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DOE STANDARD

FIRE PROTECTION FUNCTIONAL AREA QUALIFICATION STANDARD

DOE Defense Nuclear Facilities Technical Personnel



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

AREA TRNG

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APPROVAL

The Federal Technical Capabilities (FTC) Panel is responsible for reviewing and approving Functional Area Qualification Standards (FAQSs) for Department-wide application. Approval of this FAQS from the FTCP is indicated by the signature below.

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Gabriel Pugh, Chairperson
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Date

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ACRONYM LIST

AC	Administrative Controls
AGS	American Glovebox Society
AHJ	Authority Having Jurisdiction
BCO	Building Code Official
BNA	Baseline Needs Assessment
CAS	Contractor Assurance System
CFR	Code of Federal Regulation
CSE	Cognizant System Engineer
DOE	Department of Energy
DSA	Documented Safety Analysis
FAQS	Functional Area Qualification Standards
FPDA	Fire Protection Design Analysis
FPE	Fire Protection Engineer
FHA	Fire Hazard Analysis
FHE	Fire Hazard Evaluation
FTCP	Federal Technical Capabilities Panel
GTB	General Technical Base
HDBK	Handbook
HPR	Highly Protected Risk
HQ	Headquarters
IBC	International Building Code
ICC	International Code Council
IFC	International Fire Code
IC	Incident Command
ITM	Inspection, Testing, and Maintenance
LCO	Limiting Conditions for Operation
MOU	Memorandum of Understanding
MPA	Mandatory Performance Activities
MAQ	Maximum Allowable Quantities
NFPA	National Fire Protection Association
NNSA	National Nuclear Security Administration
NTC	National Training Center
PC	Performance Competency
PFHA	Preliminary Fire Hazard Analysis
QO	Qualifying Official
SD	Supplemental Directive
SFPE	Society of Fire Protection Engineers
SME	Subject Matter Experts
SMP	Safety Management Program
SR	Surveillance Requirements
SSO	Safety System Oversight
STD	Standard
TFHA	Transitional Fire Hazard Analysis
TQP	Technical Qualification Program

**U.S. DEPARTMENT OF ENERGY
FUNCTIONAL AREA QUALIFICATION STANDARD**

PURPOSE

Functional area qualification standards (FAQSs) establish common performance competencies in key nuclear facility functional areas for personnel in the U.S. Department of Energy (DOE) Technical Qualification Program (TQP).

This FAQS establishes performance competencies to ensure designated personnel have the technical competency to perform the duties and responsibilities of a fire protection engineer (FPE).

The content of this FAQS should be referenced and used, as appropriate, to develop vacancy announcements, interview questions, and other criteria associated with the recruitment, selection, and placement of personnel assigned to this FAQS.

APPLICABILITY

The DOE Order (O) 426.1, *Federal Technical Capabilities*, requires FAQS to be developed for DOE employees whose duties and responsibilities could affect the safe operation of defense nuclear or high hazard facilities to assist DOE Program, Field Offices, and Sites with implementation of their organization specific TQP.

This FAQS establishes common performance competencies for DOE personnel who perform the duties and responsibilities of an FPE. For ease of transportability of qualifications between DOE elements, program and field offices must use this FAQS without modification or addition to the competency requirements.

Satisfactory and documented attainment of the competencies in this FAQS ensures personnel possess the minimum requisite knowledge and skills to perform FPE duties and tasks. To supplement this FAQS, DOE O 426.1 requires organization-specific qualification standards to establish unique organization (headquarters, field element, site, or facility) level competencies.

IMPLEMENTATION

This FAQS, derived from a fire protection Job Task Analysis (JTA), is comprised of performance competencies based on task performances. Each performance competency includes knowledge requirements and, if necessary, mandatory performance activities (MPAs). The objective of the MPAs is to demonstrate the competency has been met by having the participant apply the related knowledge to satisfactorily perform the associated job task. An evaluation guide has been developed for the expected level of knowledge required to obtain qualification and assist the qualifying officials (QOs) responsible for verifying the attainment of knowledge. The evaluation guide is available through the National Training Center (NTC) FTCP SharePoint site at: <https://ntc.doe.gov/sites/tqp/SitePages/Home.aspx>.

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For initial qualification, participants assigned this FAQS must demonstrate attainment of the knowledge in the “Required Performance Competencies” section.

The MPAs listed in this FAQS must be satisfactorily performed and documented once. If any of the evaluation criteria are not satisfactorily met, the designated QO may require the participant to reperform the MPA. Some MPAs may be duplicated in other qualification standards. In these cases, the designated QO must verify and document the satisfactory completion of each MPA required by the applicable standards in eTQP.

Participants should perform the MPAs in their assigned work area(s). When participants cannot perform the MPAs as written in their assigned work area(s) or within the required qualification timeframe, Supervisors may use other options to facilitate completion. These options include performance in a simulated environment or making minor accommodations to either the MPA or the evaluation criteria. Justification(s) for the accommodation(s) must be documented by the QO, with approval of the supervisor and the FTCP agent.

Upon completion of the “Required Performance Competencies” of this FAQS, participants may be assigned one or more Supplemental Specialty Qualification. Each assigned Supplemental Specialty Qualification must be completed as written by the participant.

EVALUATION CRITERIA

Attainment of the performance competency knowledge requirements and MPAs listed in this FAQS must be documented in accordance with the qualifying organization TQP plan (or policy) and the requirements in DOE O 426.1.

Each performance competency includes knowledge requirements and/or MPAs designed to demonstrate attainment of the competency. The QO verifies the evaluation criteria, including organization-specific requirements, were satisfactorily met during observation of the MPA and/or review of the MPA results. Attainment of competency knowledge or MPAs must be verified by a designated QO using one (or a combination) of the following methods listed in DOE O 426.1:

- Satisfactory completion of a written examination
- Satisfactory completion of an oral evaluation
- Documented evaluation of equivalencies
- Completion of approved training courses that confirm attainment of specific knowledge requirements.

Satisfactory attainment of the competency knowledge requirements and MPAs contained in this FAQS must be documented in the electronic Technical Qualification Program (eTQP) at <https://etqp.ntc.doe.gov>.

Once the attainment of the performance competency knowledge requirements and the MPAs in this FAQS have been verified by a QO, the participant must satisfactorily complete final qualification activity requirements identified in DOE O 426.1B and/or any applicable organization-specific requirements before being designated as a qualified fire protection engineer.

INITIAL QUALIFICATION AND CONTINUING TRAINING

Appendix A, *Initial Qualification Training Recommendations*, includes a list of NTC and external training courses supporting the attainment of the required performance competencies for FPE participants.

Appendix B, *Continuing Training Recommendations*, outlines courses for FPE participants to participate in as part of the continuing training program.

DUTIES AND RESPONSIBILITIES

The following are typical duties and responsibilities expected of fire protection engineers:

- Analyze documents related to fire protection.
- Monitor day-to-day program activities to support periodic contractor performance evaluations.
- Conduct oversight activities to evaluate contractor compliance with the applicable requirements and regulations.
- Provide subject matter expertise, as requested.

Technical support duties are dependent on the organizational needs and the participant's level of subject-matter expertise and will not be addressed by the competencies in this FAQs. Position-specific duties and responsibilities for fire protection SMEs should be included in position descriptions and other qualification standards, as applicable.

BACKGROUND AND EXPERIENCE

The preferred education and experience for FPEs are as follows:

1. **Education:** An ABET accredited degree in fire protection engineering/engineering technology.

or

2. **Education:** Bachelor's degree in engineering or a science-related field or meeting the alternative requirements specified for engineers or scientists in the Qualifications Standards Handbook. An advanced technical degree is considered an advantage.

and

Experience: Industrial, military, Federal, state, or other directly related background providing specialized experience in fire protection. Experience should be demonstrated through attainment of a minimum of two years of practical experience in diverse fire protection engineering projects. Attainment of specialized experience can also be demonstrated by obtaining a professional engineering license in fire protection.

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The knowledge requirements and associated MPAs identified in this FAQS were developed with the supposition that participants have the above preferred education and experience. The supervisor and QO will determine if participants assigned this FAQS need additional developmental assignments and supporting training.

REQUIRED PERFORMANCE COMPETENCIES

Each competency defines the expected level of knowledge and performance the participant must attain. The performance competencies contained in this FAQS include additional knowledge requirements distinct from the knowledge requirements contained in the General Technical Base (GTB) Part A and B Qualification Standard (QS). Prior to (or in parallel with) initial qualification to this FAQS, participants must satisfy the requirements of the GTB Part A and GTB Part B QS.

Note 1: When regulations, DOE directives, or other industry standards are referenced in this FAQS, the most recent revision should be used. However, fire protection participants and QOs should also refer to the versions of requirements included in the local contract during qualification. Applicable knowledge requirements in predecessor documents not included in this FAQS should be included in the organization-specific QS or continuing training program.

Note 2: If specific evaluation criteria are not identified for any of the MPAs in this FAQS, the following generic evaluation criteria should be used in conjunction with local requirements:

- Identify criteria for the specific activity.
- Compare results to the criteria and document conclusions.
- Document identified issues or recommendations.
- Discuss, if applicable, how to communicate results to appropriate Federal and/or contractor personnel.

Fire Protection Knowledge

1. An FPE shall demonstrate an understanding of basic fire protection principles.

Knowledge Requirements:

- A. Discuss fire dynamic concepts such as fire behavior, fire growth, the combustion process, fire plumes, material properties, and heat transfer.
- B. Describe fire modeling methodologies, including limitations and uses for different types of models.
- C. Describe concepts of insurance industry highly protected risk (HPR).
- D. Describe the components of a water supply and distribution system for fire suppression.
- E. Discuss the methodologies and considerations used when calculating fire flow demands for sprinklered and non-sprinklered facilities.
- F. Describe the types of fire suppression and extinguishing systems and the suitability of each for preventing or mitigating site fire hazards.

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- G. Describe the components of a fire and alarm system, including interfaces with other systems such as emergency notification systems, ventilation systems, and process interlocks.
- H. Define a fire barrier system and discuss the materials and methods of construction used for openings, penetrations, and joint systems.
- I. Describe the basic elements of a means of egress and how occupancy considerations influence emergency egress requirements.
- J. Describe required provisions to prevent loss of life and property from fire resulting from hot work.
- K. Describe the key characteristics and requirements of a performance-based design/evaluation process, including the application of fire modeling.
- L. Discuss the principles and methodologies of fire investigation using National Fire Protection Association (NFPA) 921.
- M. Describe the various operations conducted by fire department and emergency response organizations, including the activities performed by a fire department/brigade at the scene of a fire or other emergency and the application of the Incident Command System.
- N. Identify and discuss industry references used to analyze human behavior and the egress modeling tools used to predict behavior-related impacts on the fire safety environment.
- O. Discuss the determination of fire protection controls based on occupancy hazards such as the storage and handling of hazardous materials.

Fire Protection Department of Energy Specific Concepts

- 2. An FPE shall demonstrate an understanding of DOE-specific concepts regarding fire protection.

Knowledge Requirements:

- A. Discuss the design control process for fire protection and life safety related systems, including the key elements of design, construction, and acceptance.
- B. Describe the key elements of facility design that are important to effective emergency response.
- C. Explain the roles and responsibilities of the fire protection authority having jurisdiction (AHJ) and the building code official (BCO), including any delegation or assignment of responsibilities.
- D. Describe the purpose, content, and key attributes of a Fire Hazards Analysis (FHA), including when an FHA is required, who can perform an FHA, and when an FHA is required to be revised.
- E. Describe the purpose and content of a glovebox fire hazard evaluation (FHE) per AGS-G010, *Standard of Practice for Glovebox Fire Protection*.

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- F. Describe the DOE fire protection specific design requirements for process hazards, including glovebox (and FHE), hot cells, nuclear confinement ventilation, hoods, and firefighting runoff.
- G. Discuss the purpose and elements of fire protection facility assessments, including the approved frequency for facility assessments.

Mandatory Performance Activity (MPA)

MPA 2.1: Review and evaluate a current or recent project design to verify fire protection requirements are met, including safety in design.

Department of Energy Directives and Requirements

3. The FPE shall demonstrate an understanding of DOE regulations, orders, and requirements for fire protection programs.

Knowledge Requirements:

- A. Discuss the fire protection aspects of the following directives, codes, standards, guides, and handbooks (current versions), including the purpose, scope, and applicability of all:
 - 1. 10 CFR 830, *Nuclear Safety Management*
 - 2. 10 CFR 851, *Worker Safety and Health Program*
 - 3. DOE O 151.1, *Comprehensive Emergency Management*
 - 4. DOE O 420.1, *Facility Safety System*
 - 5. DOE O 226.1, *Implementation of DOE Oversight Policy*
 - 6. DOE O 231.1, *Environment, Safety, and Health Reporting*
 - 7. DOE O 251.1, *Departmental Directives Program*
 - 8. DOE O 413.3, *Program and Project Management for the Acquisition of Capital Assets*
 - 9. DOE O 414.1, *Quality Assurance*
 - 10. DOE O 430.1, *Real Property Asset Management*
 - 11. DOE O 440.1, *Worker Protection Program*
 - 12. DOE O 450.2, *Integrated Safety Management*
 - 13. DOE O 473.1, *Physical Protection Program*
 - 14. DOE-STD-1066, *Fire Protection*
 - 15. DOE-HDBK-1081, *Primer on Spontaneous Heating and Pyrophoricity*
 - 16. DOE-HDBK-1163, *Integration of Hazard Analyses*
 - 17. DOE-HDBK-1224, *Hazard and Accident Analysis*
 - 18. National Fire Protection Association (NFPA) codes and standards: (This list is not all inclusive. Other NFPA codes and standards may be included based on site specific hazards and mitigative features.)
 - a. NFPA 1, *Fire Code*
 - b. NFPA 13, *Standard for the Installation of Sprinkler Systems*
 - c. NFPA 20, *Standard for the Installation of Stationary Pumps for Fire Protection*
 - d. NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*
 - e. NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*
 - f. NFPA 45, *Standard on Fire Protection for Laboratories Using Chemicals*
 - g. NFPA 51B, *Standard for Fire Prevention During Welding, Cutting, and Other Hot Work*

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- h. NFPA 72, *National Fire Alarm and Signaling Code*
 - i. NFPA 101, *Life Safety Code*
 - j. NFPA 801, *Standard for Fire Protection for Facilities Handling Radioactive Materials*
 - k. NFPA 1140, *Standard for Wildland Fire Protection*
 - l. NFPA 1500, *Standard on Fire Department Occupational Safety, Health, and Wellness Program*
 - m. NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*
19. International Building Code (IBC), International Existing Building Code, (IEBC), and International Fire Code (IFC)

- B. Describe the relationship/interface between the fire and life safety provisions of these documents with other facility provisions (e.g. security, nuclear safety, criticality safety, confinement ventilation, explosives safety, etc.)
- C. Describe the procedures and requirements governing the use of water or other neutron-moderating materials to suppress fires within moderation control areas.
- D. Review pivotal DOE fire-related events and discuss how the lessons learned have influenced DOE fire protection program directives.

Mandatory Performance Activity (MPA)

MPA 3.1: Review the site fire and emergency response program(s) and the site fire protection program. Identify the directives, codes, and standards applicable to each.

Fire Protection Program Documents

4. The FPE shall demonstrate an understanding of required program documents per DOE O 420.1, *Facility Safety*, and DOE-STD-1066, *Fire Protection*.

Knowledge Requirements:

- A. Describe the essential elements of a comprehensive fire protection program.
- B. Describe the purpose and requirements for a baseline needs assessment (BNA).
- C. Describe the purpose and requirements for a wildland fire management plan.
- D. Describe the process for review and approval of equivalencies and exemptions.
- E. Review and discuss the approval process and basis of:
 - 1. Baseline needs assessment (BNA)
 - 2. Fire protection program
 - 3. Wildland fire management plan
 - 4. Exemptions and equivalencies

Mandatory Performance Activity (MPA)

MPA 4.1: Perform a review of the contractor fire protection program

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documents, including the BNA, fire protection program, wildland fire management plan, exemptions and/or equivalencies, and develop recommendations regarding acceptability and approval by the head of field element.

Implementation of Nuclear Safety Requirements

5 The FPE shall demonstrate an understanding of nuclear safety requirements in fire protection programs.

Knowledge Requirements:

- A. Discuss and characterize the role of fire protection systems within the content of technical safety basis documentation (e.g. documented safety analysis, technical safety requirements, safety evaluation reports, and the fire hazards analysis).
- B. Describe how the FHA is integrated with the DSA and other safety basis documents.
- C. Describe safety system oversight (SSO), the role of a cognizant system engineer (CSE), and how a fire protection engineer may interface with either.
- D. Discuss general design criteria and operational requirements for new safety significant and safety class fire protection systems.

Mandatory Performance Activity (MPA)

MPA 5.1: Review and identify applicable fire protection nuclear safety requirements in a DSA and TSR.

Conduct Oversight and Evaluate Contractor Performance

6. The FPE shall demonstrate an understanding of conducting fire protection oversight assessments and evaluating the performance of contractor fire protection programs.

Knowledge Requirements:

- A. Identify and discuss best practices for establishing an effective Contractor Assurance System (CAS), including issues management, performance criteria, and metrics used to track and trend the overall health of the fire protection program.
- B. Discuss the contractor fire protection program self-assessment requirements.

Mandatory Performance Activity (MPA)

MPA 6.1: Participate in and document observations of a fire protection program oversight activity, such as a facility walk-through or observation of other contractor activity.

MPA 6.2: Perform and formally document a comprehensive assessment and orally communicate the results of the assessment to DOE and/or contractor management.

Conduct FPP Assessments

7. The FPE shall demonstrate an understanding of conducting fire protection facility assessments.

Knowledge Requirements:

- A. Discuss the purpose and elements of fire protection facility assessments, including the approval frequency for performing facility assessments.

Mandatory Performance Activity (MPA)

MPA 7.1: Compare and contrast the purpose and elements of an FHA and facility assessment.

APPENDIX A

INITIAL QUALIFICATION TRAINING RECOMMENDATIONS

Technical education and/or training may include courses/training provided by the DOE, other government agencies, outside vendors, or local educational institutions. Training topics should also address identified weaknesses in the knowledge and/or skills of the participant and current technical issues related to the associated FAQs.

Table 1: Initial Qualification Training Recommendations	
PC #1:	An ABET accredited degree in fire protection engineering/engineering technology. (For example: University of Maryland, Oklahoma State University, Worcester Polytechnic Institute, etc.)
PC #2:	None
PC #3:	None
PC #4:	None
PC #5:	SBA-100 DE, <i>Nuclear Facility Safety Basis Fundamentals</i> SBA-130DE, <i>Accident Analysis and Control Selection</i> SBA-150DE, <i>TSR Development</i> SBA-160DE, <i>USQ Process</i> SMP-200, <i>Safety System Oversight Duties and Responsibilities</i> (For FPEs that are assigned SSO responsibilities)
PC #6:	DOE-200DE, <i>Assessment Fundamentals</i>
PC #7:	None

NOTE: Many external providers provide industry training. Below are suggested providers of additional training:

- <https://www.wpi.edu/academics/study/fire-protection-engineering-certificates>
- <https://ceat.okstate.edu/extension/professional-development/courses/fire-protection-and-loss-control.html>
- <https://extendedstudies.ucsd.edu/courses-and-programs/principles-of-fire-protection-engineering>
- <https://ekuonline.eku.edu/fire/industrial-fire-protection-certificate/>

APPENDIX B

CONTINUING TRAINING RECOMMENDATIONS

Fire protection engineers shall participate in a continuing training and qualification program that includes the following elements:

1. Continuing technical education and/or training covering topics directly related to fire protection as determined appropriate by management. This may include courses/training provided by DOE, other government agencies, outside vendors, or local educational institutions.
2. Continuing training topics should address identified weaknesses in the knowledge or skills of the participant.
3. Specific continuing training requirements shall be documented in Individual Development Plans.

Recommended Continuing Training:

- Participation in the DOE/NNSA Fire Safety Committee
- Participate in fire protection evaluations and assessments.
- Fire protection-related professional engineering approved courses (PDHs or CEUs)
- Membership at the Society of Fire Protection Engineers (SFPE), NFPA
- Membership on an NFPA or ICC technical committee
- Publish in professional publications.
- Attendance at industry conferences, meetings
- Assessment courses at NTC
- Undergraduate / graduate-level courses related to fire protection or emergency response.
- Courses offered by NFPA, SFPE, US Fire Academy, American Fire Sprinkler Association, or others.
- Obtainment/maintenance of a license or certification in fire protection (PE, certified fire protection specialist (CFPS), National Institute for Certification in Engineering Technologies (NICET), etc.)
- National Association of State Fire Marshals training courses
- UL Fire Safety Research Institute training courses
- MeyerFire University online courses
- AXA XL Risk Consulting: Property Risk Consulting Guidelines (available online)
- FM Global Property Loss Prevention Data Sheets (available online)