated September 25, 2007; and *Method for Documenting and Reviewing Expert Judgments*, W-10-AD-0002U, dated September 25, 2007. The format and content of the LANL procedures was compared to the criteria established by the Review Plan and the requirements of STD-3016.

Specifically, the procedures were evaluated to determine whether sufficient criteria have been established for training and qualification of personnel generating weapon response and screening information.

Discussion of Results

The LANL procedures discuss training and qualification of personnel involved in the development and production of weapon response information including the expert judgment and expert elicitation processes. However, the weapon response analyst training consists only of required reading (section 6.0 of W-SE-0023) and qualification is discussed only in a general way as part of the introduction to roles and responsibility section applicable to weapon response analysts (section 3.5 of W-SE-0023).

Procedure W-SE-0023 implies weapon response analysts must meet the general criteria described in the introductory text of section 3.5 as a prerequisite but this does not appear to be a requirement and it is unclear who is responsible for determining if an individual meets the criteria.

The procedures for expert judgment and expert elicitation require all participants involved in judgment or elicitation activities to complete a training course that covers five topical areas key to a judgment/elicitation process.

The documents reviewed reveal that as required the LANL Design Agency Quality Assurance

Program references by separate addendum a master list of all documents utilized to implement the requirements of QC-1, Revision 10, to include procedures required to implement and support development of weapon response and weapon response bases documents.

Conclusion

The criterion is not met.

Finding
The entry-level and final qualification requirements for weapon response analysts are not adequately specified and the responsibility for identifying those qualified as weapon response analysts is unclear.

Objective 2

Initial measures required to implement the DA procedure have been completed.

Criterion 2.1

The procedure(s) have been made available to DA personnel who develop weapon response.

Approach/Lines of Inquiry

Documents Reviewed:

- QA-08-003-ABL, Memorandum, *Transmittal of Los Alamos National Laboratory STD 3016 Implementing Documentation,* 10/12/2007
- W-10-07-0090U, Memorandum, *Implementation of Los Alamos National Laboratory (LANL) Weapons Response Process and DOE-NA-STD-3016,* 09/27/07
- W-10-07-0089U, Memorandum, *Implementation Plan for Los Alamos National Laboratory (LANL) Weapons Response Process Documents,* 09/27/07
- W-SE-0023, *Los Alamos National Laboratory (LANL) Weapons Response Process,* 09/27/07
- W-10-AD-0002U, *Method for Documenting and Reviewing Expert Judgment*, 09/25/07
- W-10-AD-0001U, *Method for Performing Expert Elicitation,* 09/25/07
- W-10-07-0054U, LA-UR-07-5358, *Uses of Expert Judgment to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide, 08/07*
- ADWE-Q-0001U, *Design Agency Weapon Quality Assurance Program*

Discussion of Results

The LANL weapon response procedures listed above were approved and distributed on 9/27/07. These procedures reside within the *Master List of W-Division Quality Documents* and are referenced within the *Design Agency Weapon Quality Assurance Program*. LANL has begun a six month implementation process that will complete in March 2008. The implementation plan has few details but does include the current efforts to strengthen documented training, mentoring and the succession program for weapons response.

Conclusion

The criterion is met.

Objective 2

Initial measures required to implement the DA procedure have been completed.

Criterion 2.2

Training of weapon response development personnel on the procedures has been documented. As a minimum, documentation certifies that the weapon response personnel have read and understand the procedures and included requirements.

Approach/Lines of Inquiry

Documents Reviewed:

- QA-08-003-ABL, Memorandum, *Transmittal of Los Alamos National Laboratory STD 3016 Implementing Documentation,* 10/12/2007
- W-10-07-0090U, Memorandum, *Implementation of Los Alamos National Laboratory (LANL) Weapons Response Process and DOE-NA-STD-3016,* 09/27/07
- W-10-07-0089U, Memorandum, *Implementation Plan for Los Alamos National Laboratory (LANL) Weapons Response Process Documents,* 09/27/07
- W-SE-0023, *Los Alamos National Laboratory (LANL) Weapons Response Process,* 09/27/07
- W-10-AD-0002U, *Method for Documenting and Reviewing Expert Judgment,* 09/25/07
- W-10-AD-0001U, *Method for Performing Expert Elicitation,* 09/25/07
- W-10-07-0054U, LA-UR-07-5358, *Uses of Expert Judgment to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide, 08/07*
- ADWE-Q-0001U, *Design Agency Weapon Quality Assurance Program*

Discussion of Results

The LANL weapon response procedures listed above were approved and distributed on 9/27/07. These procedures reside within the *Master List of W-Division Quality Documents* and are referenced within the *Design Agency Weapon Quality Assurance Program.* W-Division has begun the implementation process and eight of twelve DA weapons response personnel have completed required reading certifications on the approved procedures and all are anticipated to complete this requirement by early December 2008. Until then, a formal written responsibility of the LANL Group Leader will ensure that personnel assigned to perform Weapon Response tasks are trained and qualified. Accordingly, until an individual completes the Required Reading Certification, he/she may not perform these tasks.

Training and Qualification requirements are specified for the weapons response process in W-

SE-0023 as assigned by management. There are no formal education and experience requirements. A finding related to this exists in assessment form for criterion 1.4.

Conclusion

The criterion is met.

Objective 3

The DA weapon response development procedure(s) define the process for using expert judgment and expert elicitation where needed for developing specific responses.

Criterion 3.1

The procedure(s) establish the circumstances that warrant consideration of the use of expert judgment and expert elicitation.

Approach/Lines of Inquiry

Documents Reviewed:

- QA-08-003-ABL, Memorandum, *Transmittal of Los Alamos National Laboratory STD 3016 Implementing Documentation,* 10/12/2007
- W-10-07-0090U, Memorandum, *Implementation of Los Alamos National Laboratory (LANL) Weapons Response Process and DOE-NA-STD-3016,* 09/27/07
- W-10-07-0089U, Memorandum, *Implementation Plan for Los Alamos National Laboratory (LANL) Weapons Response Process Documents,* 09/27/07
- W-SE-0023, *Los Alamos National Laboratory (LANL) Weapons Response Process,* 09/27/07
- W-10-AD-0002U, *Method for Documenting and Reviewing Expert Judgment,* 09/25/07
- W-10-AD-0001U, *Method for Performing Expert Elicitation,* 09/25/07
- W-10-07-0054U, LA-UR-07-5358, *Uses of Expert Judgment to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide, 08/07*

Discussion of Results

Los Alamos National Laboratory (LANL) Weapons Response Process indicates that expert judgment is required in almost all weapons responses.

The LANL process also says that expert judgment is performed in accordance with LANL *Method for Documenting and reviewing Expert Judgments*, W-10-AD-0002U. This document was provided for review. A note in W-10-AD-0002U states that expert elicitation is the process used to gather an expert judgment, but notes that expert judgment may also be elicited from a single individual, and that this process applies to that situation as well.

The LANL process says that expert elicitation is used when:

> Significant uncertainty exists, phenomena are not well understood, empirical investigation is not practical, or available data or information is limited or insufficient, thereby making it necessary to complement or supplement existing data, information and understanding with the interpretation and subjective judgments of technical experts.

The LANL procedure states that expert elicitation is conducted in accordance with two

references, one of which was said to be draft but which has since been approved for use. Both of the references were provided for review. The LANL procedure includes a flow chart that indicates that expert elicitation is used when the following conditions are all met:

- A previous weapons response does not accurately cover the existing request,
- Test data does not exist for the scenario,
- Related data does not exist to support the use of expert judgment,
- Relevant data cannot be obtained from experiments and analysis, and
- Modeling and calculations cannot be used.

The LANL procedures do not cover some of the key topics regarding the use of expert judgment, such as defining or selecting the scope of the problem, refining the problem, and mental processes at arriving at a solution (e.g., assumptions, definitions, decomposition into parts). Even when the response is based on a significant amount of statistical data (note that there is always stochastic uncertainty, and data-, modeling-, and completeness-type uncertainties are also usually present), expert judgment is often necessary in converting the available information into probability of response (so-called probability encoding) and representation of its uncertainty (to provide the basis for 'reasonably conservative' point-estimates). In other words, expert judgment is exercised by the WR staff on a regular basis without an accompanying elicitation process.

The unique aspects of expert judgment and the technical aspects of the process and its pitfalls are not discussed in W-10-AD-0002U.

The LANL procedure could be improved by including examples of circumstances that involve exercise of expert judgment and those that may warrant use of the expert elicitation processes.

Conclusion

The criterion is met.

The LANL procedures establish the circumstances that warrant consideration of the use of expert judgment and expert elicitation, however, more detail would increase the practical utility of the procedures.

<u>Observations</u>

- LANL procedures would benefit from additional description and/or examples of the circumstances that warrant the use of expert judgment.
- LANL procedures would benefit from additional discussion situations in which expert judgment is equivalent to a self-elicitation process, and how to adjust the documentation requirements accordingly.
- LANL procedures would benefit from additional description and/or examples of the circumstances that warrant the use of the expert elicitation process.

Objective 3

The DA weapon response development procedure(s) define the process for using expert judgment and expert elicitation where needed for developing specific responses.

Criterion 3.2

The procedure(s) establish the documentation requirements associated with the use of expert judgment and expert elicitation.

Approach/Lines of Inquiry

Documents Reviewed:

- QA-08-003-ABL, Memorandum, *Transmittal of Los Alamos National Laboratory STD 3016 Implementnig Documentation,* 10/12/2007
- W-10-07-0090U, Memorandum, *Implementation of Los Alamos National Laboratory (LANL) Weapons Response Process and DOE-NA-STD-3016,* 09/27/07
- W-10-07-0089U, Memorandum, *Implementation Plan for Los Alamos National Laboratory (LANL) Weapons Response Process Documents,* 09/27/07
- W-SE-0023, *Los Alamos National Laboratory (LANL) Weapons Response Process,* 09/27/07
- W-10-AD-0002U, *Method for Documenting and Reviewing Expert Judgment,* 09/25/07
- W-10-AD-0001U, *Method for Performing Expert Elicitation,* 09/25/07
- W-10-07-0054U, LA-UR-07-5358, *Uses of Expert Judgment to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide, 08/07*

Discussion of Results

Los Alamos National Laboratory (LANL) Weapons Response Process includes a statement that: When expert judgment is applied, the supporting data, data analysis, modeling and any additional compelling arguments, must be documented in a technical report that is referenced in the weapons response bases documentation. The report must contain sufficient detail such that peers can review, understand, and reproduce the data analysis, and understand how conclusions were developed.

Similar statements are made throughout the procedure with respect to other elements of the process. However, with respect to documenting the use of expert judgment, the LANL procedure essentially repeats the performance-based documentation requirements from the Standard, and does not specify specific details to ensure that the required performance is met. The details of documentation will vary by situation, but some specifics could be provided by describing the typical analyses that are performed and describing the documentation requirements when those types of analyses are performed.

For example, the procedure could include generic statements that apply when the condition described exists, such as: "When modeling is used to provide insight into the situation, as a minimum the nature of the model, the input parameters, and the output must be included in the report. If used, modeling must include a sensitivity analysis to ensure the stability of the outcome, and the report must discuss this analysis." Another example might be: "When test data is used to predict the outcome of an event, but the test did not replicate the actual event, the method and assumptions used to apply the test data to the actual situation must be recorded and included in the report, together with the supporting rationale. If extrapolation or interpolation is necessary, the method used to perform the extrapolation or interpolation must be included." The primary value of the procedure is in the degree to which the DA has captured what it typically does when it creates a weapons response, and specified how the basis information must be documented for each of the situations that are encountered. Such an analysis is necessary to ensure consistent, high-quality documentation.

LANL's *Method for Documenting and reviewing Expert Judgments*, W-10-AD-0002U, and the associated implementation guide, *Uses of Expert Judgment to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide,* provide additional documentation requirements for expert judgment when used in an expert elicitation process. These procedures add generic requirements that are related to the general process of developing and documenting expert judgment as would be appropriate for an expert elicitation process, but tailored for the weapons response process. Where a formal expert elicitation process is used, the generation of information includes measures to capture the thought processes of the experts being elicited. The final report includes referencing the body of empirical data on which the elicitation was based, as well as recording the process by which the elicitation was conducted.

However, the LANL guidelines on expert elicitation do not say which information generated in the elicitation process (such as expert answers to open ended questions, peer review feedback and resolution, etc.) are to be captured and retained with the records of the elicitation process. Since expert elicitation is a formalized process for gathering expert judgment, the documentation requirements should reference or include the situation-specific requirements that are needed for expert judgment, in addition to those requirements that reflect the elicitation process.

Conclusion

The criterion is not met.

The LANL procedures for expert elicitation contain most of the appropriate requirements for developing and documenting an expert elicitation, but could be strengthened by including situation specific requirements for the type of technical information that should be retained as part of the elicitation record. The procedure's treatment of expert judgment include some documentation requirements at an outcome based level, but do not specify the details needed to ensure that the required performance is met.

<u>Finding</u>
The LANL procedure does not specify specific details as to the type of information that must be retained to ensure that the required performance is met for documenting the use of expert

judgment.

Observation

The LANL guidelines on expert elicitation could be improved by discussing more specifically which information (such as expert answers to open ended questions, peer review feedback and resolution, the mental process that the expert uses in refining the problem, defining the scope, description of major sources of uncertainties, and probability encoding with the attendant assumptions) is to be captured and retained with the records of the elicitation process.

Objective 3

The DA weapon response development procedure(s) define the process for using expert judgment and expert elicitation where needed for developing specific responses.

Criterion 3.3

The procedure(s) establish key considerations that guide the development and application of expert judgment and expert elicitation in order to guard against the potential pitfalls associated with their use.

Approach/Lines of Inquiry

Documents Reviewed:

- *Los Alamos National Laboratory (LANL) Weapons Response Process*, W-SE-0023U, September 27, 2007.
- *Uses of Expert Judgment Elicitation to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide*, W-10-07-0054U, August 2007.
- *Method for Performing Expert Elicitations*, W-10-AD-0001U, September 25, 2007.
- *Method for Documenting and Reviewing Expert Judgments*, W-10-AD-0002U, September 25, 2007.

Discussion of Results

The procedures do not provide sufficient coverage of potential topics with respect to this criterion. There is no identification of key considerations and related training needs for the experts, either in an expert judgment or in an expert elicitation process, to ensure experts' familiarization with the requisite knowledge base with regard to probability encoding.

There is insufficient discussion of potential pitfalls in application of expert judgment/elicitation processes, such as biases, tendency to underestimate uncertainties, issues in converting phenomenological knowledge into probabilities, number of factors that can be handled simultaneously, factors that may impact consistency, level of detail, difference between a screened weapon response and a low probability of response, etc.

The procedures need to include sufficient detail to ensure that they are applied uniformly/consistently in all applications. The procedures could identify the key considerations briefly and refer the experts to specific references for additional required reading.

Section 4.5.4 of LANL procedures discusses "Characterization of Probabilities and Uncertainties." This section does not provide any discussion of key topics on probability encoding or the characterization of uncertainties either directly or by reference.

Conclusion

The criterion is not met.

The LANL procedures do not include sufficient detail to ensure that they are applied uniformly/consistently in likely applications involving the development of weapons responses.

Findings

- The unique aspects of expert judgment and the technical aspects of the process and its pitfalls are not discussed in W-10-AD-0002U, *Method for Documenting and Reviewing Expert Judgment*.
- There is no identification of key considerations and related training needs for the experts, either in an expert judgment or in an expert elicitation process, to ensure experts' familiarization with the requisite knowledge base regarding probability encoding.

Observation

W-10-07-0054U, *Uses of Expert Judgment to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide*, could be improved by including specific information that with respect to development of weapon responses at LANL, and by ensuring it is up-to-date in its treatment of such items as the use of binning probabilities.

Objective 3

The DA weapons response development procedure(s) define the process for using expert judgment and expert elicitation where needed for developing specific responses.

Criterion 3.4

The procedure(s) have been included in the approved DA Quality Assurance Programs – QAPs (procedures may be included by reference).

Approach/Lines of Inquiry

The following documents were reviewed:

- LANL Design Agency Quality Assurance Program;
- LANL Memorandum, September 27, 2007, from Tom Stepan to Anita Leivo;
- *Implementation Plan for LANL Weapons Response* Process *Documents,* dated September 27, 2007, from Tom Stepan to John Benner;
- LA-UR-07-5358, Revision 0, *Uses of Expert Judgment Elicitation to Estimate Outcomes Resulting from Explosive Accidents*;
- W-SE-0023, Issue A, *LANL Weapons Response Process*;
- W-10-AD-0002U, Issue A, *Method for Documenting and Reviewing Expert Judgments*;
- W-10-AD-0001, Issue A, *Method for Performing Expert Elicitations*;
- W-AD-0044, Revision A, *Master List of W-Division Quality Documents*

Discussion of Results

Review of the above documents revealed that all documents defining the implementation of STD-3016 have been identified and referenced in the W-AD-0044, Revision A, Master List of W-Division Quality Documents. This list is an addendum to the approved LANL Design Agency Quality Assurance Program.

LANL has developed an associated Implementation Plan for compliance with STD-3016. If during implementation additional documents are developed and/or current documents are modified, the W-AD-0044, Revision A, will be revised to reflect those changes.

Conclusion

The criterion is met.

Objective 4

The DA weapon response development procedure(s) define a process for conducting peer reviews of all relevant weapon response documents.

Criterion 4.1

The procedure(s) define the situations in which internal and/or external peer reviews of weapon response information are required, and the associated scope of the review(s).

Approach/Lines of Inquiry

Documents Reviewed:

- Memorandum, Winchell to Goodrum, "Transmittal of Los Alamos National Laboratory STD 3016 Implementing Documentation," October 12, 2007
- Memorandum, Stepan to Leivo, "Implementation of Los Alamos National Laboratory (LANL) Weapons Response Process and DOE-NA-STD-3016," September 27, 2007
- LA-UR-07-5358, W-10-07-0054U, *Uses of Expert Judgment Elicitation to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide,* Revision 0, August 2007
- W-SE-0023, *Los Alamos National Laboratory (LANL) Weapons Response Process (U)*, Issue A, September 27, 2007
- W-10-AD-0001U, *Method for Performing Expert Elicitations (U)*, Issue A, September 25, 2007
- W-10-AD-0002U, *Method for Documenting and Reviewing Expert Judgments (U)*, Issue A, September 25, 2007
- W-AD-0044, *Master List of W-Division Quality Documents (U),* Issue A, September 27, 2007

Discussion of Results

Los Alamos National Laboratory defines its peer review process for weapon response information in three procedures: *Los Alamos National Laboratory Weapons Response Process, Method for Performing Expert Elicitations, and Method for Documenting and Reviewing Expert Judgments*. The primary procedure is the procedure for weapons response process. Section 4.8 of this procedure includes requirements for technical review of weapons response information. Technical review is LANL's process for peer review to implement the requirements of STD-3016. The technical review is required prior to the final approval and release of all weapons response information.

The technical review process allows a graded approach to technical reviews based on the significance of the requested response, but does not adequately detail the approach to be taken to grading the peer review. Grading of the technical review process is allowed unless the weapons response information has the potential for major impact upon the safety of operations. However, the procedure does not provide a clear definition or threshold for determining whether the response has the potential for a major impact on nuclear safety. As an example, it could be

argued that a weapon insult that can be screened has the lowest impact (no impact). On the other hand, an error in screening a weapon response has the greatest potential impact.

As an opportunity for improvement, LANL should consider providing more guidance on the process and expectations for resolving minority opinions. In any system that relies heavily on expert judgment, it would seem like that experts will, from time to time, disagree. In those cases there should be a defined process for resolving differences in opinion and for documenting any minority or dissenting opinions associated with the weapon response. It would be beneficial for the LANL procedures to acknowledge that and provide a link back to the appropriate LANL process for minority opinions or differing profession opinions.

Conclusion

The criterion is not met.

Although LANL procedures do establish that peer review is required for all weapon response, the procedures allow grading of the peer review process without an adequate definition of when grading is allowed or how to grade the review process.

Finding
The LANL weapon response process allows for a graded approach to peer review without providing an adequate definition of when the graded approach is allowed, and without providing an adequate description of the allowed approach to grading the peer review process.

Observation
LANL should consider providing more guidance on the process and expectations for resolving minority opinions.

Objective 4

The DA weapon response development procedure(s) define a process for conducting peer reviews of all relevant weapon response documents.

Criterion 4.2

The procedure(s) establish criteria for independence, training, and qualification of persons participating in peer reviews of weapon response information.

Approach/Lines of Inquiry

Documents Reviewed:

- Memorandum, Winchell to Goodrum, "Transmittal of Los Alamos National Laboratory STD 3016 Implementing Documentation," October 12, 2007
- Memorandum, Stepan to Leivo, "Implementation of Los Alamos National Laboratory (LANL) Weapons Response Process and DOE-NA-STD-3016," September 27, 2007
- LA-UR-07-5358, W-10-07-0054U, *Uses of Expert Judgment Elicitation to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide,* Revision 0, August 2007
- W-SE-0023, *Los Alamos National Laboratory (LANL) Weapons Response Process (U)*, Issue A, September 27, 2007
- W-10-AD-0001U, *Method for Performing Expert Elicitations (U)*, Issue A, September 25, 2007
- W-10-AD-0002U, *Method for Documenting and Reviewing Expert Judgments (U)*, Issue A, September 25, 2007
- W-AD-0044, *Master List of W-Division Quality Documents (U),* Issue A, September 27, 2007

Discussion of Results

The LANL procedures require technical reviews to "be independent, to the extent that is reasonably achievable, of the weapon response information being reviewed." The procedures requires that, at a minimum, the reviewer not have been directly involved in the development, application or potential usage of the response information. This adequately addresses the requirement for independence in STD-3016.

The LANL procedures require the LANL Surety and Weapons Response Group Leader to assess the qualifications of the reviews. There are no specific training and qualification requirements for the peer reviewers, however.

Conclusion

The criterion is not met.

LANL procedures adequately address the requirement for independence of peer reviewers.

However, the LANL procedures do not establish specific training and qualification requirements for peer reviewers.

Finding

The LANL weapon response procedures do not establish training and qualification requirements for peer reviewers.

Objective 4

The DA weapon response development procedure(s) define a process for conducting peer reviews of all relevant weapon response documents.

Criterion 4.3

The procedure(s) establish the documentation requirements associated with peer review deliberations and comment resolution.

Approach/Lines of Inquiry

Documents Reviewed:

- Memorandum, Winchell to Goodrum, "Transmittal of Los Alamos National Laboratory STD 3016 Implementing Documentation," October 12, 2007
- Memorandum, Stepan to Leivo, "Implementation of Los Alamos National Laboratory (LANL) Weapons Response Process and DOE-NA-STD-3016," September 27, 2007
- LA-UR-07-5358, W-10-07-0054U, *Uses of Expert Judgment Elicitation to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide,* Revision 0, August 2007
- W-SE-0023, *Los Alamos National Laboratory (LANL) Weapons Response Process (U)*, Issue A, September 27, 2007
- W-10-AD-0001U, *Method for Performing Expert Elicitations (U)*, Issue A, September 25, 2007
- W-10-AD-0002U, *Method for Documenting and Reviewing Expert Judgments (U)*, Issue A, September 25, 2007
- W-AD-0044, *Master List of W-Division Quality Documents (U),* Issue A, September 27, 2007

Discussion of Results

The LANL procedure for weapon response process provides a reasonably detailed protocol for peer review, including deliberations. The LANL procedure also provides adequate definition for the contents of the peer review report. As discussed in criterion 4.1, however, LANL provides for a graded approach to the process and documentation without providing adequate guidance for when a graded approach is allowed or the extent to which grading of the process is permissible.

As an opportunity for improvement, LANL might wish to consider providing a template for the peer review report, similar to templates provided for the weapon response summary and bases documents.

Conclusion

The criterion is met.

LANL procedures adequately establish a protocol for peer review, including deliberations. LANL procedures also establish adequate requirements for documentation of the peer review process. As discussed in criterion 4.1, however, LANL provides for a graded approach to the process and documentation without providing adequate guidance for when a graded approach is allowed or the extent to which grading of the process is permissible.

Observation

LANL might wish to consider providing a template for the peer review report, similar to templates provided for the weapon response summary and bases documents.

Objective 4

The DA weapon response development procedure(s) define a process for conducting peer reviews of all relevant weapon response documents.

Criterion 4.4

The procedure(s) have been included in the approved DA QAPs (procedures may be included by reference).

Approach/Lines of Inquiry

Documents Reviewed:

- Memorandum, Winchell to Goodrum, "Transmittal of Los Alamos National Laboratory STD 3016 Implementing Documentation," October 12, 2007
- Memorandum, Stepan to Leivo, "Implementation of Los Alamos National Laboratory (LANL) Weapons Response Process and DOE-NA-STD-3016," September 27, 2007
- LA-UR-07-5358, W-10-07-0054U, *Uses of Expert Judgment Elicitation to Estimate Outcomes Resulting from Explosive Accidents: Implementation Guide,* Revision 0, August 2007
- W-SE-0023, *Los Alamos National Laboratory (LANL) Weapons Response Process (U)*, Issue A, September 27, 2007
- W-10-AD-0001U, *Method for Performing Expert Elicitations (U)*, Issue A, September 25, 2007
- W-10-AD-0002U, *Method for Documenting and Reviewing Expert Judgments (U)*, Issue A, September 25, 2007
- W-AD-0044, *Master List of W-Division Quality Documents (U),* Issue A, September 27, 2007

Discussion of Results

The documents defining the implementation of STD-3016 have been identified and referenced in the W-AD-0044, Revision A, Master List of W-Division Quality Documents. This list is an addendum to the approved LANL Design Agency Quality Assurance Program.

LANL has developed an associated Implementation Plan for compliance with STD-3016. If during implementation additional documents are developed and/or current documents are modified, the W-AD-0044, Revision A, will be revised to reflect those changes.

Conclusion

The criterion is met.

The LANL procedures are included in the *Master List of W-Division Quality Documents*, which is used to support the Design Agency Quality Assurance Program (DA WQAP ADWE-Q-0001).

ATTACHMENT 4

Sandia National Laboratories
Assessment Reports

Objective 1

The Design Agency (DA) has developed and approved a DA procedure (or procedures) that define the DA processes supporting the development of weapon response and weapon response bases documents.

Criterion 1.1

The procedure(s) define the processes, roles and responsibilities within the DA for developing weapon response and the associated documentation.

Approach/Lines of Inquiry

The evaluation was conducted by reviewing the Sandia National Laboratory procedures titled *Pantex Weapon Response Data Preparation and Review* issued September 20, 2007 and *Pantex Weapon Response Expert Elicitation* issued September 20, 2007. Additionally, the following documents were also reviewed: *Process, Best Practices, and Issues Discussion for Evaluation of Weapon Response by Sandia National Laboratories to Support Hazard Analysis at Pantex*, Version A, 2007; attachment to the 12300 Training and Qualification Program regarding weapon response analyst training and qualification; and a sample training and qualification record approved November 1, 2007. The format and content of the SNL procedure was compared to the criteria established by the Review Plan and the requirements of STD-3016.

The procedures were evaluated to determine whether processes, roles and responsibilities had been identified for the development of screening criteria and weapon responses including producing summary and bases documents (with important assumptions and/or initial conditions); transmitting information to production agencies; coordinating weapon responses with other design agencies when required; and ensuring the traceability of information/results and maintaining bases information in accordance with an NNSA approved quality assurance program.

The procedures were also evaluated to determine whether processes, roles and responsibilities had been adequately established and/or identified for conducting expert elicitation and peer review activities and for the characterization of probabilities and uncertainties for weapon response estimates.

Discussion of Results

SNL procedure *Pantex Weapon Response Data Preparation and Review* adequately identifies the roles and responsibilities for developing weapon response information. However, the procedure appears to lack direction or information regarding the processes to be used in executing those roles and responsibilities.

The procedure states weapon response information will be developed according to the processes defined in TBP-908 but that technical business practice has not been issued. Additionally, the TBP is generic in that it will apply to all three design agencies. As a result, SNL may need lab-

specific instructions to ensure the appropriate production of weapon response information. SNL has issued a paper that adequately discusses processes for creating and documenting weapon response information but that process is not discussed or otherwise specified for use in the actual SNL weapon response development procedure. Without the TBP or other process-specific descriptive information the current SNL weapon response procedure lacks sufficient detail to explain how screening and weapon response information is developed including the format and content of summary and bases documents and weapon response "rules"; identification and documentation of assumptions and initial conditions; developing weapon response probability estimates and associated uncertainty; and traceability of information.

The roles and responsibilities for the "Conduct Expert Elicitation Training and Interview" activity should be reconsidered in the SNL procedure *Pantex Weapon Response Expert Elicitation*. The current assignment is to the elicitation team. Under this arrangement the team performing the elicitation would be required to train themselves on the process and then structure/organize the activity. It appears these roles and responsibilities are more appropriate for an activity manager or other person who has the knowledge and experience to conduct the training and organize the work. The peer review process specified appears appropriate based on the information provided in the *Pantex Weapon Response Data Preparation and Review* procedure that is referenced by the expert elicitation procedure.

Conclusion

The criterion is not met.

Finding
SNL procedure *Pantex Weapon Response Data Preparation and Review* does not adequately describe the processes needed to prepare and document screening and weapon response information. Criteria 1.2 and 1.3 describe related issues that should be considered when developing corrective action.

Observation
The roles and responsibilities for the "Conduct Expert Elicitation Training and Interview" activity from the SNL procedure *Pantex Weapon Response Expert Elicitation* are assigned generically instead of to specific position. As a result, it is unclear who exactly is responsible for executing some functions.

Objective 1

The Design Agency (DA) has developed and approved a DA procedure (or procedures) that define the DA processes supporting the development of weapon response and weapon response bases documents.

Criterion 1.2

The procedure(s) require(s) the basis for weapon response to be documented with a level of detail that would permit a knowledgeable reviewer to trace weapon response and screening conclusions back to the underlying source data, calculations, analytical methods, and judgments. The documentation requirements are sufficient to allow an adequate peer review.

Approach/Lines of Inquiry

The evaluation was conducted by reviewing the Sandia National Laboratory procedures titled *Pantex Weapon Response Data Preparation and Review* issued September 20, 2007 and *Pantex Weapon Response Expert Elicitation* issued September 20, 2007. Additionally, the following documents were also reviewed: *Process, Best Practices, and Issues Discussion for Evaluation of Weapon Response by Sandia National Laboratories to Support Hazard Analysis at Pantex*, Version A, 2007; attachment to the 12300 Training and Qualification Program regarding weapon response analyst training and qualification; and a sample training and qualification record approved November 1, 2007. The format and content of the SNL procedure was compared to the criteria established by the Review Plan and the requirements of STD-3016.

The procedures were evaluated to determine whether processes have been established to assure a knowledgeable reviewer could trace weapon response and screening conclusions back to the underlying source data, calculations, analytical methods, and judgments.

Discussion of Results

The SNL procedure (*Pantex Weapon Response Data Preparation and Review*) specifies weapon response and screening information must be documented; however, the procedure lacks sufficient direction to create documentation that would permit a knowledgeable reviewer to trace weapon response and screening conclusions back to the underlying source data, calculations, analytical methods, and judgments. The "Best Practices" document does provide adequate information in this regard but it is not a requirements document.

The SNL procedure *Pantex Weapon Response Expert Elicitation* establishes that the technical basis for the results of an expert elicitation process must be documented; however, expectations for the completeness of that information or its traceability are not established.

Conclusion

The criterion is not met.

The SNL procedures lack criteria in regard to the information that must be documented to ensure traceability of the development of screening and weapon response information including information to be documented from the expert elicitation process (e.g., source data, calculations, analytical methods, assumptions, etc.).

The deficiencies discussed above appear to stem from the issues described in the discussion for criterion 1.1, i.e., the lack of a prescribed process to prepare and document screening and weapon response information. As a result, no additional findings have been developed. The concerns discussed above should be considered when developing the corrective action for criterion 1.1.

Objective 1

The Design Agency (DA) has developed and approved a DA procedure (or procedures) that define the DA processes supporting the development of weapon response and weapon response bases documents.

Criterion 1.3

The procedure(s) include provisions to ensure that the information used within or supporting weapon response basis documentation is preserved and available to support the NNSA Hazard Analysis Report (HAR) review.

Approach/Lines of Inquiry

The evaluation was conducted by reviewing the Sandia National Laboratory procedures titled *Pantex Weapon Response Data Preparation and Review* issued September 20, 2007 and *Pantex Weapon Response Expert Elicitation* issued September 20, 2007. Additionally, the following documents were also reviewed: *Process, Best Practices, and Issues Discussion for Evaluation of Weapon Response by Sandia National Laboratories to Support Hazard Analysis at Pantex*, Version A, 2007; attachment to the 12300 Training and Qualification Program regarding weapon response analyst training and qualification; and a sample training and qualification record approved November 1, 2007. The format and content of the SNL procedure was compared to the criteria established by the Review Plan and the requirements of STD-3016.

The procedures were reviewed to determine the expectations/direction regarding the development and documentation of information used to create weapon response bases information.

Discussion of Results

The procedure *Pantex Weapon Response Data Preparation and Review* specifies that weapon response screening criteria/rules and basis information will be documented for peer review. However, there are no criteria established to explain how that should be accomplished e.g., requirements for documenting source data, calculations, analytical methods, results, etc. Similar weaknesses exist for SNL procedure *Pantex Weapon Response Expert Elicitation*. The "Best Practices" document does provide adequate information in this regard but it is not a requirements document.

Conclusion

The criterion is not met.

SNL procedures do not clearly explain the expectations regarding the type of information needed to adequately document the bases for screening and weapon responses.

The deficiencies discussed above appear to stem from the issues described in the discussion for

criterion 1.1 i.e., the lack of a prescribed process to prepare and document screening and weapon response information. As a result, no additional findings have been developed. The concerns discussed above should be considered when developing the corrective action for criterion 1.1.

Objective 1

The Design Agency (DA) has developed and approved a DA procedure (or procedures) that define the DA processes supporting the development of weapon response and weapon response bases documents.

Criterion 1.4

The procedure(s) establish criteria for qualification of persons involved in the development of weapon response, and identify training requirements with respect to understanding QAP and DA Weapon Response Procedures.

Approach/Lines of Inquiry

The evaluation was conducted by reviewing the Sandia National Laboratory procedures titled *Pantex Weapon Response Data Preparation and Review* issued September 20, 2007 and *Pantex Weapon Response Expert Elicitation* issued September 20, 2007. Additionally, the following documents were also reviewed: *Process, Best Practices, and Issues Discussion for Evaluation of Weapon Response by Sandia National Laboratories to Support Hazard Analysis at Pantex*, Version A, 2007; attachment to the 12300 Training and Qualification Program regarding weapon response analyst training and qualification; and a sample training and qualification record approved November 1, 2007. The format and content of the SNL procedure was compared to the criteria established by the Review Plan and the requirements of STD-3016.

Specifically, the procedures were evaluated to determine whether sufficient criteria have been established for training and qualification of personnel generating weapon response and screening information.

Discussion of Results

The Sandia Pantex Support Project Manager and Weapon Safety Basis Engineering are identified as responsible for ensuring weapon response analysts are qualified to perform assigned tasks. That training and qualification activity is required to be documented. Weapon response analysts must be "familiar" with five functional area criteria established by the SNL weapon response procedure and "knowledgeable" with a sixth area. Those general areas appear appropriate for the task of preparing weapon response information however the processes required to attain the "familiarity" or "knowledgeable" level of expertise are not described in the procedure or provided by reference.

SNL has established weapon response analyst training and qualification criteria based on the weapon response procedure requirements and that criteria is included as part of their training and qualification program. All six functional areas specified in the weapon response procedure are covered by the weapon response analyst training and qualification criteria. Training for each functional area is a choice of formal classroom training and/or reading, all of which are specified as options. The training options appear adequate. Review of a sample training record indicates

qualification is based on the candidates' description of how each training criteria has been met through a combination of activities that can include classroom training, reading/self-study and mentoring. That justification is reviewed and approved by a manager.

An objective set of minimum training activities (e.g., classes, reading, etc.) has not been established for each weapon response analyst qualification criteria (the finding for this issue is rolled into the related finding for criterion 4.2). Instead, each analyst justifies to a manager the basis they have used to conclude they are qualified using a menu of training options.

Conclusion

The criterion is not met.

Observation
The SNL training and qualification process is not referenced in the weapon response procedure. Additionally, the qualification process does not appear to establish a minimum set of qualifications required for weapon response analysts.

Objective 2

Initial measures required to implement the DA procedure have been completed.

Criterion 2.1

The procedure(s) have been made available to DA personnel who develop weapon response.

Approach/Lines of Inquiry

Documents Reviewed:

- Sandia National Laboratories DSW Procedure: *Pantex Weapon Response Data Preparation and Review*, Revision D, 9/20/07
- Sandia National Laboratories DSW Procedure: *Pantex Weapon Response Expert Elicitation*, Revision A, 9/20/07
- Sandia National Laboratories Weapons Quality Assurance Plan: *NWSMU Quality Assurance Plan (WQAP)*, Revision 5, 9/20/07

Discussion of Results

Sandia National Laboratories has made the weapon response procedures (2) available within the Integrated Laboratory Management System (ILMS) as part of the DSW (Directed Stockpile Work) procedures and requirements within the Nuclear Weapons Operational Information. The *Pantex Weapon Response Data Preparation and Review*, Revision D, has been in place for several years and updated to meet STD-3016. The *Pantex Weapon Response Expert Elicitation*, Revision A is a new procedure. Both procedures were made available on the ILM system September 20, 2007.

The weapon response procedures are included within the SNL Weapons Quality Assurance Plan, providing a quality assurance context for these procedures and expressing the linkage to the ILMS.

Communication of the new procedure to DA personnel who develop weapon response is the responsibility of the procedure author, the Sandia PX Support Project Manager, and the DA personnel's (Weapons Safety Basis Engineering) Department Head. This communication takes place through each SNL employee's Performance Management Form. Objective evidence was not presented to indicate that DA personnel' PMFs were updated, however TRAQS training summaries were provided for all six weapons response analysts.

Conclusion

The criterion is met.

The SNL weapon response procedures (2) are available within the Integrated Laboratory Management System (ILMS) and referenced appropriately within the SNL Weapons Quality Assurance Plan. The procedure(s) have been made available to all SNL personnel, including DA

personnel who develop weapon response.

Observation

Objective evidence was not presented to indicate that DA personnel PMFs were updated or that DA personnel are otherwise aware of these procedures. See also Criterion 2.2.

Objective 2

Initial measures required to implement the DA procedure have been completed.

Criterion 2.2

Training of weapon response development personnel on the procedures has been documented. As a minimum, documentation certifies that the weapon response personnel have read and understand the procedures and included requirements.

Approach/Lines of Inquiry

Document Reviewed:

- Sandia National Laboratories DSW Procedure: *Pantex Weapon Response Data Preparation and Review*, Revision D, 9/20/07
- Sandia National Laboratories DSW Procedure: *Pantex Weapon Response Expert Elicitation*, Revision A, 09/20/07
- Sandia Procedure: *Weapon Response Analyst Training and Qualification, September, 2007*
- E-mail Training Records (6): *Training, Records, and Qualification System (TRAQS) Request Approved for Weapon Response Analysts*, November 1, 2007

Personnel Interviewed:

- SNL's PX Support Project Manager
- Manager, Weapons Safety Basis Engineering

Discussion of Results

Training and Qualification requirements for weapon response analysts are listed within the procedure and place responsibility with the Sandia PX Support Project Manager and the DA personnel's Weapons Safety Basis Engineering Department Head. The SNL procedure requires weapons responders to be "knowledgeable" about weapon system and component testing/analysis data sources. The TRAQS training record provides detailed training components to satisfy these areas. For related areas, analysts are required to have an initial "familiarity" level of knowledge and then acquire sufficient knowledge and experience through supervised and mentored hands-on work. Normally, it takes 6-8 months for people with good background and education (for weapons system and component design requirements, weapon complex/operation hazard analysis requirements and methodologies; and policies and processes related to nuclear weapon safety). There are no formal education and experience requirements, no formal training requirements. Assignment by management is the qualification requirement. Such assignment, following documentation of required training was provided in the TRAQS e-mail notifications for each weapons analyst.

The SNL PX Support Project Manager indicated that the method of training and familiarization for PA personnel implementing these procedures would be documented within each affected employee's Performance Management Form and addressed at the time that a weapons response team was formed. Changes to weapons response procedures trigger changes to the training and qualification document for weapons response analysts. For the expert elicitation procedure, SNL does not intend any training since the nature of Pantex support at the engineering laboratories at Sandia is counter to such a procedure.

A weapons response analyst training procedure provides additional guidance on available training and required reading expectations. Documentation of qualification for the six weapons response analysts was provided. Documentation of completion of required reading for the new and revised weapons response procedures by all weapons response analysts was provided.

The level of detail in the process requirements is brief and therefore provides limited direction on the process. Documented training and qualification on the weapon response procedures is required, per the *Pantex Weapon Response Data Preparation* procedure, to demonstrate familiarity with the policies and processes related to nuclear weapons safety. Readiness to implement these weapon response procedures by weapons response analysts is based upon completion of the documented training and required reading in the TRACS e-mail notifications.

Conclusion

The criterion is met.

Objective 3

The DA weapon response development procedure(s) define the process for using expert judgment and expert elicitation where needed for developing specific responses.

Criterion 3.1

The procedure(s) establish the circumstances that warrant consideration of the use of expert judgment and expert elicitation.

Approach/Lines of Inquiry

Documents Reviewed:

- Sandia National Laboratories DSW Procedure: *Pantex Weapon Response Data Preparation and Review*, Revision D, 9/20/07
- Sandia National Laboratories DSW Procedure: *Pantex Weapon Response Expert Elicitation*, Revision A, 09/20/07
- Sandia Paper: *Process, Best Practices, and Issue Discussion for Evaluation of Weapon Response by Sandia National Laboratories to Support Hazard Analyses at Pantex*, September, 2007
- Sandia Procedure Attachment: *Weapon Response Analyst Training and Qualification*, September, 2007
- Sandia Training Record: *Training, Records, and Qualification System (TRAQS)* Request Approved for Weapon Response Analyst

Discussion of Results

The SNL procedure makes a distinction between Expert Judgment and Engineering Judgment. The SNL procedure notes that:

> If sufficiently compelling information is not available and Engineering Judgment as described above does not provide technically defensible weapon response information, subject matter experts may be involved in providing additional judgment in support of weapon response development.

Engineering Judgment is apparently to be used in situations where judgment is needed to interpret or extrapolate available data. The procedure says that Engineering Judgment is to be used 'with the following understanding:'

- Any technically qualified person would be expected to come to essentially the same conclusion given the same set of information or data.
- The desired end state is a conservative estimate vs. a precise characterization of probability of response
- Resource expenditures to refine weapon response are driven by the control set and not by the accuracy of the answer.

The SNL procedure basically reserves the term Expert Judgment for those situations in which

Expert Elicitation is conducted from a single expert.

The SNL weapons response procedure includes an abbreviated set of steps for informally eliciting Expert Judgment, and references a separate procedure for Expert Elicitation. The SNL procedure does not describe any situation in which Expert Elicitation must be used. According to the SNL weapons response procedure, Expert Elicitation *may* be performed if the conditions described in STD-3016 exist, and if

- The issue is critical to safety and/or efficiency;
- Other means of obtaining requisite data or information (e.g., calculations based on accepted scientific laws and principles) have been thoroughly considered and determined to be not practical to implement; and,
- Uncertainties remain large and significant.

This is a statement of permission, not a requirement to at least consider using expert elicitation under certain considerations, as intended by the standard.

As written, the SNL procedures do not make it clear that the definition of Expert Judgment and the associated documentation requirements take precedence over the SNL requirements associated with Engineering Judgment in those situations where the definitions overlap. In application, many situations for which the documentation requirements of the standard were intended to apply could likely be considered Engineering Judgment under the SNL definition. Even when a weapon response is based on a significant amount of statistical data (note that there is always stochastic uncertainty, and data-, modeling-, and completeness-type uncertainties are also usually present), expert judgment is often necessary in converting the available information into probability of response (so-called probability encoding) and representation of its uncertainty (to provide the basis for 'reasonably conservative' point-estimates). However, to an individual expert, the application of judgment in a given situation may seem routine and reproducible; it may seem to yield a conservative estimate, and the expert may not be aware of the influence of the accuracy of the answer (as opposed to the impact of the control set) on resource expenditures. Thus, the subjective definition of Engineering Judgment may precondition experts to identify their judgments as Engineering Judgment rather than Expert Judgment, even in cases that fit the definition of Expert Judgment.

It should be noted that representatives from SNL proposed the concept of the use of Engineering Judgment for application of engineering data at a workshop on the implementation of the standard. Conceptually, using Engineering Judgment in situations where an engineer chooses an appropriate data set or performs standard, well defined and accepted practices to arrive at an engineering answer could appropriately be defined as not involving Expert Judgment in the sense invoked by the standard. However, measures should be implemented to ensure that NNSA expectations for documentation of Expert Judgment are met, and that the subjective definition of Engineering Judgment is appropriately applied.

Similarly, what SNL refers to as 'informal expert judgment' is likely exercised by their Weapon Response staff on a regular basis without an accompanying expert judgment or elicitation process. Again, the problem is not with the idea that expert judgment may be obtained informally; the problem is that the informal expert judgment process amounts to an expert

elicitation of one but without following the expert elicitation process, so that the provisions for avoiding pitfalls of expert elicitation and for ensuring an adequate record of key considerations and assumptions are circumvented.

Conclusion

The criterion is not met.

The SNL procedure establishes high level circumstances that warrant consideration of the use of expert judgment and expert elicitation, but does not provide sufficient detail to be of practical impact.

Findings

- It is not clear in the procedure that the definition of expert judgment, and the associated documentation requirements, take precedence over the notional definition of engineering judgment; the broad definition of engineering judgment would appear in practice to overlap many instances that would meet the definition of expert judgment as used in the DOE Standard.
- The treatment of informal expert judgment improperly bypasses the expert elicitation process requirements without specifying adequate documentation requirements when informal expert judgment is used.

Observations

- The SNL procedure could be improved by use of real examples in which engineering judgment, expert judgment and expert elicitation was appropriate.
- SNL procedures could be improved by a discussion of situations in which expert judgment is equivalent to a self-elicitation process.
- Measures should be implemented to ensure that NNSA expectations for documentation of Expert Judgment are met, and that the subjective definition of Engineering Judgment is appropriately applied.

Objective 3

The DA weapon response development procedure(s) define the process for using expert judgment and expert elicitation where needed for developing specific responses.

Criterion 3.2

The procedure(s) establish the documentation requirements associated with the use of expert judgment and expert elicitation.

Approach/Lines of Inquiry

Documents Reviewed:

- Sandia National Laboratories DSW Procedure: *Pantex Weapon Response Data Preparation and Review*, Revision D, 9/20/07
- Sandia National Laboratories DSW Procedure: *Pantex Weapon Response Expert Elicitation*, Revision A, 09/20/07
- Sandia Paper: *Process, Best Practices, and Issue Discussion for Evaluation of Weapon Response by Sandia National Laboratories to Support Hazard Analyses at Pantex*, September, 2007
- Sandia Procedure Attachment: *Weapon Response Analyst Training and Qualification*, September, 2007
- Sandia Training Record: *Training, Records, and Qualification System (TRAQS)* Request Approved for Weapon Response Analyst

Discussion of Results

The entire documentation requirement for the weapons response process is provided in a single set of bullets, as follows:

"Document the results of the peer review in an ER as a record in the IMS. The following should be documented:

- Purpose of review and material (e.g., assumptions, rules, technical justifications) reviewed by the peers
- Names, organizations, and qualification of peer reviewers along with their concurrence
- Comment resolution as appropriate (e.g., deviations, minority opinions, argumentative/major issues)."

No detail is provided, not even a generic, high level, performance based outcome that is expected for the documentation, such as a statement that sufficient information needs to be documented so that a similarly qualified weapon analyst could arrive at the same conclusion based on the documentation. Although a technical basis document is required, the technical details that must be included in the document are not clearly established. Performance-based documentation requirements are not provided for the use of Expert Judgment, Engineering Judgment, or Expert Elicitation; objective-based documentation requirements do not specify specific details that are

needed to ensure that the performance objectives are met. It is not sufficient to require a complete technical basis. That level of requirement is what the standard requires. It is expected that the design agency procedures will establish technically what constitutes a complete basis at a detailed technical level.

An additional document was provided for review, *Process, Best Practices, and Issue Discussion for Evaluation of Weapon Response by Sandia National Laboratories to Support Hazard Analyses at Pantex*, however, compliance with this paper is not called out as a requirement in the DSW procedure, making this document descriptive at best. More detail on documentation is provided in this document than in the actual procedure, but, the discussion of specific documentation requirements lacks the technical detail that would be useful to ensure consistent level of quality in the final bases documents.

The details of documentation will vary by situation, but some specifics could be provided to establish a standard expectation by describing the typical analyses that are performed and describing the documentation requirements for those analyses.

For example, the procedure could include generic statements that apply when the condition described exists, such as: "When modeling is used to provide insight into the situation, as a minimum, the nature of the model, the input parameters, and the output must be included in the report. If used, modeling must include a sensitivity analysis to ensure the stability of the outcome, and the report must discuss this analysis." Another example might be: "When test data is used to predict the outcome of an event, but the test did not replicate the actual event, the method and assumptions used to apply the test data to the actual situation must be recorded and included in the report, together with the supporting rationale. If extrapolation or interpolation is necessary, the method used to perform the extrapolation or interpolation must be included."

The primary value of the procedure is in the degree to which the DA has captured what it typically does when it creates a weapons response, and specified how the basis information must be documented for each of the situations that are encountered. Such an analysis is necessary to ensure consistent, high-quality documentation.

SNL's *Pantex Weapon Response Expert Elicitation*, Revision A, provides additional documentation requirements for expert judgment when used in an expert elicitation process. This procedure adds generic requirements that are related to the general process of developing and documenting expert judgment as would be appropriate for an expert elicitation process, but only in a very cursory manner. Where a formal expert elicitation process is used, the generation of information only includes measures to capture the technical basis for the expert's opinion. There are no explicit documentation requirements for the body of empirical data on which the elicitation was based, or for capturing the specific details on which the expert judgment was based.

The SNL procedure for expert elicitation does not articulate the degree to which information generated in the elicitation process (such as expert answers to open ended questions, peer review feedback and resolution, etc.) is to be captured and retained with the records of the elicitation process. Since expert elicitation is a formalized process for gathering expert judgment, the

documentation requirements should reference or include the situation-specific requirements that are needed for expert judgment, in addition to those requirements that reflect the elicitation process.

Because the description of the Weapon Response process is lacking in certain details (See Findings for Criteria 1.1, 3.2, and 3.3), the documentation requirements for expert judgment (equivalent to self-elicitation in an expert elicitation process) are also insufficient in the level of detail that is expected in documentation. For example, the mental process that the expert uses in refining the problem, defining the scope, description of major sources of uncertainties, and probability encoding with the attendant assumptions need to be adequately documented. Use of examples from a long history of providing Weapon Response should be considered, as they can be very informative for current and future Weapon Response staff and experts, as in ensuring more uniform application of DA Weapon Response processes.

Conclusion

The criterion is not met.

The SNL procedures for expert judgment include some documentation requirements. However, the expert elicitation procedure does not include specific documentation requirements that would generate a complete basis for the outcome. The requirements for documentation of expert judgment do not specify the details needed to ensure that the required performance is met. The SNL procedure on expert elicitation does not articulate the degree to which information generated in the elicitation process (such as expert answers to open ended questions, peer review feedback and resolution, etc.) is to be captured and retained with the records of the elicitation process.

Findings

- SNL procedures do not adequately define what must be documented with respect to the exercise of expert judgment and expert elicitation. There are two general deficiencies in this regard. The procedures do not establish the expected utility of the documentation (such as an expectation to provide sufficient detail so that a qualified analyst could reproduce the outcome); and, the procedures do not establish concrete guidance as to technical details that must be documented in order to create the desired utility (as could be done, for example, by providing examples of adequate documentation for certain types of analyses or elicitations).
- The SNL procedure for expert elicitation does not say which information generated in the elicitation process (such as expert answers to open ended questions, peer review feedback and resolution, etc.) is to be captured and retained with the records of the elicitation process.

Observations

- The requirements are unclear for documenting the basis for choosing to use expert judgment, informal expert elicitation, and formal expert elicitation
- The expectations for documentation of expert judgment, informal expert elicitation, and expert elicitation are unclear.

documentation requirements should reference or include the situation-specific requirements that are needed for expert judgment, in addition to those requirements that reflect the elicitation process.

Because the description of the Weapon Response process is lacking in certain details (See Findings for Criteria 1.1, 3.2, and 3.3), the documentation requirements for expert judgment (equivalent to self-elicitation in an expert elicitation process) are also insufficient in the level of detail that is expected in documentation. For example, the mental process that the expert uses in refining the problem, defining the scope, description of major sources of uncertainties, and probability encoding with the attendant assumptions need to be adequately documented. Use of examples from a long history of providing Weapon Response should be considered, as they can be very informative for current and future Weapon Response staff and experts, as in ensuring more uniform application of DA Weapon Response processes.

Conclusion

The criterion is not met.

The SNL procedures for expert judgment include some documentation requirements. However, the expert elicitation procedure does not include specific documentation requirements that would generate a complete basis for the outcome. The requirements for documentation of expert judgment do not specify the details needed to ensure that the required performance is met. The SNL procedure on expert elicitation does not articulate the degree to which information generated in the elicitation process (such as expert answers to open ended questions, peer review feedback and resolution, etc.) is to be captured and retained with the records of the elicitation process.

Findings

- SNL procedures do not adequately define what must be documented with respect to the exercise of expert judgment and expert elicitation. There are two general deficiencies in this regard. The procedures do not establish the expected utility of the documentation (such as an expectation to provide sufficient detail so that a qualified analyst could reproduce the outcome); and, the procedures do not establish concrete guidance as to technical details that must be documented in order to create the desired utility (as could be done, for example, by providing examples of adequate documentation for certain types of analyses or elicitations).
- The SNL procedure for expert elicitation does not say which information generated in the elicitation process (such as expert answers to open ended questions, peer review feedback and resolution, etc.) is to be captured and retained with the records of the elicitation process.

Observations

- The requirements are unclear for documenting the basis for choosing to use expert judgment, informal expert elicitation, and formal expert elicitation
- The expectations for documentation of expert judgment, informal expert elicitation, and expert elicitation are unclear.

Objective 3

The DA weapon response development procedure(s) define the process for using expert judgment and expert elicitation where needed for developing specific responses.

Criterion 3.3

The procedure(s) establish key considerations that guide the development and application of expert judgment and expert elicitation in order to guard against the potential pitfalls associated with their use.

Approach/Lines of Inquiry

Documents Reviewed:

- Sandia National Laboratories DSW Procedure: *Pantex Weapon Response Data Preparation and Review*, Revision D, 9/20/07
- Sandia National Laboratories DSW Procedure: *Pantex Weapon Response Expert Elicitation*, Revision A, 09/20/07
- Sandia Paper: *Process, Best Practices, and Issue Discussion for Evaluation of Weapon Response by Sandia National Laboratories to Support Hazard Analyses at Pantex*, September, 2007
- Sandia Procedure Attachment: *Weapon Response Analyst Training and Qualification*, September, 2007
- Sandia Training Record: *Training, Records, and Qualification System (TRAQS)* Request Approved for Weapon Response Analyst

Discussion of Results

The SNL procedures do not provide sufficient coverage of potential topics with respect to this criterion. Although the paper that SNL provided includes very detailed discussions in some aspects of statistical analyses and probability theory, there is no procedural requirement to link the discussion in the paper to the weapon response process that is (or will be) actually employed at SNL. The status of this document within SNL is not clear, i.e., it is not clear whether this is a corporate-level requirements document, as it was not even referenced within the first two references.

To satisfy this criterion, it was expected that the procedures would provide some brief topical coverage on the potential pitfalls associated with the use of expert judgment and elicitation. It was also expected that the discussion in the procedures would be reinforced by a more detailed treatment of these topics in a training program that, in turn, would rely principally on brief periods of self study of key considerations that the expert should be aware of in converting his phenomenological knowledge into a probability of weapon response. It was expected that the qualification and training requirements would provide a list of appropriate references that would provide the broader background that is desired.

Referring to this third reference above, it is noted that on page 3 it states: "It is emphasized that this process requires knowledgeable engineers with experience in weapon systems, components, and operations at Pantex." On page 10 it states: "This assignment is based on the following types of information:

- Use of the weapon safety theme when appropriate considering normal and abnormal environments
- Test results
- Modeling results
- Engineering judgment

Engineering expertise, experience, and engineering judgment are required to integrate these sources of information together to generate a probability of consequence for a component." Application of this collective level of knowledge to solve specific problems is what is generally viewed as 'expert judgment.' Specific procedural safeguards against the pitfalls associated with this application are specifically what are sought for through this criterion.

In summary, the above references do not identify key considerations and related training needs for the experts, either in an expert judgment or in an expert elicitation process, to ensure experts' familiarization with the requisite knowledge base in converting phenomenological information into probability of weapon response.

There is no discussion of potential pitfalls in application of expert judgment/elicitation processes, such as biases, tendency to underestimate uncertainties, issues in converting phenomenological knowledge into probabilities, number of factors that can be handled simultaneously, factors that may impact consistency, level of detail, difference between a screened weapon response and a low probability of response, etc.

The procedures need to include sufficient detail to ensure that they are applied uniformly and consistently in all applications. The procedures could identify the key considerations briefly and refer the experts to specific references for additional required reading.

Conclusion

The criterion is not met.

SNL Procedures do not establish key considerations to adequately guide the development and application of expert judgment and expert elicitation to guard against the potential pitfalls associated with their use.

<u>Finding</u>
There is no discussion of potential pitfalls in application of expert judgment/elicitation processes, such as biases, tendency to underestimate uncertainties, issues in converting phenomenological knowledge into probabilities, number of factors that can be handled simultaneously, factors that may impact consistency, level of detail, difference between a screened weapon response and a low probability of response, etc.

Observation

The SNL criteria for selecting when expert judgment may be used, when informal expert elicitation may be used, or when the use of formal expert elicitation should be used are fairly subjective.

Objective 3

The DA weapons response development procedure(s) define the process for using expert judgment and expert elicitation where needed for developing specific responses.

Criterion 3.4

The procedure(s) have been included in the approved DA Quality Assurance Programs – QAPs (procedures may be included by reference).

Approach/Lines of Inquiry:

Documents reviewed:

- SNL Weapons Quality Assurance Procedure dated: September 30, 2005, Revised July 21, 2007.
- *Weapon Safety Basis Engineering Department (12347) Weapon Response Analyst Training and Qualification Criteria* (Note: this appears to be a descriptive paper, not a formal part of the process or a binding statement upon the DA)
- Sandia National Laboratories DSW Procedure: *Pantex Weapon Response Data Preparation and Review*, Revision D, 9/20/07
- Sandia National Laboratories DSW Procedure: *Pantex Weapon Response Expert Elicitation*, Revision A, 09/20/07
- Sandia Paper: *Process, Best Practices, and Issue Discussion for Evaluation of Weapon Response by Sandia National Laboratories to Support Hazard Analyses at Pantex*, September, 2007
- Sandia Procedure Attachment: *Weapon Response Analyst Training and Qualification*, September, 2007
- Sandia Training Record: *Training, Records, and Qualification System (TRAQS)* Request Approved for Weapon Response Analyst

Discussion of Results

The link between the Sandia weapon response and expert elicitation procedures and the Sandia quality assurance program documentation is discussed in detail in criterion 2.1. The Sandia procedures have been included in the appropriate laboratory quality assurance program documentation.

Conclusion

The criterion is met.

The SNL weapon response procedure(s) have been included in the approved SNL Quality Assurance Programs.

Objective 4

The DA weapon response development procedure(s) define a process for conducting peer reviews of all relevant weapon response documents.

Criterion 4.1

The procedure(s) define the situations in which internal and/or external peer reviews of weapon response information are required, and the associated scope of the review(s).

Approach/Lines of Inquiry

Documents Reviewed:

- *Pantex Weapon Response Data Preparation and Review,* Revision D, September 20, 2007.
- *Pantex Weapon Response Expert Elicitation*, Revision A, September 20, 2007
- *Process, Best Practices, and Issue Discussion for Evaluation of Weapon Response by Sandia National Laboratories to Support Hazard Analyses at Pantex*, Version A, 2007
- *Weapon Response Analyst Training and Qualification*, December 12, 2007
- 12332 General Assessment Training and Qualification Program
- NSAP-002, *NESSG Member Certification Process*, April 2006

Discussion of Results

Sandia National Laboratories (SNL) defines peer review process requirements for weapon response in the procedure, *Pantex Weapon Response Data Preparation and Review.* The SNL procedure requires peer review of weapon response information. However, the SNL requirement for peer review of weapon response is simply a statement the Pantex Program Manager must "Ensure weapon response peer review is conducted according to STD-3016 requirements." The procedure then repeats the general requirements for peer review from STD-3016, but does not provide significant additional detail in a couple key areas.

First, the SNL weapon response procedure does not clearly define the required scope of the peer review for SNL weapon response information. The procedure states that "Peer Reviews are performed to ensure completeness and accuracy of weapon response information and peer reviewers will have the access to all technical basis information." It is not clear from this statement, however, whether peer reviewers are expected to review all of the technical basis information as part of the peer review or whether they're just to be given access to such information.

In addition, the SNL procedure does not define a clear approach or process for conducting the peer review, other than identifying the personnel responsible for ensuring the peer review occurs, noting general qualification requirements, and levying documentation requirements for the results of the peer review. The procedure does not define expectations for the peer review lead

(if there is one), at what point in the development of weapon response that the peer review should occur, the expected interaction between peer reviewers and weapon analysts, etc.

Conclusion

The criterion is not met.

SNL procedures establish that peer review is required for weapon response, in accordance with STD-3016. However, the SNL procedure does not provide any specific guidance on the aspects of the weapon response that require peer review or associated scope of the review.

Findings

- The SNL weapon response procedure does not clearly define the required scope of the peer review for weapon response information.
- The SNL procedure does not define a clear approach or process for conducting the peer review.

Objective 4

The DA weapon response development procedure(s) define a process for conducting peer reviews of all relevant weapon response documents.

Criterion 4.2

The procedure(s) establish criteria for independence, training, and qualification of persons participating in peer reviews of weapon response information.

Approach/Lines of Inquiry

Documents Reviewed:

- *Pantex Weapon Response Data Preparation and Review,* Revision D, September 20, 2007.
- *Pantex Weapon Response Expert Elicitation*, Revision A, September 20, 2007
- *Process, Best Practices, and Issue Discussion for Evaluation of Weapon Response by Sandia National Laboratories to Support Hazard Analyses at Pantex*, Version A, 2007
- *Weapon Response Analyst Training and Qualification*, December 12, 2007
- 12332 General Assessment Training and Qualification Program
- NSAP-002, *NESSG Member Certification Process*, April 2006

Discussion of Results

The training and qualification requirements for peer reviewers are defined in the SNL weapon response procedure. The procedure requires that peer reviewers have "(1) requisite technical knowledge to understand and challenge weapon response information from systems, components, safety, and Pantex operation perspectives; and (2) independence from the development of weapon response to insure there is no conflict of interest." The procedure goes on to note that peer reviewers are either engineers from system organizations or independent assessors. The procedure does not, however, specify what the training and qualification requirements are for system engineers and only provides a general outline of training and qualification expectations for independent assessors.

The training and qualification program for Weapon Response Analysts does not define an appropriate level of knowledge for key competencies, including those associated with Pantex weapon response. The training and qualification program for independent assessors does not include specific training requirements on the weapon response procedures for SNL. In general, the training and qualification programs for weapon response analysts and for independent assessors do not capture all of the necessary core competencies in a way that would ensure an appropriate level of knowledge of the SNL weapon response and peer review process. Additional discussion of qualification requirements for Weapon Response Analysts is included under criterion 1.2.

The general requirement in the SNL procedure that peer reviewers should be independent from

the development of the weapon response is an adequate definition of the requirement for independence.

Conclusion

The criterion is not met.

The SNL procedure adequately addresses the requirement for independence of peer reviewers. However, the training and qualification requirements for peer reviewers, as defined in the SNL weapon response procedure and in the training and qualification programs for weapon response analysts and independent assessors, do not address the necessary core competencies in a way that would ensure a working or expert level of knowledge of the SNL weapon response and peer review process.

Finding
The training and qualification programs for weapon response analysts and for independent assessors do not capture all of the necessary core competencies in a way that would ensure an appropriate level of knowledge of the SNL weapon response and peer review process.

Objective 4

The DA weapon response development procedure(s) define a process for conducting peer reviews of all relevant weapon response documents.

Criterion 4.3

The procedure(s) establish the documentation requirements associated with peer review deliberations and comment resolution.

Approach/Lines of Inquiry

Documents Reviewed:

- *Pantex Weapon Response Data Preparation and Review,* Revision D, September 20, 2007.
- *Pantex Weapon Response Expert Elicitation*, Revision A, September 20, 2007
- *Process, Best Practices, and Issue Discussion for Evaluation of Weapon Response by Sandia National Laboratories to Support Hazard Analyses at Pantex*, Version A, 2007
- *Weapon Response Analyst Training and Qualification*, December 12, 2007
- 12332 General Assessment Training and Qualification Program
- NSAP-002, *NESSG Member Certification Process*, April 2006

Discussion of Results

The SNL procedure includes specific requirements for documentation of the peer review and notes that the peer review documentation must include comment resolution (including minority opinions).

Conclusion

The criterion is met.

The SNL procedure establishes requirements for documenting peer review of weapon response information.

Objective 4

The DA weapon response development procedure(s) define a process for conducting peer reviews of all relevant weapon response documents.

Criterion 4.4

The procedure(s) have been included in the approved DA QAPs (procedures may be included by reference).

Approach/Lines of Inquiry

Documents Reviewed:

- *Pantex Weapon Response Data Preparation and Review,* Revision D, September 20, 2007.
- *Pantex Weapon Response Expert Elicitation*, Revision A, September 20, 2007
- *Process, Best Practices, and Issue Discussion for Evaluation of Weapon Response by Sandia National Laboratories to Support Hazard Analyses at Pantex*, Version A, 2007
- *Weapon Response Analyst Training and Qualification*, December 12, 2007
- 12332 General Assessment Training and Qualification Program
- NSAP-002, *NESSG Member Certification Process*, April 2006

Discussion of Results

The link between the Sandia weapon response and expert elicitation procedures and the Sandia quality assurance program documentation is discussed in detail in criterion 2.1. The Sandia procedures have been included in the appropriate laboratory quality assurance program documentation.

Conclusion

The criterion is met.

The Sandia procedures for weapon response and expert elicitation have been included in the appropriate laboratory quality assurance program document.