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DOE–STD–1185-2004
August 2004

DOE STANDARD

NUCLEAR EXPLOSIVE SAFETY STUDY FUNCTIONAL AREA QUALIFICATION STANDARD

DOE Defense Nuclear Facilities Technical Personnel

U.S. Department of Energy AREA TRNG
Washington, D.C. 20585

APPROVAL

The Federal Technical Capability Panel consists of senior U.S. Department of Energy managers responsible for overseeing the Federal Technical Capability Program. This Panel is responsible for reviewing and approving the Qualification Standard for Department-wide application. Approval of this Qualification Standard by the Federal Technical Capability Panel is indicated by signature below.

Roy J. Schepens
Chairman
Federal Technical Capability Panel

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ACKNOWLEDGMENT

The NNSA Service Center Nuclear Explosive Safety Division Manager is the Sponsor for the Nuclear Explosive Safety Study Qualification Standard. The Sponsor is responsible for coordinating the development and/or review of the Functional Area Qualification Standard by subject matter experts to ensure that the technical content of the standard is accurate and adequate for Department-wide application for those involved in the Nuclear Explosive Safety Study Program. The Sponsor, in coordination with the Federal Technical Capability Panel, is also responsible for ensuring that the Functional Area Qualification Standard is maintained current.

The following subject matter experts (SMEs) participated in the development and/or review of this Qualification Standard:

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U.S. DEPARTMENT OF ENERGY
FUNCTIONAL AREA QUALIFICATION STANDARD

Nuclear Explosive Safety Study

PURPOSE

DOE M 426.1-1, Federal Technical Capability Manual, commits the Department to continuously strive for technical excellence. The Technical Qualification Program, along with the supporting Technical Qualification Standards, complements the personnel processes that support the Department's drive for technical excellence. In support of this goal, the competency requirements defined in the Technical Qualification Standards should be aligned with and integrated into the recruitment and staffing processes for technical positions. The Technical Qualification Standards should form the primary basis for developing vacancy announcements, qualification requirements, crediting plans, interviewing questions, and other criteria associated with the recruitment, selection, and internal placement of technical personnel. Office of Personnel Management minimum qualifications standards will be greatly enhanced by application of appropriate materials from the technical Functional Area Qualification Standards.

The Technical Qualification Standards are not intended to replace the U.S. Office of Personnel Management (OPM) Qualifications Standards nor other Departmental personnel standards, rules, plans, or processes. The primary purpose of the Technical Qualification Program is to ensure that employees have the requisite technical competency to support the mission of the Department. The Technical Qualification Program forms the basis for the development and assignment of DOE personnel responsible for ensuring the safe operation of defense nuclear facilities.

APPLICABILITY

The Nuclear Explosive Safety Study Functional Area Qualification Standard establishes common functional area competency requirements for Department of Energy personnel who provide assistance, direction, guidance, oversight, or evaluation of contractor technical activities that could impact the safe operation of DOE’s defense nuclear facilities. The technical Functional Area Qualification Standard has been developed as a tool to assist DOE Program and Field office sin the development and implementation of the Technical Qualification Program in their organization. For ease of transportability of qualifications between DOE elements, Program and Field offices are expected to use this technical Functional Area Qualification Standard without modification or additions. Needed additional office/site/facility specific technical competencies should be handled separately. Satisfactory and documented attainment of the competency requirements contained in this technical Functional Area Qualification Standard ensures that personnel possess the requisite competence to fulfill their functional area duties and responsibilities. Office/Facility-Specific Qualification Standards supplement this technical Functional Area Qualification Standard and establish unique operational competency requirements at the Headquarters or Field element, site, or facility level.

While the qualification program is directive on federal employees who participate in nuclear explosive safety studies, it is intended that all certified nuclear explosive safety study group members, regardless of organization, meet the knowledge and experience requirements of this standard as directed in DOE-STD-3015. This standard replaces the requirements listed in DOE-STD-3015-2001, Appendix A.

IMPLEMENTATION

This technical Functional Area Qualification Standard identifies the minimum technical competency requirements for Department of Energy personnel. Although there are other competency requirements associated with the positions held by DOE personnel, this Functional Area Qualification Standard is limited to identifying the specific technical competencies. The competency statements define the expected knowledge and/or skill that an individual must meet. Each of the competency statements is further explained by a listing of supporting knowledge and/or skill statements.

The competencies identify a familiarity level, a working level, or an expert level of knowledge; or they require the individual to demonstrate the ability to perform a task or activity. These levels are defined as follows:

> **Familiarity level** is defined as basic knowledge of or exposure to the subject or process adequate to discuss the subject or process with individuals of greater knowledge.
>
> **Working level** is defined as the knowledge required to monitor and assess operations/activities, to apply standards of acceptable performance, and to reference appropriate materials and/or expert advice as required to ensure the safety of Departmental activities.
>
> **Expert level** is defined as a comprehensive, intensive knowledge of the subject or process sufficient to provide advice in the absence of procedural guidance.
>
> **Demonstrate the ability** is defined as the actual performance of a task or activity in accordance with policy, procedures, guidelines, and/or accepted industry or Department practices.

Headquarters and Field elements shall establish a program and process to ensure that DOE personnel possess the competencies required of their position. That includes the competencies identified in this technical Functional Area Qualification Standard. Documentation of the completion of the requirements of the Standard shall be included in the employee's training and qualification record.

Equivalencies should be used sparingly with the utmost rigor and scrutiny to maintain the spirit and intent of the TQP. Equivalencies may be granted for individual competencies based upon objective evidence of previous education, training, certification, or experience. Objective evidence includes a combination of transcripts, certifications, and, in some cases, a knowledge sampling through a written and/or oral examination. Equivalencies shall be granted in accordance with the Technical Qualification Program Plan of the office qualifying the individual. The supporting knowledge and/or skill statements, while not requirements, should be considered before granting equivalency for a competency.

Training shall be provided to employees in the Technical Qualification Program who do not meet the competencies contained in the technical Functional Area Qualification Standard. Training may include, but is not limited to, formal classroom and computer based courses, self-study, mentoring,

on-the-job training, and special assignments. Departmental training will be based upon appropriate supporting knowledge and/or skill statements similar to the ones listed for each of the competency statements. Headquarters and Field elements should use the supporting knowledge and/or skill statements as a basis for evaluating the content of any training used to provide individuals with the requisite knowledge and/or skill required to meet the technical Functional Area Qualification Standard competency statements.

EVALUATION REQUIREMENTS

Attainment of the competencies listed in this technical Functional Area Qualification Standard should be documented by a qualifying official, immediate supervisor, or the team leader of personnel in accordance with the Technical Qualification Program Plan of the office qualifying the individual.

CONTINUING EDUCATION, TRAINING, AND PROFICIENCY

DOE personnel shall participate in continuing education and training as necessary to improve their performance and proficiency and ensure that they stay up-to-date on changing technology and new requirements. This may include courses and/or training provided by:

- Department of Energy
- Other government agencies
- Outside vendors
- Educational institutions

Beyond formal classroom or computer-based courses, continuing training may include

- Self Study
- Attendance at symposia, seminars, exhibitions
- Special assignments
- On-the-job experience

A description of suggested learning proficiency activities and the requirements for the continuing education and training program for Safety Software Quality Assurance personnel are included in Appendix A of this document.

DUTIES AND RESPONSIBILITIES

The following are the typical duties and responsibilities expected of personnel assigned to the Nuclear Explosive Safety Study Functional Area:

1. Provides guidance on and interpretation of Nuclear Explosive Safety (NES) requirements and policy.

2. Briefs and consults with Defense Nuclear Facilities Safety Board (DNFSB) staff and ad-hoc technical groups about NES principles, responsibilities, and roles in nuclear explosive design and operations.

3. Drafts policy Directives for the DOE/ National Nuclear Security Administration (NNSA) Service Center/ Nuclear Explosive Safety Division (NESD) and reviews DOE/NNSA policies

on NES.

4. Provides instruction and guidance regarding NES to individuals assigned NES responsibilities.

5. Works directly with officials in DOE/NNSA site offices, national laboratories, and the production plant in resolving NES issues.

6. Consults with line management during the nuclear explosive operation (NEO) development process regarding NES.

7. Evaluates occurrences applicable to NES. Monitors corrective action.

8. Manages and implements the NES change evaluation process.

9. Monitors ongoing NEOs to ensure compliance with NES standards and other NES requirements.

10. Evaluates effectiveness of corrective action on Nuclear Explosive Safety Study Group (NESSG) findings and maintains a record of that assessment.

11. Provides formal briefings to DOE/NNSA management officials regarding problem areas requiring their attention to correct NES deficiencies in the DOE/NNSA.

12. Develops correspondence, reports, procedures, and other documents requiring written communication proficiency.

13. Serves as a member or chair of the NESSG.

14. Consults and coordinates with various DOE/NNSA offices, line management, and the national laboratories to determine the scope and content of NES evaluations.

15. Coordinates with DOE/NNSA line management organizations to establish specific requirements for the technical input documentation, and technical and administrative support for each NES evaluation.

16. Evaluates the technical input documentation provided for each NES evaluation.

17. Leads the NESSG and manages NESSG activities to ensure a thorough evaluation is performed.

18. Prepares the report of each NESSG activity and coordinates the DOE/NNSA management review. Provides DOE/NNSA management with an NES recommendation prior to forwarding the report to the DOE/NNSA Headquarters for approval.

19. Evaluates the adequacy of NEO controls to satisfy the NES standards.

20. Evaluates the safety of facilities, fixtures, electrical testers, electrical equipment, transport equipment, handling equipment, mechanical equipment, and administrative and operational procedures and controls as they affect NES.

21. Evaluates physical security (e.g., facilities, equipment, and procedures) employed for the protection of nuclear explosives to determine if it constitutes a threat to NES.

22. Coordinates input documentation adequacy reviews prior to commencing an NES Study.

23. Ensures coordination between readiness review activities and NESSG activities.

24. Additional duties and responsibilities specific to the site, facility, operational activities, and/or other involved organizations shall be contained in the office/facility-specific qualification standard(s).

Position-specific duties and responsibilities for Nuclear Explosive Safety personnel are contained in their Office/Facility-Specific Qualification Standard or Position Description.

BACKGROUND AND EXPERIENCE

The U. S. Office of Personnel Management's Qualification Standards Handbook establishes minimum education, training, experience, or other relevant requirements applicable to a particular occupational series/grade level, as well as alternatives to meeting specified requirements.

The preferred education and experience for Nuclear Explosive Safety personnel are:

1. Education:

   Bachelor of Science degree in engineering or physics. Preferred education is a Master of Science in engineering or physics with a strong preference for individuals with a Ph.D. in a technical area.

2. Experience:

   Five (5) years of industrial, military, Federal, state, or other directly related experience that has provided specialized experience in nuclear explosive safety, 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 Standard.

REQUIRED TECHNICAL COMPETENCIES

The competencies contained in this Standard are distinct from those competencies contained in the General Technical Base Qualification Standard. All Nuclear Explosive Safety personnel must satisfy the competency requirements of the General Technical Base Qualification Standard prior to or in parallel with the competency requirements contained in this Standard. Each of the competency statements defines the level of expected knowledge and or skill that an individual must posses to meet the intent of this Standard. The supporting knowledge and/or skill statements further describe the intent of the competency statements.

Note: When regulations or Department of Energy directives or other industry standards are referenced in the Qualification Standard, the most recent revision should be used.

GENERAL TECHNICAL

1. Nuclear explosive safety study personnel 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. Nuclear explosive safety study personnel 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 nuclear explosive safety implications of the following:

- LiH and LiD
- Fogbank
- Beryllium
- UH_3
- Plutonium hydride

c. Discuss the safety and toxicity issues associated with weapon and process materials as listed in the existing current Weapon Safety Specifications for weapons in the stockpile. Discuss the protocols for handling the components of nuclear weapons and trainers during NES reviews.

3. Nuclear explosive safety study personnel 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. Nuclear explosive safety study personnel 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 listed above 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. Nuclear explosive safety study personnel 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. Nuclear explosive safety study personnel 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. Nuclear explosive safety study personnel 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 (ESD)
- 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. Nuclear explosive safety study personnel must have knowledge of the U.S. stockpile.

Supporting Knowledge and/or Skills

a. Find and discuss authoritative descriptions of weapons in the stockpile.

9. Nuclear explosive safety study personnel must have knowledge of high explosives and their applicability in nuclear explosives.

Supporting Knowledge and/or Skills

a. Discuss the difference between IHEs and 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. Nuclear explosive safety study personnel 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 a human ESD.

e. Describe the use of booster explosives.

f. Describe the use of non-electrical initiators in nuclear weapons.

11. Nuclear explosive safety study personnel 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. Nuclear explosive safety study personnel 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

a. 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):

- Assembly/disassembly bays
- Assembly/disassembly cells
- Ramps
- Special purpose facilities

  Vacuum chambers
  Mass properties facilities
  Radiography facilities
  Separation test facility
  Paint bay

13. Nuclear explosive safety study personnel 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 a human ESD.

d. Describe lightning protection measures used in bays, cells, and ramps.

14. Nuclear explosive safety study personnel must have knowledge of fire protection systems and their importance to NES.

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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. Nuclear explosive safety study personnel 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. Nuclear explosive safety study personnel 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. Nuclear explosive safety study personnel 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 testers and master equipment list equipment used at the Pantex Plant.

c. Discuss DG 10001, Design Guide, Electrical Testers for Use with Nuclear Explosives.

18. Nuclear explosive safety study personnel 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. Nuclear explosive safety study personnel must have knowledge of DOE O 452.2, Safety of Nuclear Explosive Operations, and DOE O 452.1, Nuclear Explosive and Weapons Surety.

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. Nuclear explosive safety study personnel must have knowledge of DOE-STD-3015, Nuclear Explosive Safety Study Process.

Supporting Knowledge and/or Skills

a. Discuss the purpose and scope of DOE-STD-3015, Nuclear Explosive Safety Evaluation Process.

b. Discuss this position's role and responsibilities regarding compliance with this standard.

c. Discuss the Nuclear Explosive Safety Study, Operational Safety Review, and Nuclear Explosive Safety Change Evaluation (NCE) processes including group composition, meetings, documentation preparation, conduct, reporting and approval.

d. Discuss the requirements for Nuclear Explosive Safety Study Group membership, including training, certification and independence.

21. Nuclear explosive safety study personnel must have knowledge of the NES Study, 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 an NES Study, an OSR, and an NCE.

d. Discuss the requirements for preparing for and conducting an NES Study or an OSR.

e. Provide examples of situations that would require an NES Study and an OSR.

f. Explain the relationship between a master study and an operation-specific study.

22. Nuclear explosive safety study personnel 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. Nuclear explosive safety study personnel must have knowledge of the NES rules.

Supporting Knowledge and/or Skills

a. Discuss the different types of NES rules and provide examples of each.

24. Nuclear explosive safety study personnel must have knowledge of Chapter 11.7 of the Development and Production Manual, Nuclear Explosive Operations 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 (trivial) NES changes.

f. Discuss the criteria for DOE/NNSA approval not requiring a NESS.

25. Nuclear explosive safety study personnel must have knowledge of nuclear safety requirements for the safety of nuclear explosive operations 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 nuclear test site.

26. Nuclear explosive safety study personnel must have knowledge of the specific NESRs for NEO 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. Nuclear explosive safety study personnel 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. Nuclear explosive safety study personnel 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 Safety Analysis Reports.

Supporting Knowledge and/or Skills

a. Discuss the conceptual basis and process for preparation of a facility/activity Documented Safety Analysis.

b. Discuss the following in relation to the preparation of the Documented Safety Analysis:

- 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 documented safety analysis 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 Documented Safety Analysis.

29. Nuclear explosive safety study personnel must have knowledge of DOE M 440.1-1, DOE Explosive 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. Nuclear explosive safety study personnel 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. Nuclear explosive safety study personnel must have knowledge of the 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. Nuclear safety study personnel shall demonstrate a familiarity level knowledge of 10CFR830 Part 120, Quality Assurance.

Supporting Knowledge and/or Skills

a. Describe each of the ten quality assurance criteria and their relationship to nuclear explosive safety and nuclear explosive study activities.

b. Discuss the relationship between quality assurance and nuclear explosive safety management.

33. Nuclear explosive safety study personnel must have knowledge of the Documented Safety Analyses requirements of 10 CFR 830, Nuclear Safety Management.

Supporting Knowledge and/or Skills

a. Discuss the basic purposes and objectives of a Documented Safety Analysis.

b. Describe the responsibilities of contractors authorized to operate defense nuclear facilities for the development and maintenance of a Documented Safety Analysis.

c. Describe the different requirements for the scope and content of each type of Documented Safety Analysis.

d. Discuss the requirements for the contractor to maintain the Documented Safety Analysis current.

e. Discuss the application of the graded approach relative to the DSA development.

34. Nuclear explosive safety study personnel 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 Unreviewed Safety Question process.

b. Discuss the reasons for performing an Unreviewed Safety Question determination.

c. Define the following terms:

- Discrepant as found condition
- Potential inadequacy in the safety analysis
- Proposed Change

d. Define the conditions for an Unreviewed Safety Question.

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 Technical Safety Requirements.

f. Discuss the procedures for performing a USQ evaluation and its relationship to NES and the NCE process.

35. Nuclear explosive safety study personnel must have knowledge of technical safety requirements (TSRs) as described in 10 CFR 830.205, Technical Safety Requirements.

Supporting Knowledge and/or Skills

a. Discuss the purpose of Technical Safety Requirements.

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 Technical Safety Requirements:

- Use and Application
- Basis
- Design Features

d. Discuss the definition and implementation principles for the term OPERABILITY as used in a Technical Safety Requirement.

e. Discuss the relationship of functional requirements and performance criteria to the Technical Safety Requirements.

f. Discuss the conditions that constitute a violation of the Technical Safety Requirements and state the reporting requirements should a violation occur.

g. Discuss the requirements for administrative control of the Technical Safety Requirements.

h. Discuss the possible source documents that may be used in developing Technical Safety Requirements. Discuss the role of Documented Safety Analyses in selecting Technical Safety Requirements and the respective flow down.

i. Discuss the requirements for emergency actions that depart from the approved Technical Safety Requirements.

j. Discuss the application of the graded approach relative to Technical Safety Requirements.

36. NES personnel shall demonstrate familiarity with the impact of software quality assurance on nuclear explosive safety.

Supporting Knowledge and/or Skills

a. Describe the potential impact on nuclear explosive safety 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. Nuclear explosive safety study personnel 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. Nuclear explosive safety study personnel 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 NESS finding.

PERFORMANCE REQUIREMENTS

39. Nuclear explosive safety study personnel must have the ability to perform the duties of an NESSG Chair. (Chair Only)

Supporting Knowledge and/or Skills

a. Participate in a minimum of three NESSG activities as an NESSG chair-in-training, member-in-training, member, or technical advisor in the three years preceding initial qualification to the requirements in this document. Participation includes attending planning meetings; selecting members; reviewing input documentation; conducting adequacy reviews; managing briefings, demonstrations, and deliberations; questioning briefers; identifying safety concerns; drafting findings; and coordinating and producing reports.

b. For a minimum of one of the required NESSG activities, the candidate, acting as an NESSG chair under instruction, shall lead an NESSG under the guidance and direction of a certified chair. This includes leading the phases listed above to the satisfaction of a qualified NESSG chair.

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

40. Nuclear explosive safety study personnel must have the ability to perform the duties of an NESSG member. (Members)

Supporting Knowledge and/or Skills

a. Participate in a minimum of two NESSG activities in the three years immediately preceding final qualification to the requirements in this document as an NESSG member-in-training. As a member-in-training, the candidate is expected to review input documentation, participate in final planning meetings, briefings, and demonstrations; question briefers; identify safety concerns; engage in deliberations; and contribute to the NESSG report.

b. The candidate shall be under the guidance and direction of the certified NESSG member from the candidate's organization. The certified NESSG member and NESSG chair shall provide feedback to the candidate regarding performance.

Note: NESSG members-in-training shall not sign NESSG reports.

APPENDIX A
CONTINUING EDUCATION, TRAINING AND PROFICIENCY PROGRAM

The following list represents suggested continuing education, training and other opportunities that are available for DOE personnel after completion of the competency requirements in this technical Functional Area Qualification Standard. It is extremely important that personnel involved with this program maintain their proficiency through continuing education, training, reading, or other activities such as workshops, seminars, and conferences. The list of suggested activities was developed by the Subject Matter Experts involved in the development of the Functional Area Qualification Standard and is not all inclusive.

LIST OF CONTINUING EDUCATION, TRAINING AND OTHER ACTIVITIES

NESS members and chairs shall participate in a minimum of 30 hours of office/facility/position-specific continuing training per year that includes the following elements:

1. Technical education and/or training covering topics directly related to the duties and responsibilities of the candidate as determined by line management. This may include courses and/or training provided by:

    - DOE
    - National Laboratories
    - Management and Operations 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 candidate.

3. Training in areas added to the Nuclear Explosive Safety Study Functional Area Qualification Standard since initial qualification.

4. Training in new technical developments in nuclear explosive safety.

5. Specific continuing training requirements shall be documented in Individual Development Plans (IDPs).

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CONCLUDING MATERIAL

Review Activities:
DOE
NA-NNSA
EH
EM
NE
FE
NN
NNSA/SC

Site Offices:
Pantex Site Office
Kirtland Site Office
Los Alamos Site Office
Nevada Site Office

Preparing Activities
DOE-EH-22, NNSA/SC/NESD

Project Number:
TRNG-0039