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DOE STANDARD

NUCLEAR EXPLOSIVE SAFETY EVALUATION PROCESS



U.S. Department of Energy
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AREA SAFT

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FOREWORD

This Department of Energy (DOE) Technical Standard is approved for use by the Assistant Deputy Administrator for Military Application and Stockpile Operations, National Nuclear Security Administration (NNSA), and is available for use with DOE O 452.1, NUCLEAR EXPLOSIVE AND WEAPON SURETY PROGRAM, and DOE O 452.2, SAFETY OF NUCLEAR EXPLOSIVE OPERATIONS, by all DOE/NNSA components and their contractors who are responsible for the nuclear explosive operations (NEOs) and associated activities and facilities.

Standards are used to identify methods that DOE/NNSA find acceptable for implementing the Department's requirements. Beneficial comments (recommendations, additions, deletions) and any pertinent data that may be of use in improving this document should be addressed to:

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As invoked by DOE O 452.2, this DOE Technical Standard provides requirements and guidance for the nuclear explosive safety study process, as well as other nuclear explosive safety evaluations.

Throughout this standard, the word “must” is used to denote actions that must be performed if the objectives of this standard are to be met.

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1. PURPOSE

This technical standard provides specific information regarding nuclear explosive safety studies (NESSs), operational safety reviews (OSRs), and nuclear explosive safety change evaluations (NCEs) and is in accordance with DOE O 452.2, *Safety of Nuclear Explosive Operations*.

2. SCOPE

This technical standard describes the responsibilities and requirements for conducting a NESS, OSR, and NCE. This standard does not apply to response to unplanned events (e.g., Accident Response Group activities), which are addressed in DOE 5500-series Orders and DOE O 151.1A, *Comprehensive Emergency Management System*. DOE O 452.2 defines the boundaries between planned and unplanned events that may require a different approach for a nuclear explosive safety (NES) evaluation. NES concepts and procedures contained in DOE O 452.2, and this standard may be tailored to meet unique disposition requirements for a specific damaged nuclear explosive/weapon or improvised nuclear device.

3. BACKGROUND

Nuclear explosives, by their design and intended use, require collocation of high explosives and fissile material. The design agencies are responsible for designing safety into the nuclear explosive. The design and production agencies are responsible for designing safety into processes involving the nuclear explosive, including considerations of facility interfaces. In addition, safety is assured through comprehensive, independent safety reviews involving the DOE/NNSA national laboratories, Headquarters (HQ), Service Center (SC) and applicable Site Offices and Management and Operating (M&O) contractors with NES expertise.

The Nuclear Explosive Safety Study Group (NESSG) evaluates NEOs to determine whether the NES Standards specified in DOE O 452.2 are met.

4. RESPONSIBILITIES

- a. Assistant Deputy Administrator for Military Application and Stockpile Operations (NA-12) is responsible for:
 - 1. Selecting, ensuring the hiring/contracting of, funding, and certifying a minimum of four NESSG Senior Technical Advisors (STAs).
 - 2. Approving or disapproving NESS and OSR reports.
 - 3. Approving or disapproving NCE-evaluated change proposals that produce a minority opinion.
 - 4. Approving or disapproving requests regarding administrative extension of NESS expiration dates.
 - 5. Approving or disapproving OSR remediation plans.

- b. Director, Office of Nuclear Weapon Surety and Quality (NA-121) is responsible for:
 - 1. Providing, ensuring the training of, and certifying their NESSG members.

- c. Director, Office of Nuclear Weapons Stockpile (NA-122) is responsible for:
 - 1. Generating quarterly status reports on corrective actions for approved NESSG findings.

- d. NNSA Site Office Managers and the Assistant Deputy Administrator for Secure Transportation (NA-15), as appropriate, are responsible for:
 - 1. Providing, ensuring the training of, and certifying their NESSG members (Site Offices only).
 - 2. Consulting with the NNSA Service Center/Nuclear Explosive Safety Division (NNSA-SC/NESD) as to whether the appropriate form of NES evaluation, for a proposed NEO change, is an NCE or a NESS, based on the criteria in Section 5.1.
 - 3. Requesting NES evaluations and ensuring NESSGs have adequate administrative and logistical resources.
 - 4. Informing NA-12 of the status and resolution plan for NESSG findings and position with regard to any minority opinions.

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5. Approving or disapproving NCE-evaluated change proposals that do not produce a minority opinion.
 6. Defining a process for closure of approved NESSG findings and providing tracking to closure.
- e. Manager, NNSA-SC/Nuclear Explosive Safety Division (NESD) is responsible for:
1. Providing, ensuring the training of, and certifying a minimum of four NNSA federal employees as NESSG chairs.
 2. Recruiting NESSG STAs and recommending selection to NA-12.
 3. Ensuring NESSG STAs receive the NES training required for certification.
 4. Developing new NES training courses as needed.
 5. Consulting with the NNSA Site Office Manager or NA-15, as applicable, as to whether the appropriate form of NES evaluation, for a proposed NEO change, is an NCE or a NESS, based on the criteria in Section 5.1.
 6. Providing periodic NES evaluation schedule updates.
 7. Selecting a NESSG chair for each NES evaluation.
 8. Determining the method for sharing documented feedback with the project team, line management, and the NES community.
- f. NNSA-SC NESSG chair is responsible for:
1. Selecting and ensuring the appropriate composition of certified NESSG personnel for each NES evaluation.
 2. Requiring Technical Advisors (TAs) to participate in a NES evaluation, as appropriate.
 3. Coordinating with the project team and/or line management to schedule the NES evaluation.
 4. Organizing, convening, and leading the NES evaluation.
 5. Ensuring the preparation of NESS reports, OSR reports, and NCE memorandums.
 6. Preparing a transmittal letter for NESS and OSR reports.
 7. Submitting NESS reports, OSR reports, NCE memorandums, and transmittal letters

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- to the responsible approval authority.
8. Forwarding final copies of NESS reports, OSR reports, NCE memorandums, endorsement letters, and documented approvals or disapprovals to participating NESSG personnel and appropriate organizations.
 9. Formally coordinating substantive changes to NESS reports, OSR reports, and NCE memorandums with participating NESSG personnel.
 10. Suspending a NES evaluation if unable to fulfill the requirements of DOE O 452.2 and this Standard.
- g. Design Agencies and M&O contractors are responsible for:
1. Providing, ensuring the training of, and certifying their NESSG members.
 2. Providing TAs to support NES evaluations, if required.
 3. Providing input documentation, briefings, and demonstrations to the NESSG, as required, and certifying the accuracy of the information provided.
 4. Taking appropriate action on approved NESSG findings, as required.

5. TYPES OF NUCLEAR EXPLOSIVE SAFETY EVALUATIONS

The three different types of evaluations performed by the NESSG are a NESS, OSR, and NCE.

5.1 NUCLEAR EXPLOSIVE SAFETY STUDY (NESS)

In a NESS, the NESSG evaluates a proposed NEO to determine if controls are adequate to meet the three DOE NES Standards and other NES criteria as defined in DOE O 452.2.

A NESS must be performed:

- a. For the startup of a new facility for a NEO.
- b. For all proposed NEOs.
- c. When determined to be necessary by the NNSA Site Office Manager or NA-15, as applicable, in consultation with the NNSA/SC-NESD.

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- d. When disagreement between the NNSA Site Office Manager or NA-15, as applicable, and the NNSA/SC-NESD exists as to whether the appropriate form of NES evaluation is an NCE or a NESS.

There are two types of NESSs: Master and Operation-specific Studies. NES Master Studies evaluate facilities, equipment and tooling, processes, and management systems that are common to many NEOs. Operation-specific NESSs include the interfaces with applicable Master Studies.

5.2 OPERATIONAL SAFETY REVIEW (OSR)

In an OSR, the NESSG evaluates authorized, ongoing NEOs to determine if controls remain adequate to meet the three DOE NES Standards and other NES criteria as defined in DOE O 452.2. The scoping of OSRs is to be consistent with the relevant NES Master Study or operation-specific NESS.

An OSR must be performed for authorized NEOs in accordance with DOE O 452.2.

5.3 NUCLEAR EXPLOSIVE SAFETY CHANGE EVALUATION (NCE)

In an NCE, the NESSG determines if a proposed change, or new information, reduces assurance of meeting any of the three DOE NES Standards and other NES criteria.

An NCE must be performed when determined to be necessary by the NES change control process.

6. NESSG PERSONNEL REQUIREMENTS

The term NESSG personnel includes chairs, other members, and Senior Technical Advisors (STAs). A NESSG is a specific composition of NESSG personnel convened to perform a NES evaluation.

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The STAs reinforce the independence and diversity of the NESSG. The STAs are largely from outside the DOE/NNSA community and have experience in serving on high-level panels reviewing high consequence operations. The intent of STA participation is twofold: first, functioning as NESSG personnel, to stimulate a more basic and complete defense by the Project Teams of the safety bases for operations being proposed; and second, as advisors, to suggest to senior NNSA management opportunities for improvement in the NES evaluation process.

In order to be a part of a NESSG convened to perform a NES evaluation, NESSG personnel must:

- a. Be trained. Section 6.1 describes NESSG personnel training.
- b. Be certified. Section 6.2 describes NESSG personnel certification.
- c. Be independent. Section 6.3 describes NESSG personnel independence.

6.1 NESSG PERSONNEL TRAINING

The NNSA SC will establish a training program that ensures chairs attain and maintain proficiency in meeting the requirements established in Appendix A. The NNSA SC will also ensure that a process exists whereby experienced chairs provide background and knowledge to less experienced chairs.

The NNSA SC will ensure that STAs receive the NES training required for their certification.

Organizations providing NESSG personnel, other than chairs and STAs, will establish a training program that ensures their members attain and maintain proficiency in meeting the requirements established in Appendix A. These organizations will also ensure that a process exists whereby experienced members provide background and knowledge to less experienced members.

The NNSA SC will ensure new NES training courses are identified or developed, as

needed, to assist NESSG personnel and personnel-in-training in meeting and maintaining the requirements for NESSG personnel certification.

6.2 NESSG PERSONNEL CERTIFICATION

NESSG personnel are required to possess certain non-technical traits to achieve the desired NESSG characteristics. A key trait is the ability to apply NES expertise and make mature judgments in evaluating NEOs. NESSG personnel must have the ability and willingness to question and challenge the line management safety statement, line of logic, and justification for all issues with the potential to impact NES. NESSG personnel must be able and willing to actively participate as part of a team and to take an unpopular stand when warranted. NESSG personnel also need the oral communication skills to participate effectively in deliberations and the written communication skills to document findings clearly.

The manager, NNSA-SC/NESD certifies chairs. Certification is based on satisfaction of the requirements established in Appendix A and the non-technical traits specified above. Certification is documented by a certification letter and is valid for one year.

NA-12 certifies STAs. Certification is based on satisfactory completion of the NES training and the non-technical traits specified above. Certification is documented in a certification letter to the NNSA-SC/NESD. STA certification has no expiration date.

NA-12, Site Office managers, Laboratory Directors, and M&O Contractor managers will designate certification authorities. Designated certification authorities of organizations providing NESSG personnel, other than chairs and STAs, certify each of their members. Certification is based on satisfaction of the requirements established in Appendix A and the non-technical traits specified above. Certification is documented by a certification letter to the NNSA-SC/NESD and is valid for one year.

6.3 NESSG PERSONNEL INDEPENDENCE

NESSG personnel must not:

- a. Have current responsibility for the design, development, production, or testing of the specific nuclear explosive or NEO being evaluated.
- b. Have responsibility for advocacy of special interests of any organization or defending the specific nuclear explosive, facilities, or NEO being evaluated.
- c. Participate in the preparation of NESS input documentation, OSR supporting documentation, NCE input, or the preparation or presentation of briefings.

NESSG personnel must make objective and independent judgments regarding the NES of the system, operation, or process being evaluated.

7. TECHNICAL ADVISORS (TAs)

The chair may require participation of TAs during the conduct of a NES evaluation. The objective of TA participation is to support a NES evaluation with expert advice in a specific technical discipline.

TAs must not:

- a. Have current responsibility for the design, development, production, or testing of the specific nuclear explosive or NEO being evaluated.
- b. Have responsibility for advocacy of special interests of any organization or defending the specific nuclear explosive, facilities, or NEO being evaluated.
- c. Participate in the preparation of NESS input documentation, OSR supporting documentation, NCE input, or the preparation or presentation of briefings.

8. NESS, OSR, AND NCE PROCESSES

8.1 NESSG COMPOSITION

The following table displays the minimum required NESSG composition for NES

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evaluations. NCEs require at least three NESSG personnel. Additional NESSG personnel may be drawn from NNSA-SC/NESD, NSO, PXSO, NA-121, LANL, LLNL, SNL, and BWXT.

TABLE 1.

REQUIRED NESSG PERSONNEL FOR NES EVALUATIONS			
PROVIDING ORGANIZATION	NESS	OSR	NCE
NNSA SC	1 (Chair)	1 (Chair)	1 (Chair)
NSO	1 (NTS evaluations)	1 (NTS evaluations)	1 (NTS evaluations)
PXSO	1 (Pantex evaluations)	1 (Pantex evaluations)	1 (Pantex evaluations)
NNSA NA-12	2 (STAs)	1 (STA)	
LANL	1	1	1*
LLNL	1	1	
SNL	1	1	
BWXT	1 (Pantex evaluations)	1 (Pantex evaluations)	

* At least one NESSG member is required from any one of the indicated providing organizations.

The manager, NNSA-SC/NESD must provide periodic NES evaluation schedule updates to NESSG member organizations and select a chair for each NES evaluation.

Organizations providing NESSG personnel, other than chairs, nominate NESSG personnel for each NES evaluation, as requested. NNSA HQ will notify the chair if a NNSA HQ NESSG member or observer will participate in a NES evaluation.

The chair must select NESSG personnel for a NES evaluation and verify that their NESSG certification will be current at the initiation of the evaluation. NESSG personnel should not be changed for the duration of a specific NES evaluation.

8.2 NESS PROCESS

8.2.1 NESS PLANNING MEETINGS

The project team is responsible for conducting planning meetings with the NNSA-SC/NESD and other NESSG personnel organizations, responsible line management organizations, design agency, and production agency, as appropriate. To ensure a common understanding of the approach being taken for the NESS, the planning meetings will:

- a. Define the scope and objectives of the NESS.
- b. Identify required NESS input.
- c. Assign organizational responsibilities for input compilation.
- d. Identify organizational points of contact.
- e. Develop a schedule for input preparation, input delivery, NESSG review of input, and other NESS preparatory activities.
- f. Plan briefings, demonstrations, and resources as required to support the study.

The project team is responsible for documenting and distributing planning meeting decisions, agreements, assumptions, and issues to the planning meeting participants.

8.2.2 NESS INPUT DOCUMENTATION

A NESS relies heavily on detailed information and analyses. The project team is responsible for the compilation and distribution of NESS input documentation to NESS participant organizations.

In addition to the scope and objectives of the NESS, the input documentation must include the following, if applicable:

- a. A description of the nuclear explosive, including:
 1. General weapon overview, including modifications, alterations, and safety related implications.

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2. One-point safety analysis, including a summary of test results and analysis of the interface of the nuclear explosive with process tooling.
 3. NES theme and description of the nuclear explosive design safety features.
 4. Characteristics of explosives; detonators; actuators; propellants; reactive materials; batteries; high-pressure vessels; and flammable and combustible materials.
 5. Electrical circuits and functions in the nuclear explosive.
 6. Any conditions unusual or unique to the nuclear explosive or high explosive.
 7. Non-DOE/NNSA supplied components, when these components are a part of the nuclear explosive while it is in DOE/NNSA custody.
 8. Susceptibilities to energy sources including electrostatic discharge (ESD), electromagnetic radiation, and other electrical, thermal, mechanical, and chemical.
 9. Potential hazards associated with telemetry features/connectors.
- b. A description of the proposed NEO, including:
1. Process flow.
 2. Approved, written procedures for the safe conduct of the NEO.
 3. Proposed tests and inspections, including supporting rationale.
 4. Descriptions of tooling and other equipment, including interfaces with the nuclear explosive, and drawings of process tooling.
 5. Electrical tester design and safety analysis, including interfaces with the nuclear explosive, and independent tester safety assessment.
 6. Design and safety attributes of equipment used for transporting the nuclear explosive including shipping containers and description and analysis of tie-down patterns for transportation operations.
 7. Description of any major unique features of the process and tooling under review.
 8. Changes to design agency drawings and specifications.

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- c. Safety basis information including:
 - 1. The safety basis for facilities to be used in the evaluated NEO including fire protection systems, seismic analysis, lightning analysis, design basis accidents, etc.
 - 2. The hazards assessment for the specific NEO.
 - 3. Identification of controls and supporting rationale with analysis and/or test data.
 - 4. The controls applicability matrix, source documents for controls, and flow down (implementing procedures) of controls.
 - 5. Identification of all accident scenarios that result in inadvertent nuclear detonation (IND), high explosive detonation, high explosive deflagration, or fissile material dispersal.
 - 6. Analysis of pathways leading to IND, including a vulnerability assessment.
 - 7. Potential threats to NES from security operations, surveillance or other inspection requirements, or human error.
 - 8. Potential threats to NES from associated systems (e.g., spin rockets, parachute deployment systems, use control features, or instrumentation for nuclear explosive test devices).
 - 9. Isolation of nuclear explosives from unwanted energy sources, both internal and external to the facility, including but not limited to, electrical, thermal, mechanical, and chemical energy sources.

- d. Relevant information from existing NESSG reports including both open and closed findings, both implemented and pending corrective actions, occurrence reports, and safety related Significant Finding Investigations.

To the extent that these topics are adequately covered in existing documents, those documents may be acceptable NESS input. Examples are: Documented Safety Analyses (DSA), Safety Analysis Reports (SARs), Hazard Analysis Reports (HARs), Technical Safety Requirements (TSRs), Basis for Interim Operations (BIOs), Weapon Safety Specifications (WSSs), and their references. These existing documents should

be appropriately indexed to facilitate topical searches.

The project team is responsible for obtaining explicit certification of the technical accuracy of NESS input documentation from the organizations providing the input.

8.2.3 NESS PREPARATION

NESSG personnel, and TAs participating in a NESS, are responsible for and will be given sufficient time and resources to read and evaluate the input documentation, perform individual study and research, and develop lines of inquiry, prior to commencing the NESS. Sufficient time for NESS preparation varies with the scope and complexity of the evaluated NEO. A nominal preparation period is on the order of six weeks following receipt of the input documentation.

During the preparation period, all NESS participants will convene with the project team to:

- Determine if the input documentation is adequate to proceed with the NESS,
- Finalize the approach to the NESS,
- Establish a detailed agenda for the NESS, and
- Establish a schedule for the NESS.

The specific timing and agenda for this meeting are among the decisions made during the NESS planning meetings and finalized in discussions between the chair and the project team lead. NESSG personnel may decide to receive various technical briefings in conjunction with this meeting. As a result, this meeting should be scheduled to allow sufficient time for NESSG personnel, and TAs participating in a NESS, to more closely examine the portions of the input documentation related to the briefings. The chair documents and distributes the results of this meeting including a statement regarding the input adequacy, any agreed to resolution of deficiencies, and the NESS schedule to the meeting participants.

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Until the NESSG personnel reach a consensus that the input is adequate, and NESSG personnel and the project team determine any additional preparation time needed, the NESS start date and schedule are tentative.

Preparation for, and conduct of, a NESS is the primary responsibility of the NESSG personnel, and TAs participating in a NESS, for the timeframe required to support the NESS. Conflicts must be resolved in favor of NESS duties from the date the input documentation is available until conclusion of the NESS.

NNSA line management organizations establish NESS readiness criteria. The project team and line management organizations must provide a formal declaration of readiness based on these criteria.

8.2.4 CONDUCTING THE NESS

Six key elements central to the conduct of a NESS are briefings, demonstrations, deliberations, report generation, feedback, and validation. These six elements may occur serially, overlap, or be modified in content based on the scope of the NESS and planning meeting decisions. During the conduct of the NESS, NESSG personnel evaluate the entire process and complete suite of controls against the three DOE NES Standards, and other NES criteria, and may identify issues for discussion.

8.2.4.1 *BRIEFINGS*

NESS briefings are the presentation of information by various subject matter experts covering key information from the input documentation. In effect, these briefings are an oral defense of the proposed NEOs. NESSG personnel may request briefings at the planning meetings or during the conduct of the NESS. Briefings are intended to ensure a common understanding of the NEO being evaluated and provide a forum for discussion. NESSG personnel will critically consider the briefings, question or challenge the briefers, and identify potential

issues as they arise.

8.2.4.2 DEMONSTRATIONS

NESS demonstrations are a simulation of proposed NEOs using trainer units or other mock-ups. Demonstration details, including the fidelity of the simulation, are established during the planning meetings but may be modified during the conduct of the NESS. Demonstrations allow an examination of the interface between the unit and the tooling, equipment, testers, and facility. NESSG personnel will critically evaluate the process for opportunities to strengthen NES controls.

Demonstrations must:

- a. Be conducted in a manner that provides the most realistic simulation practicable.
- b. Be conducted by trained and qualified technicians.
- c. Use actual or representative equipment, tools, tooling, and support equipment.
- d. Use approved, production ready, written procedures. In other words, procedures in a useable condition upon authorization to perform the NEO.
- e. Be conducted in an actual bay, cell, or other facility representative of conditions in which the NEO is performed. A training facility set-up to accurately replicate the actual facility in size and layout may be an acceptable alternative. NESSG personnel are the final arbiters of the suitability of the representative conditions of the demonstration.

8.2.4.3 DELIBERATIONS

NESS deliberations involve a collaborative effort among the NESSG personnel, TAs, project team, and subject matter experts to identify and debate all sides of the issues. NESS participants deliberate issues identified during NESS preparation, briefings, and demonstrations. NESSG personnel evaluate the issues

against the three DOE NES Standards and other NES criteria, categorize the issues, and initiate written documentation as conclusions develop.

Although the NESSG strives for consensus, NESSG personnel may submit minority opinions when individual judgment differs from the consensus. If NESSG personnel submit a minority opinion, it must be included in the NESS report in its entirety and NESSG majority personnel must prepare a written response to the minority opinion.

The NESSG normally conducts deliberations in open meetings and is receptive to relevant input from knowledgeable, informed sources. NESSG personnel may also hold executive sessions (closed meetings in which only NESSG personnel participate) at the discretion of the chair.

8.2.4.4 REPORT GENERATION

Section 8.2.5 details NESS report requirements.

8.2.4.5 FEEDBACK

Feedback is important for the success of both the NEO under evaluation and future NES activities. NESS personnel should capture and document lessons learned throughout all NESS activities (including preparation and planning). The NNSA-SC/NESD determines the method for sharing documented feedback with the project team, line management, and the NES community.

8.2.4.6 VALIDATION

A NESS Validation is observation of actual NEOs to determine if there is consistency with simulated operations demonstrated during a NESS. The NESSG will recommend to the responsible Site Office manager or NA-15, as appropriate,

whether a NESS Validation should be performed following commencement of operations. The scope, schedule, and expectations of the validation (including validation participants) are determined by the NESSG personnel and documented in the NESS report.

8.2.5 NESS REPORTS

The NESS report must include the following:

- a. Abstract
- b. Table of contents
- c. NESSG personnel signature page
- d. Identification of NESS input
- e. Purpose and background, including identification of other applicable NESS reports
- f. Scope defining the evaluated NEOs
- g. Evaluation criteria used to judge the NES of the NEOs (Example: the NES Standards)
- h. Activities of the NESSG, including dates and location(s) where the evaluation was conducted
- i. Summary descriptions of the nuclear explosive and evaluated NEOs
- j. Evaluation results, including:
 1. Issues and conclusions, with supporting rationale
 2. Adequacy of controls to meet the three DOE NES Standards
 3. Findings:
 - (a) "Pre-start" findings, if any
 - (b) "Post-start" findings, if any
 4. Summary of deliberation topics (substantive discussions that did not result in a finding)
 5. A statement on the adequacy of resources (such as documentation, briefings, demonstrations, observations, time, and administrative support) to perform the evaluation

6. NESSG personnel minority opinion(s), if any, and associated majority response
- k. References, including publication date and revision number
- l. Appendices:
 1. NESS agenda
 2. Participants
 3. Approval correspondence (in final report after HQ approval)

NESSG personnel are responsible for the content of the NESS report.

NESSG personnel will sign the report. Signature of the NESS report represents concurrence with the conclusions and findings, unless noted in minority opinions. Signing the NESS report does not imply that the signer's organization agrees with the report contents.

If the report is substantively changed after it is signed, the chair must formally coordinate the changes with NESSG personnel.

8.2.6 APPROVAL PROCESS FOR NESS REPORTS

The chair submits a coordination copy of the NESS report to NA-12 for approval, with a transmittal letter summarizing the NESS results. Copies of the report and transmittal letter are provided to the responsible NNSA Site Office manager or NA-15, as applicable, and to NA-121. NESSG personnel may be asked to provide briefings to line managers as part of the NESS approval process.

The responsible Site Office manager or NA-15, as applicable, must inform NA-12 of the resolution plan for NESS "pre-start" and "post-start" findings and response to any minority opinions. Additional information regarding the evaluation may be added at the discretion of the Site Office manager or NA-15, as applicable.

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NA-12 is the NESS approval authority and must document the report approval (or reason for disapproval), comment on any minority opinions, and specify any conditions of approval in correspondence that includes the responsible Site Office manager or NA-15, as applicable, and the chair.

The chair provides a copy of the NESS final report to participating NESSG personnel.

8.3 OSR PROCESS

In an OSR, the NESSG evaluates authorized, ongoing NEOs to determine if the adequacy of controls has been degraded as a result of changes to the process, new information, or new expectations relevant to NES. An OSR must be conducted at least once every 60 months.

8.3.1 OSR PLANNING MEETINGS

The NNSA-SC/NESD conducts planning meetings with responsible line management organizations, as appropriate. To ensure a common understanding of the approach being taken for the OSR, the planning meetings will:

- a. Define the scope and objectives of the OSR.
- b. Identify required OSR supporting documentation.
- c. Assign organizational responsibilities for compilation of supporting documentation.
- d. Develop a tentative schedule for the OSR.

The chair documents and distributes planning meeting decisions, agreements, assumptions, and issues to OSR participants and appropriate organizations.

8.3.2 OSR SUPPORTING DOCUMENTATION

An OSR relies on up-to-date existing information, existing analyses, and observation of NEOs. Line management is responsible for the compilation and distribution of

OSR supporting documentation to OSR participants.

The supporting documentation must include the following:

- a. Current approved written procedures.
- b. Changes to the configuration of the nuclear explosive and changes to the WSS since the NESS.
- c. Significant process, equipment, tooling, tester, and facility changes since the NESS including all those that, for NES considerations, could not be approved by the M&O contractor.
- d. Current Authorization Basis documents including changes requiring DOE/NNSA approval since the NESS.
- e. Applicable NCE memorandums, occurrence reports, and safety related Significant Finding Investigations.
- f. Relevant information from applicable NESS reports including both open and closed findings, and both implemented and pending corrective actions.

8.3.3 OSR PREPARATION

NESSG personnel, and TAs participating in an OSR, are responsible for and will be given sufficient time and resources to read and evaluate the supporting documentation, and perform individual study and research, prior to commencing an OSR. Sufficient time for OSR preparation varies with the scope and complexity of the evaluated NEO. A nominal preparation period is on the order of three weeks following receipt of the supporting documentation.

During the preparation period, the chair will conduct a final planning meeting with all OSR participants and responsible line management organizations to:

- a. Define the scope and objectives of the OSR.
- b. Review operational schedules and opportunities to observe relevant NEOs.
- c. Identify required briefing topics.
- d. Review the status of current Authorization Basis documents.

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- e. Plan briefings, observations, and resources as required to support the OSR.
- f. Establish an agenda and schedule for the OSR.

The chair documents and distributes the results of this meeting including a statement regarding the OSR scope, objectives, and schedule to the meeting participants.

Preparation for, and conduct of, an OSR is the primary responsibility of the NESSG personnel, and TAs participating in an OSR, for the timeframe required to support the OSR. Conflicts must be resolved in favor of OSR duties from the date the supporting documentation is available until conclusion of the OSR.

8.3.4 CONDUCTING THE OSR

Five key elements central to the conduct of an OSR are briefings, NEO observations, deliberations, report generation, and feedback. One significant difference between a NESS and an OSR is that the OSR participants will observe actual NEOs rather than a simulation using trainer units or other mock-ups. During the conduct of the OSR, NESSG personnel evaluate the adequacy of controls to meet the three DOE NES Standards, and other NES criteria, as evidenced in the performance of the NEO, the written procedures, equipment design, and facilities.

An OSR must reach one of the following conclusions:

1. The NEO continues to meet the three DOE NES Standards (i.e., no pre-start findings have been identified).
2. The NEO does not meet the three DOE NES Standards and must be suspended (i.e., pre-start findings have been identified). Actions must be taken to address specific NES concerns before resuming operations.

OSR briefings should be informative in nature rather than an oral defense typical of NESS briefings. NESSG personnel may request briefings at planning meetings. The purpose is to ensure a common understanding of the NEO being evaluated and

facilitate productive NEO observations.

OSR deliberations follow the same process as a NESS, which is described in Section 8.2.4.3. OSR report generation follows the same process as a NESS, which is described in Section 8.2.4.4. OSR feedback follows the same process as a NESS, which is described in Section 8.2.4.5.

8.3.5 OSR REPORTS

The requirements for an OSR report are identical to the requirements for a NESS report, which is defined in Section 8.2.5.

8.3.6 APPROVAL PROCESS FOR OSR REPORTS

The requirements for approval of an OSR report are identical to the requirements for approval of a NESS report, which is defined in Section 8.2.6.

8.4 NCE PROCESS

In an NCE, the NESSG determines if a proposed change, or new information, reduces assurance of meeting any of the three DOE NES Standards and other NES criteria.

8.4.1 NCE PLANNING

Because change proposals, or NCEs of new information, vary widely in complexity, the level of effort and degree of detail needed for effective planning will also vary. The need for a formal planning meeting is determined through advanced planning discussions between the change proposal organizations, or organizations providing new information, and the NNSA-SC/NESD. If necessary, the NNSA-SC/NESD conducts a planning meeting, as appropriate. To ensure a common understanding of the approach being taken for the NCE, the planning will:

- a. Define the scope and objectives of the NCE.

- b. Identify required briefing topics.
- c. Identify required demonstrations.
- d. Plan briefings, demonstrations, and resources as required to support the NCE.
- e. Establish an agenda and schedule for the NCE.

The chair documents and distributes planning results to NCE participants and appropriate organizations.

8.4.2 NCE INPUT

Because change proposals, or NCEs of new information, vary widely in complexity, the level of effort and degree of detail needed for documentation will also vary. The originator of the change proposal is responsible for preparation of the change package and distribution to NCE participants.

The change package for proposed changes evaluated by an NCE should be tailored to the specific proposal and must include the following:

- a. A complete description of the proposed change including the process flow and approved, production ready, written procedures.
- b. An evaluation of the hazards associated with the proposed change and identification of any new controls or changes to existing controls derived for the hazards.
- c. Supporting documentation as needed to defend the proposal.
- d. Relevant information including both open and closed findings, and both implemented and pending corrective actions.

The change package should include sufficient information to describe the proposed change and establish that it is not a threat to NES. The approach to support this conclusion may be tailored to the nature of the change and availability of applicable safety analyses. For example, a comparative analysis may be used to show that an existing approved process bounds the proposed operations from a NES perspective.

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As another example, a complete (stand-alone) analysis may be used to show that implementation of the proposed change would not pose a threat to NES.

8.4.3 NCE PREPARATION

NESSG personnel, and TAs participating in an NCE, will be given sufficient time and resources to read and evaluate the change package. Because change proposals, or NCEs of new information, vary widely in complexity, sufficient time for NCE preparation will vary from a nominal preparation period following receipt of the change package to no preparation, prior to commencing an NCE.

8.4.4 CONDUCTING THE NCE

Five elements central to the conduct of an NCE are briefings, demonstrations, deliberations, documentation of results, and feedback. The need for briefings and demonstrations are determined during the NCE planning, but may also be requested by NESSG personnel during the conduct of the NCE. During the conduct of the NCE, NESSG personnel determine if a proposed change, or new information, reduces assurance of meeting any of the three DOE NES Standards and other NES criteria. For a change proposal to address an approved NESSG finding, NESSG personnel must also determine whether the proposed change adequately corrects the NES deficiency.

An NCE must reach one of the following conclusions:

1. The proposed change does not reduce assurance of meeting the three DOE NES Standards (i.e., no pre-start findings have been identified).
2. The proposed change reduces assurance of meeting the three DOE NES Standards (i.e., pre-start findings have been identified).

During the conduct of the NCE, the chair may advise the originator of the change proposal of any additional information required above and beyond the initial change package submittal. This could result in suspension of the NCE until the additional

information is provided.

Although the NESSG strives for consensus, NESSG personnel may submit minority opinions when individual judgment differs from the consensus. If NESSG personnel submit a minority opinion, it must be included in the NCE memorandum in its entirety and NESSG majority personnel must prepare a written response to the minority opinion.

8.4.5 NCE MEMORANDUMS

The NCE must be documented in a memorandum that includes:

- a. Chair Signature and NESSG personnel identification
- b. Identification and summary description of the subject evaluated
- c. Evaluation results, including:
 1. Conclusions with supporting rationale
 2. Findings:
 - (a) “Pre-start” findings, if any
 - (b) “Post-start” findings, if any
 3. A statement on the adequacy of resources (such as documentation, briefings, demonstrations, NESSG composition, time, and administrative support) to perform the evaluation
 4. NESSG personnel minority opinion(s), if any, and associated majority response
- d. Change Package (attached or referenced)
- e. Participants

NESSG personnel are responsible for the content of the NCE memorandum. The level of detail should be tailored to the subject and must be adequate to support the approval authority’s decision.

8.4.6 CHANGE APPROVAL PROCESS

The approval authorities for change proposals evaluated by an NCE are:

- a. NA-12 for NCE memorandums containing minority opinions; otherwise,
- b. The Site Office Manager for Pantex and NTS operations, or
- c. NA-15 for Office of Secure Transportation (OST) operations.

The chair submits the NCE memorandum to the approval authority and a copy to NA-121.

When NA-12 is the approval authority, the chair will provide a copy for the responsible Site Office manager or NA-15, as applicable. NA-12 must document the change approval (or reason for disapproval) in correspondence that includes the responsible Site Office manager or NA-15, as applicable, and the chair. Following NA-12 approval, the responsible Site Office manager or NA-15, as applicable, may then approve implementation of the change in correspondence to the originator of the change proposal, with copies to the chair and NA-121.

When the Site Office manager or NA-15 is the approval authority, the approval authority must document the change approval (or reason for disapproval) in correspondence to the originator of the change proposal, with copies to the chair and NA-121.

The chair provides a copy of the final NCE memorandum and change approval (or disapproval) correspondence to participating NESSG personnel.

8.5 CORRECTIVE ACTIONS FOR NESSG FINDINGS

Approval of NESSG reports constitutes NNSA tasking to take action on the findings, unless the approval authority specifies otherwise. Responsible Site Offices and NA-15 have the authority to act on NESSG findings in advance of NA-12 approval. When

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NESSG findings impact ongoing operations, the Site Office or NA-15 should provide direction to operations personnel deemed appropriate based on the information in the findings. The range of options include suspending the affected operations, implementing corrective or compensatory measures, and allowing operations to continue unchanged pending further evaluation or NA-12 decision.

Responsible Site Offices and NA-15 must define a process for closure of approved NESSG findings that:

- Ensures closure of approved NESSG findings categorized as “pre-start” prior to initiation or continuation of NEOs;
- Establishes plans, resources, responsibilities, and timing for closure of approved NESSG findings categorized as “post-start”; and
- Provides for tracking approved NESSG findings to closure.

NA-122 must generate quarterly status reports on the corrective actions planned and taken for approved NESSG findings. Distribution is to include NA-12, NA-121, the responsible Site Offices, NA-15, NNSA-SC/NESD, design agencies, and M&O contractors.

The current status of all open NESSG findings must be addressed in subsequent NESSs, OSRs, and, if relevant, NCEs.

9. EXPIRATIONS AND EXTENSIONS

9.1 EXPIRATIONS

All NESSs are valid for 5 years unless the requirements for a non-expiring NESS are met. The requirements for a non-expiring NESS require the contractor responsible for a NEO at a DOE/NNSA nuclear facility to meet the DSA requirements established in 10CFR830.

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An OSR must be conducted at least once every 60 months, for authorized NEOs with a non-expiring NESS. If an OSR will not be conducted within the prescribed time interval, the responsible Site Office manager or NA-15, as applicable, must notify NA-12 at least 90 days prior to the end of the required interval and submit a remediation plan to NA-12 prior to the end of the required interval. A copy of the remediation plan will be provided to NNSA-SC/NESD.

NA-12 is the approval authority for remediation plans and must document the remediation plan approval (or reason for disapproval) in correspondence to the responsible Site Office manager or NA-15, as applicable, and the NNSA-SC/NESD.

9.2 EXTENSIONS

The requester of an administrative extension to a NESS expiration date submits the request to NA-12 for approval. A copy of the request will be provided to NNSA-SC/NESD. The request must include:

- A compelling reason for the extension;
- The basis for the statement on continued safety, including how 10CFR830 requirements are met; and
- Identification of open NESSG findings categorized as “post-start”.

NA-12 is the approval authority for administrative extension of NESS expiration dates and must document the approval (or reason for disapproval) in correspondence to the requester and the NNSA-SC/NESD.

APPENDIX A

NESSG PERSONNEL

TRAINING REQUIREMENTS

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PURPOSE

This Appendix establishes competency requirements for Nuclear Explosive Safety Study Group (NESSG) chairs and other members. Satisfactory and documented completion of the competency requirements contained in this Appendix ensures that NESSG chairs and other members possess the minimum requisite competencies to fulfill their duties and responsibilities.

APPLICABILITY

The competency requirements in this Appendix apply to NESSG chairs and other members, regardless of organization.

SENIOR TECHNICAL ADVISORS

STAs are selected from private industry, the academic community, and other government agencies and possess superior technical backgrounds with varied experience in high consequence operations. STAs are expected to provide a diversified perspective based on their knowledge and experience. STAs will be provided general orientation training on nuclear explosive operations (NEOs) and the NES evaluation process prior to assignment to a NESSG. Upon satisfactory completion of training, the NNSA-SC/NESD will recommend STA candidates to NA-12 for certification.

The following are types of qualities sought after in selecting NESSG STAs:

- Recognized senior-level scientist or engineer with broad technical and managerial experience.
- Expert knowledge of technical disciplines, such as seismic phenomena, lightning, high explosives, or electrical engineering.
- Experience with the review, approval, operation, and management of high consequence production, manufacturing, and/or power plant operations.
- Demonstrated active participation and value added in expert panels, peer reviews, etc.
- Technical investigative skills to support safety evaluations and challenge line management's safety case.
- Upper level management experience with the ability to seek technical expertise and advice from national laboratories, industry, and/or academic communities.

IMPLEMENTATION REQUIREMENTS

Organizations providing NESSG chairs or other members must establish a program and process to ensure that each of their members meet the competency requirements contained in this Appendix. Documented completion of the competency requirements will be included in the individual's training records.

In selected cases, it may be necessary to exempt an individual from one or more of the competencies contained in this Appendix. Exemptions from individual competencies must be justified and documented. The individual's certification authority, as identified in DOE-STD-3015, approves requests for exemptions.

Equivalencies may be granted for individual competencies based upon an objective evaluation with corresponding evidence of the individual's prior advanced education, experience, certification, and/or training. Equivalencies should be used sparingly and then with the utmost rigor and scrutiny to maintain the spirit and intent of this Appendix. The supporting knowledge and/or skill statements for the individual competencies should be evaluated. Recent experience or training that included examinations should also be evaluated. Completion of a professional certification such as a Professional Engineering license related directly to the competency requirements should be considered. Satisfactory completion of graduate level college courses that relate directly to specific competencies may be considered equivalent.

Initial training to meet the competencies contained in this Appendix will be provided to NESSG chairs-in-training and members-in-training. NESSG trainees must meet the requirements of this Appendix, prior to certification.

BACKGROUND AND EXPERIENCE

The preferred education and experience for NESSG chairs and other members is:

1. Education:

The minimum education requirement is a Bachelor of Science in Engineering or Physics. Preferred education is a Master of Science in Engineering or Physics with a strong preference for individuals with a PhD in a technical area.

2. Experience:

The minimum experience requirement is 5 years of federal, state, military, industrial, or other directly related experience that has provided specialized experience in NES, design, assembly/disassembly, maintenance, testing, transportation, handling, or storage; or other similar experience in high consequence explosive or nuclear safety operations. Specialized experience can be demonstrated through possession of the competencies outlined in this Appendix.

REQUIRED COMPETENCIES

The competencies contained in this Appendix are divided into the following four categories:

1. Technical Knowledge and Skills
2. Governing Orders, Standards, and Directives
3. General Management
4. Performance Requirements

Each competency category is defined by one or more competency statements indicated by bold print. The competency statements define the expected knowledge and/or skill that an individual must possess and are requirements. Each of the competency statements is further explained by a

listing of supporting knowledge and/or skill statements. The supporting knowledge and/or skill statements are not requirements and need not be fulfilled to meet the intent of the competency.

TECHNICAL KNOWLEDGE AND SKILLS

NOTE: When DOE directives are referenced, the most recent revision should be used.

1. NESSG chairs and other members must have knowledge of the physics of nuclear weapons and explosives.

Supporting Knowledge and/or Skills

- a. Define the following terms:
 - Excitation energy
 - Critical energy
 - Fissile material
 - Fissionable material
 - Fertile material
- b. Describe the curve of binding energy per nucleon vs. mass number and give a qualitative description of the reasons for its shape.
- c. Explain why only the heaviest nuclei are easily fissioned.
- d. Explain why uranium-235 fissions with thermal neutrons and uranium-238 fissions only with fast neutrons.
- e. Discuss the effects and applications of the following factors relevant to criticality safety of operations:
 - Mass
 - Shape
 - Separation
 - Geometry
 - Moderation
 - Reflection
 - Concentration
 - Volume
 - Density
 - Neutron absorbers
 - Heterogeneity
 - Enrichment
- f. Discuss the influence of the presence of non-fissionable materials in contact with fissionable material on nuclear criticality safety.
- g. Discuss the following processes and their application in nuclear explosive design:
 - Nuclear fission

- Nuclear fusion
 - h. Define the term “fissile materials” and give examples applicable to nuclear explosive design.
- 2. NESSG chairs and other members must have knowledge of the materials used in nuclear weapons and nuclear explosives, including hazardous properties.**

Supporting Knowledge and/or Skills

- a. Discuss the mechanical, chemical, nuclear, and radiological characteristics and related hazards from the following materials used in nuclear explosives/weapons:
 - Uranium
 - Plutonium
 - Tritium
 - Thorium
 - b. Discuss the NES implications of the following:
 - LiH and LiD
 - Fogbank
 - Beryllium
 - UH₃
 - Plutonium hydride
 - c. Discuss the safety and toxicity issues associated with weapon and process materials as listed in the existing current Weapon Safety Specifications (WSSs) for weapons in the stockpile. Discuss the protocols for handling the components of nuclear weapons and trainers during NES evaluations.
- 3. NESSG chairs and other members must have knowledge of the internal design of nuclear explosives.**

Supporting Knowledge and/or Skills

- a. Describe, in general terms, the basic design and working principles of implosion and gun-type devices.
- b. Describe the basic design of a thermonuclear weapon using a secondary.
- c. Explain the following nuclear explosive concepts and terminology:
 - Initiation
 - Boosting
 - Alpha (Neutron Multiplication)
- d. Discuss the function, purpose, and design of the following systems and components:
 - Arming
 - Fusing

- Firing
- High explosives
- Fissionable material
- Fissile material - primary and secondary
- Detonators
- Boosting device
- Neutron generators

4. NESSG chairs and other members must have knowledge of nuclear detonation safety design concepts.

Supporting Knowledge and/or Skills

- a. Describe the following nuclear detonation safety design concepts:

The concept of isolation:

- Identify when barriers are breached during assembly/disassembly.
- Identify when strong links are absent or potentially bypassed.

The concept of incompatibility:

- Identify available energy sources and their effects on nuclear explosive components.
- Identify available signals that could drive a unique signal discriminator.

The concept of inoperability:

- Give examples of weak links in various nuclear explosives.
- Describe the features and safety role of the weak link(s).

The concept of independence:

- Describe common-mode failure and give examples relevant to nuclear weapon designs.

- b. Discuss the role of first principles in the implementation of the nuclear detonation safety design principles (safety theme).
- c. Describe nuclear explosive components or features that have been employed to provide isolation, inoperability, and incompatibility, including:
- Barriers
 - Weak links
 - Strong links
 - Unique signals
- d. Describe nuclear explosive design features that have been employed to prevent/mitigate fissile material dispersal, including:
- Insensitive high explosives (IHEs)
 - Fire-resistant pits

5. NESSG chairs and other members must have knowledge of the effects of abnormal environments on nuclear explosives.

Supporting Knowledge and/or Skills

- a. Discuss the term “abnormal environment.”
- b. List the categories of abnormal environments specific to NEOs and storage, and describe the characteristics of each.

6. NESSG chairs and other members must have knowledge of one-point safety and related issues.

Supporting Knowledge and/or Skills

- a. Describe the concept of one-point safety.
- b. List possible conditions that might challenge one-point safety.
- c. Describe designs that have been used to make warheads multi-point safe.

7. NESSG chairs and other members must have knowledge of fusing, arming, control, and ancillary systems in nuclear weapons.

Supporting Knowledge and/or Skills

- a. Discuss the basic components of fusing systems for reentry bodies (RBs), reentry vehicles (RVs), and gravity bombs, including:
 - Radars
 - Contact fuses
 - Timers
 - Power supplies
- b. Discuss the basic components of arming systems for RB/RVs and gravity bombs, including:
 - Environmental sensing devices (ESDs)
 - Fuse switches
 - Power supplies
 - Capacitor discharge units
 - Ferro-magnetic units
 - Switches
- c. Describe the nuclear explosive use control features typical of U.S. weapons.
- d. Describe the following as used in nuclear weapons and the hazards associated with each:
 - Aeroshell
 - Bomb case

- Radiation shielding
- Yield-select mechanisms
- Release mechanisms

8. NESSG chairs and other members must have knowledge of the U.S. stockpile.

Supporting Knowledge and/or Skills

Find and discuss authoritative descriptions of weapons in the stockpile.

9. NESSG chairs and other members must have knowledge of high explosives and their applicability in nuclear explosives.

Supporting Knowledge and/or Skills

- a. Discuss the difference between IHEs and conventional high explosives (CHEs) used in nuclear explosives.
- b. Describe the function of primary and secondary explosives in nuclear explosive design.
- c. Discuss and compare the effects of the following interrelated high-explosive terms that apply to nuclear explosive design:
 - Detonations
 - High explosive violent reactions
 - Deflagration
 - Combustion
- d. Describe the response of high explosives used in nuclear explosive design to the following external stimuli:
 - Mechanical
 - Electrical
 - Thermal
- e. Discuss the effects of aging on the high-explosive materials used in nuclear explosive design.

10. NESSG chairs and other members must have knowledge of detonators.

Supporting Knowledge and/or Skills

- a. Describe the main-charge detonators used in nuclear weapons, including the principles of operation, overall design, operating thresholds, and aging characteristics.
- b. Describe the following detonator types:
 - Exploding bridge wire
 - Hot wire
 - Slapper

- Mechanical safe and arming
- c. Describe the electrical sensitivity of detonators and squibs.
- d. Describe the standards for human electrostatic discharge.
- e. Describe the use of booster explosives.
- f. Describe the use of non-electrical initiators in nuclear weapons.

11. NESSG chairs and other members must have knowledge of squibs, propellants, and other pyrotechnics.

Supporting Knowledge and/or Skills

- a. Identify the hazards from each of the following features of nuclear explosive design:
 - Spin rockets
 - Parachute subsystems
 - Boosting device

12. NESSG chairs and other members must have knowledge of the facilities used to assemble, disassemble, stage, test, and handle nuclear explosives, including facility safety equipment and equipment that interfaces with nuclear explosives.

Supporting Knowledge and/or Skills

Describe the following facilities, including unique safety features, such as blast valves, blast doors, fire detection, deluge, grounding, and lightning protection, as applicable to the Pantex Plant and the Device Assembly Facility (DAF):

- a. Assembly/disassembly bays
- b. Assembly/disassembly cells
- c. Ramps
- d. Special purpose facilities
 - Vacuum chambers
 - Mass properties facilities
 - Radiography facilities
 - Separation test facility
 - Paint bay

13. NESSG chairs and other members must have knowledge of electrical isolation systems and their importance to NES.

Supporting Knowledge and/or Skills

- a. Describe the hazards presented to the safety of NEOs and associated activities by the introduction of electrical energy sources or equipment using any electrical source into a nuclear explosive area (NEA).
- b. Describe the controls and design measures to prevent or limit the introduction of electrical energy into a nuclear explosive.
- c. Describe measures to control static charges, including human electrostatic discharge.
- d. Describe lightning protection measures used in bays, cells, and ramps.

14. NESSG chairs and other members must have knowledge of fire protection systems and their importance to NES.

Supporting Knowledge and/or Skills

- a. List the various types of fire protection systems, including active and passive mitigation controls, detection systems, suppression systems, etc., that service NEAs and describe the effects of their use on the safety of NEOs and associated activities.
- b. Discuss the derivation of combustible controls, such as standoff distances, fuel packages, and containerization, from analyses.

15. NESSG chairs and other members must have knowledge of threats such as seismic disturbances, extreme weather, aircraft crash, external fires, and other natural phenomena.

Supporting Knowledge and/or Skills

- a. Describe the response of facilities to the design-basis seismic event and the predicted response of facility-related equipment.
- b. Describe the response of facilities to tornadoes, hurricanes, and flooding and the predicted response of facility-related equipment.
- c. Describe the response of facilities to aircraft crashes and the predicted response of facility-related equipment.
- d. Describe the response of facilities to external fires and the predicted response of facility-related equipment.

16. NESSG chairs and other members must have knowledge of tooling, rigging, and hoisting equipment used for handling nuclear explosives.

Supporting Knowledge and/or Skills

- a. Explain how the design of each of the following is important in minimizing or eliminating the potential for mishandling nuclear explosives and preventing accidents:
 - Tooling
 - Rigging equipment
 - Hoisting equipment
- b. Interpret design drawings and technical specifications for the tooling, rigging, and hoisting equipment used in handling nuclear explosives.
- c. Identify the conditions that might disqualify slings and hoisting equipment for use in handling nuclear explosives.

17. NESSG chairs and other members must have knowledge of the control of electrical equipment used in an NEA.

Supporting Knowledge and/or Skills

- a. Discuss the various types of electrical equipment that may be present in an NEA and the controls placed on them.
- b. Discuss the approval process for master tester list (MTL) testers and master equipment list (MEL) equipment used at the Pantex Plant.
- c. Discuss DG 10001, *Design Guide, Electrical Testers for Use with Nuclear Explosives*.

18. NESSG chairs and other members must have knowledge of the requirements for the safe off-site and on-site transportation of nuclear explosives.

Supporting Knowledge and/or Skills

- a. Discuss the scope and content of the applicable NES master studies that address over-the-road transportation and on-site transportation of nuclear explosives.
- b. Describe hazards associated with the design and construction of vehicles authorized to transport nuclear explosives and the positive measures to control hazards.
- c. Discuss the tie-down requirements for nuclear explosives during off-site and on-site transportation.

GOVERNING ORDERS, STANDARDS, AND DIRECTIVES

19. NESSG chairs and other members must have knowledge of DOE O 452.2, *Safety of Nuclear Explosive Operations*, and DOE O 452.1, *Nuclear Explosive and Weapon Surety Program*.

Supporting Knowledge and/or Skills

- a. Discuss the purpose and scope of the listed Orders.
 - b. Discuss this position's role and responsibilities regarding implementation of and compliance with the listed Orders.
 - c. Discuss the following terms and requirements:
 - High-explosive deflagration
 - High-explosive detonation
 - Nuclear detonation
 - Nuclear explosive
 - NEA
 - NEO
 - NES
 - Nuclear weapon
 - HRP
 - Surety
 - Use control
 - Change control
 - Nuclear Explosive-Like Assembly (NELA) standards
 - Exemption requirements
 - d. Discuss the purpose of the two-person concept and requirements as specified in DOE O 452.2, *Safety of Nuclear Explosive Operations*.
 - e. Discuss the general NES rules established for all DOE NEOs.
 - f. Discuss the attributes, objectives, and interrelationships of the five DOE nuclear explosive surety standards.
 - g. Discuss in detail the three NES standards that all NEOs must meet as stated in DOE O 452.2, *Safety of Nuclear Explosive Operations*.
 - h. Discuss the requirements for operations involving nuclear explosives that are not known to be one-point safe.
- 20. NESSG chairs and other members must have knowledge of DOE-STD-3015, *Nuclear Explosive Safety Evaluation Process*.**

Supporting Knowledge and/or Skills

- a. Discuss the purpose and scope of DOE-STD-3015, *Nuclear Explosive Safety Evaluation Process*.
- b. Discuss NESSG personnel roles and responsibilities regarding compliance with this Appendix.

- c. Discuss the Nuclear Explosive Safety Study (NESS), Operational Safety Review (OSR), and Nuclear Explosive Safety Change Evaluation (NCE) processes including NESSG composition, meetings, documentation preparation, conduct, reporting and approval.
- d. Discuss the requirements for NESSG personnel, including training, certification and independence.

21. NESSG chairs and other members must have knowledge of the NESS, OSR, and NCE processes.

Supporting Knowledge and/or Skills

- a. Describe the composition requirements for an NESSG.
- b. Describe the scope of the NESSG responsibilities.
- c. Explain the functions of a NESS, an OSR, and an NCE.
- d. Discuss the requirements for preparation and conduct of a NESS or an OSR.
- e. Provide examples of situations that would require a NESS or an OSR.
- f. Explain the relationship between a master study and an operation-specific study.

22. NESSG chairs and other members must have knowledge of the NELA requirements.

Supporting Knowledge and/or Skills

- a. Discuss the difference between a nuclear explosive and a NELA.
- b. Discuss specific NELA standards and requirements.

23. NESSG chairs and other members must have knowledge of the nuclear explosive safety rules (NESRs).

Supporting Knowledge and/or Skills

Discuss the different types of NESRs and provide examples of each.

24. NESSG chairs and other members must have knowledge of Chapter 11.7 of the Development and Production Manual, *Nuclear Explosive Operation Change Control Process*.

Supporting Knowledge and/or Skills

- a. State the purpose and applicability of Chapter 11.7.

- b. Discuss the change control process and why this is important to NEOs.
- c. Discuss the actions required by each entity in the change control process.
- d. Discuss the guidance on the NES change evaluation process.
- e. Discuss the criteria for contractor approved NEO changes.

25. NESSG chairs and other members must have knowledge of nuclear safety requirements for the safety of NEOs at the Nevada Test Site.

Supporting Knowledge and/or Skills

- a. Discuss the general supplemental Nevada Site Office NESRs.
- b. Discuss the Nevada Site Office NESRs for electrical instruments connected to a nuclear device.
- c. Discuss the NESRs for nuclear devices at the Nevada test site.

26. NESSG chairs and other members must have knowledge of the specific NESRs for NEOs conducted at the Device Assembly Facility (DAF).

Supporting Knowledge and/or Skills

- a. Describe the DAF rules pertaining to high explosives.
- b. Describe the DAF rule pertaining to fire sets.
- c. Describe the DAF rule pertaining to NELAs.
- d. Describe the DAF rules pertaining to transportation.

27. NESSG chairs and other members must have knowledge of DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities*, necessary to ensure implementation.

Supporting Knowledge and/or Skills

- a. Discuss the purpose of DOE O 5480.19, *Conduct of Operations Requirements for DOE Facilities*.
- b. Discuss the concept of graded approach and how it applies to the implementation of conduct of operations.
- c. Explain the role of lessons learned in operations, and sources for identifying lessons learned and industry experience.

28. NESSG chairs and other members must have knowledge of the requirements in Department of Energy (DOE) Technical Standard DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analysis*.

Supporting Knowledge and/or Skills

- a. Discuss the conceptual basis and process for preparation of a facility/activity Documented Safety Analysis (DSA).
- b. Discuss the following in relation to the preparation of the DSA:
 - Worker safety
 - Defense-in-depth
 - Programmatic commitments
 - Technical safety requirements (TSRs)
 - Structures, systems, and components (SSCs)
 - Hazard analysis
 - Accident analysis
 - Application of the graded approach
 - Safe harbor methods
- c. Compare the different requirements for the DSA section and content as specified in applicable safe harbor methods.
- d. Describe the objectives of requiring accident analyses in safety basis documents.
- e. Identify and discuss the treatment of uncertainty and the realistic effects in accident analyses.
- f. Identify the purpose and relationship between Chapters 3, 4 and 5 and the Technical Safety Requirements of the DSA.

29. NESSG chairs and other members must have knowledge of DOE M 440.1-1, *DOE Explosives Safety Manual*.

Supporting Knowledge and/or Skills

- a. Discuss the applicability of the requirements in this manual to NEOs.
- b. Discuss the explosive safety requirements associated with the following:
 - General operations safety guidelines
 - Work environment
 - Area controls
 - Electrical storms and lightning protection
 - Static electricity
 - Electrical equipment and wiring

- Material handling
- Transportation

30. NESSG chairs and other members must have knowledge of the requirements for protection, security, and control of nuclear explosives and nuclear weapons as described in DOE O 452.4, *Security and Control of Nuclear Explosives and Nuclear Weapons*.

Supporting Knowledge and/or Skills

- a. Discuss the objectives of DOE O 452.4, Security and Control of Nuclear Explosives and Nuclear Weapons.
- b. Discuss the relationship between NES and deliberate unauthorized use measures.

31. NESSG chairs and other members must have knowledge of the human reliability program (HRP) described in 10 CFR 712, *Human Reliability Program*.

Supporting Knowledge and/or Skills

- a. Discuss the following terms as they relate to HRP:
 - Nuclear explosive duty
 - HRP certification
 - Temporary removal
- b. Discuss the relationship between HRP certification and other job qualification requirements.
- c. Identify the prerequisites for HRP certification and describe the HRP certification process.
- d. Discuss the responsibilities of HRP-certified personnel and their supervisors.

32. NESSG chairs and other members must demonstrate a familiarity with 10 CFR 830 Part 120, *Quality Assurance*.

Supporting Knowledge and/or Skills

- a. Describe each of the ten quality assurance criteria and their relationship to NES and NES evaluation activities.
- b. Discuss the relationship between quality assurance and NES management.

33. NESSG chairs and other members must have knowledge of the DSA requirements of 10 CFR 830, *Nuclear Safety Management*.

Supporting Knowledge and/or Skills

- a. Discuss the basic purposes and objectives of a DSA.
 - b. Describe the responsibilities of contractors authorized to operate defense nuclear facilities for the development and maintenance of a DSA.
 - c. Describe the different requirements for the scope and content of each type of DSA.
 - d. Discuss the requirements for the contractor to maintain current DSAs.
 - e. Discuss the application of the graded approach relative to the DSA development.
- 34. NESSG chairs and other members must have knowledge of the unreviewed safety question (USQ) process with respect to its impact on NEOs and associated activities and facilities.**

Supporting Knowledge and/or Skills

- a. Discuss the purpose of the USQ process.
 - b. Discuss the reasons for performing an unreviewed safety question determination (USQD).
 - c. Define the following terms:
 - Discrepant as found condition
 - Potential inadequacy in the safety analysis
 - Proposed change
 - d. Define the conditions for an USQ.
 - e. Describe the actions to be taken by a contractor upon identifying information that indicates a potential inadequacy of safety analyses or, a possible reduction in the margin of safety as defined in the TSRs.
 - f. Discuss the procedures for performing an USQ evaluation and its relationship to NES and the NCE process.
- 35. NESSG chairs and other members must have knowledge of TSRs as described in 10 CFR 830.205, *Technical Safety Requirements*.**

Supporting Knowledge and/or Skills

- a. Discuss the purpose of TSRs.
- b. Define the following terms and discuss the purpose of each:
 - Safety limit

- Operating limits
 - Limiting control settings
 - Limiting conditions for operation
 - Surveillance requirements
 - Administrative controls
- c. Describe the general content of each of the following sections of the TSRs:
- Use and application
 - Basis
 - Design features
- d. Discuss the definition and implementation principles for the term “operability”, as used in a TSR.
- e. Discuss the relationship of functional requirements and performance criteria to the TSRs.
- f. Discuss the conditions that constitute a violation of the TSRs and state the reporting requirements should a violation occur.
- g. Discuss the requirements for administrative control of the TSRs.
- h. Discuss the possible source documents that may be used in developing TSRs. Discuss the role of DSAs in selecting TSRs and the respective flow down.
- i. Discuss the requirements for emergency actions that depart from the approved TSRs.
- j. Discuss the application of the graded approach relative to TSRs.

36. NESSG chairs and other members must demonstrate a familiarity with the impact of software quality assurance on NES.

Supporting Knowledge and/or Skills

Describe the potential impact on NES caused by poor software quality assurance in the following situations:

- Software that controls weapon movement at Pantex
- Software that controls testers
- Software used to write, control, record or display NEOPs and processes during operations
- Software used to analyze hazards
- Software used to monitor HRP and personnel access

GENERAL MANAGEMENT

37. NESSG chairs and other members must have knowledge of safety analysis techniques and their application to NEOs, facilities, and associated activities.

Supporting Knowledge and/or Skills

- a. Discuss safety analysis techniques and their applications to NEOs, facilities, and associated activities.
- b. Describe the following hazard evaluation techniques and the types of results they produce:
 - Checklist analysis
 - Preliminary hazard analysis
 - What-if analysis
 - Hazard and operability analysis
 - Failure modes and effects analysis
 - Fault tree analysis
 - Event tree analysis
 - Human reliability analysis
- c. Describe the basis upon which to judge the adequacy of a hazard evaluation including:
 - Thoroughness of hazard identification
 - Rigor of analysis versus complexity of operation and potential consequences of accidents
 - Conservatism of assumptions
 - Applicability of data
 - Consistency and control of expert elicitation process
 - Validity and conservatism of scenario screening criteria
 - Reflection of lack of knowledge in uncertainty estimates

38. NESSG chairs and other members must have knowledge of technical communications.

Supporting Knowledge and/or Skills

- a. Demonstrate proficiency in written communication, including business and technical writing.
- b. Demonstrate proficiency in oral communications, including briefings, one-on-one presentations, and formal presentations.
- c. Demonstrate knowledge of interpersonal communications necessary to effectively communicate, verbally and non-verbally, with DOE management, DOE technical personnel, and all levels of contractor personnel.
- d. Demonstrate proficiency in writing a defensible NESSG finding.

PERFORMANCE REQUIREMENTS

39. NESSG chairs must have the ability to perform the duties of a NESSG Chair.

Supporting Knowledge and/or Skills

- a. Participate in a minimum of three NESSG activities as a NESSG chair-in-training, member-in-training, or member in the three years preceding documented completion of the competency requirements contained in this Appendix. Participation includes attending planning meetings; reviewing input documentation; participating in adequacy reviews, briefings, demonstrations, and deliberations; identifying safety concerns; drafting findings; report generation; and feedback.
- b. For a minimum of one of the required NESSG activities, the candidate, acting as a NESSG chair under instruction, must lead a NESSG under the guidance and direction of a certified chair. This includes leading the phases listed above to the satisfaction of a certified NESSG chair.

NOTE: NESSG chairs-in-training may not sign NESSG reports. The certified chair acting as a mentor during these activities retains all responsibilities, including signing the report.

40. NESSG members must have the ability to perform the duties of a NESSG member.

Supporting Knowledge and/or Skills

- a. Participate in a minimum of two NESSG activities as a NESSG member-in-training in the three years preceding documented completion of the competency requirements contained in this Appendix. Participation includes reviewing input documentation; participating in final planning meetings, adequacy reviews, briefings, demonstrations, and deliberations; identifying safety concerns; and contributing to report generation and feedback.
- b. The candidate must be under the guidance and direction of the certified NESSG member from the candidate's organization. The certified NESSG member and NESSG chair will provide feedback to the candidate regarding performance.

NOTE: NESSG members-in-training may not sign NESSG reports.

EVALUATION REQUIREMENTS

Certification authorities will document attainment of required competencies using the following methods:

- Documented evaluation of equivalencies
- Written examination
- Documented oral evaluation
- Documented observation of performance

CONTINUING TRAINING AND PROFICIENCY REQUIREMENTS

NESSG chairs and other members must participate in a minimum of 30 hours of office/facility/position-specific continuing training per year. Documented completion of training that includes the following elements will be included in the individual's training records:

1. Technical education and/or training covering topics directly related to the duties and responsibilities of the individual as determined by line management. This may include courses and/or training provided by:
 - DOE,
 - The National Laboratories,
 - DOE's M&O Contractors,
 - Annual Nuclear Explosive Safety Workshops,
 - Other government agencies,
 - Outside vendors, or
 - Educational institutions.
2. Training covering topics that address identified deficiencies in the knowledge and/or skill of the individual.
3. Training in areas added to the competency requirements since certification.
4. Training in new technical developments in NES.

CONCLUDING MATERIAL

Review Activity:

DOE/NNSA
SC
EH
EM
NE
NN

Field Offices
NNSA-SC/NESD
Pantex Site Office
Sandia Site Office
Los Alamos Site Office
Nevada Site Office
Livermore Site Office

Preparing Activity:

NNSA-NA-121

Project Number:

SAFT-0092

National Laboratories

LANL
LLNL
SNL