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DOE–STD–1182–2014
September 2014

DOE STANDARD

CIVIL/STRUCTURAL ENGINEERING 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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Technical Standards Program

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APPROVAL

The Federal Technical Capability Panel consists of senior U.S. Department of Energy (DOE) 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.

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FEDERAL TECHNICAL CAPABILITY PANEL

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ACKNOWLEDGEMENT

The Office of River Protection is the sponsor for the Civil/Structural Engineering Functional Area Qualification Standard (FAQS). The sponsor is responsible for coordinating the development and/or review of the FAQS by subject matter experts to ensure the technical content of the standard is accurate and adequate for Department-wide application for those involved in the Civil/Structural Engineering program. The sponsor, in coordination with the Federal Technical Capability Panel, is also responsible for ensuring the FAQS is maintained current.

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DOE-STD-1182-2014

U.S. DEPARTMENT OF ENERGY
FUNCTIONAL AREA QUALIFICATION STANDARD

CIVIL/STRUCTURAL ENGINEERING

PURPOSE

The primary purpose of the Technical Qualification Program (TQP) is to ensure employees have the requisite technical competency to support the mission of the Department. The TQP forms the basis for the development and assignment of DOE personnel responsible for ensuring the safe operation of defense nuclear facilities. The technical qualification standards are not intended to replace the U.S. Office of Personnel Management (OPM) qualifications standards or other departmental personnel standards, rules, plans, or processes. However, the technical qualification standards should form the primary basis for developing vacancy announcements, qualification requirements, crediting plans, interview questions, and other criteria associated with the recruitment, selection, and internal placement of technical personnel.

APPLICABILITY

The Civil/Structural Engineering Functional Area Qualification Standard (FAQS) establishes common functional area competency requirements for all DOE Civil/Structural Engineering 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. This technical FAQS has been developed as a tool to assist DOE program and field offices in the development and implementation of the TQP in their organization. For ease of transportability of qualifications between DOE elements, program and field offices must use this technical FAQS without modification. Satisfactory and documented attainment of the competency requirements contained in this technical FAQS ensures personnel possess the minimum requisite competence to fulfill functional area duties and responsibilities common to the DOE complex. Additionally, needed office-/site-/facility-specific qualification standards, handled separately, supplement this technical FAQS and establish unique operational competency requirements at the Headquarters or field element, site, or facility level.

It should be noted that the competencies of management and leadership, general technical knowledge, regulations, administrative capability, and assessment and oversight are embodied in the competencies in this standard. All these factors have a bearing on safety. Although the focus of this standard is technical competence, competencies such as good communication, recognized credibility, ability to listen and process information, and the ability to guide quality work efforts are recognized as important aspects of safety.

IMPLEMENTATION

This FAQS identifies the minimum technical competency requirements for DOE personnel. Although there are other competency requirements associated with these positions, this FAQS identifies the specific, common technical competencies required throughout all defense nuclear facilities for civil/structural engineering personnel.

The term “must” denotes a mandatory requirement, “should” denotes a recommended practice that is not required, and “may” denotes an option in this standard.

The competencies identify various levels 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 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 knowledge required to monitor and assess operations/activities, to apply standards of acceptable performance, and to recognize the need to seek and obtain appropriate expert advice (e.g., technical, legal, safety) or consult appropriate reference materials required to ensure the safety of DOE activities.
- **Demonstrate the ability** is the actual performance of a task or activity in accordance with policy, procedures, guidelines, and/or accepted industry or DOE practices.

Headquarters and field elements must establish a program and process to ensure DOE personnel possess the competencies required by their position, including the competencies identified in this technical FAQS. Documentation of the completion of the requirements in this standard must be included in the employees’ training and qualification records. Satisfactory attainment of competency requirements contained in this technical FAQS may be documented using the example Civil/Structural Engineering FAQS qualification card from the Federal Technical Capability Program Directives and Standards page, http://www.energy.gov/ehss/services/nuclear-safety/department-energy-technical-standards-program.

Equivalencies should be used sparingly and with the utmost rigor and scrutiny to maintain the spirit and intent of the TQP. Equivalencies may be granted for individual competencies based on objective evidence of previous education, training, certification, or experience. Objective evidence includes a combination of transcripts, certifications, and in some cases, a knowledge sampling obtained through written and/or oral examinations. Equivalencies must be granted in accordance with the TQP plan of the site/office/Headquarters organization qualifying the individual. Supporting knowledge and/or skill statements should, and mandatory performance activities must, be considered before granting an equivalency for a competency.

Training must be provided to employees in the TQP who do not meet competencies contained in this technical FAQS. 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 must be based on appropriate supporting knowledge and/or skill statements similar to those listed for each competency requirement. Headquarters and field elements should use the supporting knowledge and/or skill statements as a basis for evaluating the content of any training.

EVALUATION REQUIREMENTS

Attainment of competencies listed in this technical FAQS must be documented in accordance with the TQP plan or policy of the site/office/Headquarters organization qualifying the individual and the requirements in DOE M 360.1-1B, *Federal Employee Training Manual*, and DOE O 426.1, *Federal Technical Capability.*

The qualifying official or immediate supervisor should ensure the candidate meets the background and experience requirements of this FAQS. If the immediate supervisor is not qualified in this functional area, the supervisor should consult with a qualified individual prior to using one or a combination of the following individual competency evaluation methods:

- Satisfactory completion of a written examination
- Satisfactory completion of an oral examination
- Satisfactory accomplishment of an observed task or activity directly related to a competency
- Documented evaluation of equivalencies (e.g., applicable experience in the field) without a written examination

Field element managers/Headquarters program managers must qualify candidates as possessing the basic technical knowledge, technical discipline competency, and position-specific knowledge, skills, and abilities required for their positions.

Final qualification of candidates must be performed using one or a combination of the following methods:

- Satisfactory completion of a comprehensive written examination with a minimum passing grade of 80 percent.
- Satisfactory completion of an oral examination by a qualified Senior Technical Safety Manager (STSM) or a qualification board of technically qualified personnel that includes at least one qualified STSM.
- Satisfactory completion of a walkthrough of a facility with a qualifying official for the purpose of verifying a candidate's knowledge and practical skills of selected key elements.

Guidance for oral interviews and written exams is contained in DOE-HDBK-1205-97, *Guide to Good Practices for the Design, Development, and Implementation of Examinations*, and DOE-HDBK-1080-97, *Guide to Good Practices for Oral Examinations.*

For oral examinations and walkthroughs, qualifying officials or board members should ask critical questions intended to integrate identified learning objectives during qualification. Field element managers/Headquarters program managers or designees must develop formal guidance for oral examinations and walkthroughs that includes:

- Standards for qualification
- Use of technical advisors by a board
- Questioning procedures or protocol
- Pass/fail criteria
- Board deliberations and voting authorization procedures
- Documentation process

INITIAL QUALIFICATION AND TRAINING

Qualification of civil/structural engineering personnel must be conducted in accordance with the requirements of DOE O 426.1, Chg. 1, *Federal Technical Capability.*

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

- DOE
- Other government agencies
- Outside vendors
- Educational institutions
- Professional societies

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

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

A description of suggested learning activities and the requirements for the continuing education and training program for this FAQS are included in appendix A.

DUTIES AND RESPONSIBILITIES

The following are typical duties and responsibilities expected of personnel assigned to the civil/structural engineering functional area:

Hazard/Safety Analysis

A. Review safety documents and prepare evaluation reports.

B. Review and assess identification of site-specific natural phenomena and other external and internal hazards, design basis accidents, and safety classification of applicable controls to ensure integrity of structures, systems, and components (SSC).

Safety Standards and Design Requirements

A. Perform design reviews to ensure design inputs and assumptions, design methodologies, documentation, etc. are in accordance with the DOE standards, national consensus codes and standards, acceptable practice, and project procedures.

B. Serve as a subject matter expert and technical resource for civil/structural engineering and natural phenomena hazards including development of orders, standards, and for personnel in training.

Quality Assurance (QA)

A. Verify the application of QA requirements for civil/structural systems and components.

Management and Oversight

A. Provide oversight of the contractor's design and construction activities and programs in the civil/structural engineering areas.

B. Participate in establishing and/or reviewing project, facility, or site-specific civil/structural engineering guidance and requirements.

C. Evaluate DOE facility and program-related civil/structural systems for safe and efficient operation, maintenance, and testing, including emergency systems.

D. Evaluate contractor compliance with the applicable regulations and DOE directives and standards related to civil/structural systems.

Note: Position-specific duties and responsibilities for civil/structural engineering personnel are contained in office-/site-/facility-specific qualification standards and/or position descriptions.

BACKGROUND AND EXPERIENCE

The OPM *Qualification Standards Operating Manual* 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 civil/structural engineering personnel are:

1. Education ***(Required)***

    a. Bachelor of Science or higher degree in civil/structural engineering or in an applicable engineering field, from an accredited institution, or meet the alternative requirements specified in the OPM standards for Occupational Series 810. There are a variety of ways a person can meet these qualifications.

    b. It is possible for a person to meet the minimum OPM qualifications without having a strong foundation in structural engineering. Because it is important for the civil/structural engineer to have a strong educational foundation especially related to structural engineering, the civil/structural engineer must have taken the following accredited courses:

        1) Statics
        2) Mechanics/Strength of Materials
        3) Structural Mechanics/Dynamics
        4) Basic Soil Mechanics/Geotechnical Engineering
        5) Fluid Mechanics/Hydrology
        6) Advanced Structural Analysis
        7) Structural Steel Design Reinforced Concrete Design
        8) Construction Materials

c. The above requirements may be waived for an individual who has a structural endorsement on a Professional Engineer license they hold.

Preferred: Bachelor of Science degree in civil engineering from an accredited institution with an emphasis in structural engineering.

2. Experience

a. **Required:** Industrial, commercial, military, federal, state, or other directly related background that has provided specialized experience in civil/structural engineering. Specialized experience can be demonstrated through possession of the competencies outlined in this standard.

b. In addition to the education and experience, a civil/structural engineer will normally hold at least an Engineer-in-Training Certificate. State registration as a Professional Engineer with an emphasis on civil/structural engineering is preferred.

REQUIRED TECHNICAL COMPETENCIES

The competencies contained in this standard are distinct from competencies contained in the DOE-STD-1146, *General Technical Base Qualification Standard*. All civil/structural engineering personnel must satisfy the competency requirements of the DOE-STD-1146 prior to or in parallel with the competency requirements contained in this standard. Each competency requirement defines the level of expected knowledge and/or skill an individual must possess to meet the intent of this standard. Each competency requirement is further described by supporting knowledge and/or skill statements that describe the intent of the competency statement. In selected competencies, expected knowledge and/or skills have been designated as “mandatory performance activities.” In these competencies, the actions are not optional.

Note: When regulations, DOE directives, or other industry standards are referenced in this FAQS, the most recent revision should be used. It is recognized that some civil/structural engineering personnel may oversee facilities that utilize predecessor documents to those identified. In those cases, such documents should be included in local qualification standards.

HAZARD/SAFETY ANALYSIS

1. Civil/structural engineering personnel must demonstrate a familiarity level knowledge of site characterization related to earthquakes.

Supporting Knowledge and/or Skills:

a. Discuss the phenomena of earthquakes in relation to rupture of faults in the earth’s crust and the associated slip on these faults.

b. Discuss various types of faults.

c. Discuss various terminology used in defining earthquake magnitude and location.

d. Demonstrate familiarity with propagation of earthquake and its impact on structures.

e. Demonstrate familiarity with seismic hazard evaluation, PSHA methodology, development and implementation of ground motion prediction (ANS 2.27, ANS 2.29, NUREG/CR-6728, NUREG-2115, NUREG-2117).

2. Civil/structural engineering personnel must demonstrate a familiarity level knowledge of tornadoes, hurricanes, and extreme straight line winds.

Supporting Knowledge and/or Skills:

a. Discuss the formation and propagation of tornadoes and hurricanes.

b. Discuss the Enhanced Fujita scale for tornadoes.

c. Discuss the quarter-mile and 3-second wind gust speeds.

d. Discuss and distinguish the effects of high winds, tornadoes, and hurricanes on SSCs.

e. Discuss wind generated missiles.

f. Familiarity with and use of American National Standards Institute [ANSI]/American Nuclear Society [ANS] 2.27.

3. Civil/structural engineering personnel must demonstrate a familiarity level knowledge of floods and tsunamis.

Supporting Knowledge and/or Skills:

a. Discuss the various types of flooding and their causes.
b. Discuss the formation of tsunamis.
c. Discuss the effects of floods and tsunamis on SSCs.
d. Familiarity with and use of American National Standards Institute [ANSI]/American Nuclear Society [ANS] 2.27.

4. Civil/structural engineering personnel must demonstrate a familiarity level knowledge of geotechnical engineering.

Supporting Knowledge and/or Skills:

a. Discuss the following in relation to civil engineering and site conditions and their potential impacts on foundations and structures:
    1) Subsurface exploration (drilling, in situ, and geophysical techniques) and sampling methods
    2) Soil mechanics - static and dynamic analysis
    3) Shallow and deep foundations
    4) Earth retaining structures
    5) Slope stability
    6) Soil liquefaction
    7) Settlement theory.
    8) Familiarity with and use of American National Standards Institute [ANSI]/American Nuclear Society [ANS] 2.27

5. Civil/structural engineering personnel must demonstrate a familiarity level knowledge of the civil/structural engineering requirements of the applicable Federal Regulation 10 *Code of Federal Regulations* (CFR) 830, "Nuclear Safety Management," safety-basis documents and processes, and associated orders, standards, and guides.

Supporting Knowledge and/or Skills:

a. Discuss the requirements of 10 CFR 830, Subpart B with respect to the documented safety analysis (DSA), technical safety requirements, and the unreviewed safety question process for nuclear facilities.

b. Discuss the basic purpose and content of a DSA as discussed in DOE-STD-3009-94, *Preparation Guide for U.S. DOE Nonreactor Nuclear Facility Safety Analysis Reports*; DOE O 420.1C, *Facility Safety*; and DOE G 421.1-2A, *Implementation Guide for use in Developing Documented Safety Analyses to Meet Subpart B, 10 CFR 830*.

c. Discuss the purpose and content of technical safety requirements as discussed in DOE G 423.1-1A, *Implementation Guide for use in Developing Technical Safety Requirements* and DOE-STD-3009, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses.*

d. Discuss the purpose of the unreviewed safety question process as described in DOE G 424.1-1B, *Implementation Guide for use in Addressing Unreviewed Safety Question Requirements*.

e. Describe the basic purpose and content of a safety evaluation report as discussed in DOE-STD-1104, *Review and Approval of Nuclear Facility Safety Basis Documents*.

f. Describe the process followed for new nuclear facilities in terms of meeting safety basis requirements as outlined in DOE-STD-1189, *Integration of Safety into the Design Process*.

SAFETY STANDARDS AND DESIGN REQUIREMENTS

6. Civil/structural engineering personnel must demonstrate a working level knowledge of analytical and computer-based techniques for analyzing nuclear safety related SSCs.

Supporting Knowledge and/or Skills:

a. Discuss basic theory and principles behind finite element analysis and its application in commuter programs for static and dynamic structural analysis.

b. Discuss examples of types of finite elements typically encountered in commercial computer programs, their use and limitations in modeling including use of appropriate mesh size, convergence, and proper simulation of boundary conditions and releases of nodal degrees of freedom.

c. Discuss numerical techniques used for static and dynamic finite element analysis, selection and reduction of dynamic degrees of freedom, response spectrum, and time-history analysis.

7. Civil/structural engineering personnel must demonstrate a working level knowledge of seismic analysis and design criteria for nuclear safety related SSCs.

Supporting Knowledge and/or Skills:

a. Discuss the provisions in American Society of Civil Engineers (ASCE) 4-98, *Seismic Analysis of Safety-Related Nuclear Structures*, related to:

   1) Site response analysis and development of design response spectra.

   2) Important considerations in modeling of structures for seismic analysis including lumped mass stick model; finite element model; models for single- and multi-step analysis; models for dynamic analysis; and modeling of mass, stiffness, and damping.

   3) Different types of analysis commonly employed in seismic analysis such as equivalent static method, linear and nonlinear response spectrum and time history analysis, and frequency domain analysis.

   4) Soil-structure interaction modeling and analysis including simplified frequency independent lumped spring method, frequency dependent direct and substructuring methods.

   5) Methods for subsystems analysis and nonbuilding components for seismic effects.

   6) Methods for analyzing buried pipes and conduits, earth retaining and basement walls, aboveground vertical tanks, distribution systems, unanchored components, and base isolation systems.

b. Discuss the provisions of the ASCE 43-05, *Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities,* related to the graded approach for earthquake design provisions, development of design basis earthquake ground motion, evaluation of seismic demand, and structural capacities.

8. Civil/structural engineering personnel must demonstrate a working level knowledge of safety classification of civil/structural SSCs and their design requirements in DOE directives.

Supporting Knowledge and/or Skills:

a. Describe the purpose, scope, and application of the following DOE directive and guides in the safety classification of SSCs:

   1) DOE O 420.1C

   2) DOE G 420.1-1A, *Nonreactor Nuclear Safety Design Criteria and Explosive Safety Criteria Guide for use with DOE O 420.1C, Facility Safety*

b. Discuss how engineered safety controls from hazard and accident analysis are identified and made functional through the proper design and evaluation of SSCs.

c. Discuss the difference in the design requirements, including the use of codes and standards for SSCs designated as:

   1) Safety class

   2) Safety-significant

   3) Defense-in-depth

9. Civil/structural engineering personnel must demonstrate a working level knowledge of DOE and other National Standards for natural phenomena hazards analysis and design criteria for DOE facilities.

a. Discuss the analysis and design methodology of DOE-STD-1020, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities* and DOE-STD-1189 for new construction, including the use of other national standards referenced in DOE-STD-1020 (American National Standards Institute [ANSI]/American Nuclear Society [ANS] 2.26, ASCE-4, and ASCE/Structural Engineering Institute [SEI] 43).

b. Explain how an evaluation of existing facilities is performed, when a back-fit analysis should be performed, and what kind of relief in the criteria can be allowed for existing facilities.

10. Civil/structural engineering personnel must demonstrate a working level knowledge of major national consensus codes and standards related to steel and concrete structural design.

Supporting Knowledge and/or Skills:

a. Demonstrate working level knowledge of the following:

1) ASCE/SEI Standard

- ASCE/SEI 7, *Minimum Design Loads for Buildings and Other Structures*

2) Reinforced Concrete and Masonry, American Concrete Institute (ACI)

- ACI 318, *Building Code Requirements for Structural Concrete and Commentary*
- ACI 349, *Nuclear Safety-Related Concrete Structures and Commentary*
- TMS 402/ACI 530/ASCE 5, *Building Code Requirements & Specification for Masonry Structures and Related Commentaries*

3) Structural Steel, ANSI/American Institute of Steel Construction (AISC)

- ANSI/AISC 360, *Specification for Structural Steel Buildings*
- ANSI/AISC N690*, Specifications for the Design, Fabrication and Erection of Steel Safety-Related Structures for Nuclear Facilities*
- AISC 327, *Seismic Design Manual*
- AISC 341, *Seismic Provisions for Structural Steel Buildings*
- AISC 358, *Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications*

11. Civil/structural engineering personnel must demonstrate a working level knowledge of the international building code provisions related to civil/structural engineering analysis and design requirements:

Supporting Knowledge and/or Skills:

a. Discuss application of the following provisions of the International Building Code to DOE projects:

   1) Regulatory framework of the International Building Code (Chapter 1)

   2) Application of building code requirements to SDC-1 and SDC-2 SSCs (Chapter 3)

   3) Special detailed requirements based on use and occupancy (Chapter 4 sections related to hazardous materials)

   4) Structural design (Chapter 16)

   5) Structural tests and special inspections (Chapter 17)

   6) Soils and foundations (Chapter 18)

   7) Concrete (Chapter 19)

   8) Masonry (Chapter 21)

   9) Steel (Chapter 22)

QUALITY ASSURANCE

12. Civil/structural engineering personnel must demonstrate a familiarity level knowledge of the application of QA policies, programs, and processes in the design and construction of civil/structural systems and components.

Supporting Knowledge and/or Skills:

a. Describe the general QA requirements, of 10 CFR 830.120, *Quality Assurance*, DOE O 414.1D, *Quality Assurance*, and following DOE QA Guidance documents.

   1) DOE G 414.1-1C, *Management and Independent Assessments Guide*

   2) DOE G 414.1-2B, Admin Chg. 1, *Quality Assurance Program Guide*

   3) DOE G 414.1-4, *Safety Software Guide.*

b. Describe how American Society for Mechanical Engineers NQA-1, *Quality Assurance for Nuclear Facility Applications*, or other national or international standards are applied to implement QA criteria.

c. Describe how QA requirements are implemented in the following:

   1) Safety analysis

   2) Application of the graded approach requirement

   3) Design process controls

   4) Design verification and validation

   5) Procurement and construction

d. Describe DOE and contractor responsibilities and requirements for implementing an approved QA Program including flowdown of QA requirements.

e. Describe the application of the 10 QA criteria of DOE O 414.1D and 10 CFR 830, Subpart A, which address the following:

1) Management

2) Performance

3) Assessment.

MANAGEMENT AND OVERSIGHT

13. Civil/structural engineering personnel must demonstrate a familiarity level knowledge of program and project management.

Supporting Knowledge and/or Skills:

a. Discuss the provisions of DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets* and associated guides related to:

1) Phases of a project lifecycle

2) Each of the critical decision points in relation to civil/structural engineering activities

3) What a code of record is and how it changes over the life of a project

4) Purpose, scope, and application of the safety in design elements from DOE-STD-1189 and how they interface with the requirements from DOE O 413.3B.

14. Civil/structural engineering personnel must demonstrate a familiarity level knowledge of the DOE/facility contract provisions necessary to provide oversight and assessments of a contractor's performance.

Supporting Knowledge and/or Skills:

a. Discuss the provisions of DOE O 226.1B, Department of Energy Oversight Policy related to:

1) the role of civil/structural engineering personnel in contractor oversight.

2) the assessment requirements and limitations of civil/structural engineering personnel interfacing with contractor employees.

3) how planning, observing, interviewing, and document research are used during an assessment.

4) the essential elements of an assessment including the areas of investigation, fact-finding, and reporting.

5) the system engineering concept as it applies to oversight of safety systems, using the guidance in DOE-STD-1073, *Configuration Management*.

6) the application of the compliance documents section of contracts.

15. Civil/structural engineering personnel must demonstrate the ability to provide oversight and assessment of a contractor's performance.

a. Assessment or Surveillance:

Civil/structural engineering personnel must demonstrate the ability to perform a civil/structural assessment or surveillance to ensure that the design, construction, and/or operation are being conducted in accordance with DOE O 420.1C, associated guide, and national consensus codes and standards.

b. Design Review:

Civil/structural engineering personnel must demonstrate the ability to participate in a structural analysis design review. This will include reviewing assumptions, technical specifications, design calculations, and drawings to ensure that the design is appropriate, constructible, operable, and maintainable.

c. Safety Basis Review:

Civil/structural engineering personnel must demonstrate the ability to perform a review of safety basis documentation to ensure that designated structural safety systems have been properly assessed including a determination that they are designed and constructed to meet the functional requirements and performance criteria identified in the DSA.

d. Technical Presentation:

Civil/structural engineering personnel must demonstrate the ability to prepare and make a technical presentation on civil structural engineering matters to internal and external organizations.

APPENDIX A

CONTINUING EDUCATION, TRAINING AND PROFICIENCY PROGRAM

This standard does not require requalification.

Headquarters or field element managers must ensure the following:

1. Establish expectations related to the performance of duties and responsibilities in this FAQS, considering regulatory and/or contractual requirements as appropriate.
2. Identify specific continuing training requirements in the site/office/position specific qualification standard(s) or procedures.
3. Approve all established continuing training requirements related to defense nuclear facility safety oversight as determined for their office or site.

Civil/structural engineering personnel must complete continuing technical education and/or training covering topics directly related to this civil/structural engineering FAQS as determined by the appropriate Headquarters or field element managers as follows:

1. Address changes to DOE directives, guides, standards, policies, and rules since the last qualification was completed.
2. Perform practical factor exercises as appropriate, especially those that are mandatory and others as required by the associated FAQS.
3. Attend seminars, symposia, or technical meetings related to civil/structural engineering as resources are available.

Note: Continuing technical education and/or training may include courses/training provided by DOE, other government agencies, outside vendors, or local educational institutions. Continuing training topics should also address identified weaknesses in the knowledge or skills of the individual personnel, and current technical issues related to the associated FAQS. Where continuing education is mandatory for maintaining professional registration (e.g., Professional Engineer) or professional certification (e.g., Certified Health Physicist), this will normally be sufficient, and only needs to be augmented by DOE directives reviews and any site-specific requirements (e.g., new/revised documented safety analyses).

APPENDIX B

REFERENCES

10 CFR 830, “Nuclear Safety Management,” *Code of Federal Regulations*, as amended.

10 CFR 830.120, “Quality Assurance,” *Code of Federal Regulations*, as amended.

ACI 318, *Building Code Requirements for Structural Concrete and Commentary*

ACI 349, *Nuclear Safety-Related Concrete Structures and Commentary*

AISC 327, *Seismic Design Manual*

AISC 341, *Seismic Provisions for Structural Steel Buildings*

AISC 358, *Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications*

ANSI/AISC 360, *Specification for Structural Steel Buildings*

ANSI/AISC N690, *Specifications for the Design, Fabrication and Erection of Steel Safety-Related Structures for Nuclear Facilities*

ANSI/ANS-2.3, *Estimating Tornado, Hurricane, and Extreme Straight Line Wind Characteristics at Nuclear Facility Sites*

ANSI/ANS-2.26, *Categorization of Nuclear Facility Structures, Systems and Components for Seismic Design*

ANSI/ANS-2.27, *Criteria for Investigation of Nuclear Facility Sites for Seismic Hazard Assessment*

ANSI/ANS-2.29, *Probabilistic Seismic Hazard Analysis*

ASCE 4-98, *Seismic Analysis of Safety-Related Nuclear Structures and Commentary*

ASCE/SEI 43-05, *Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities*

ASCE/SEI 7, *Minimum Design Loads for Buildings and Other Structures*

ASME NQA-1, *Quality Assurance for Nuclear Facility Applications*, American Society for Mechanical Engineering.

DOE O 413.3B, *Program and Project Management for the Acquisition of Capital Assets*

DOE G 414.1-1B, *Management and Independent Assessments Guide*

DOE G 414.1-2B Admin Chg. 1, *Quality Assurance Program Guide*

DOE G 414.1-4, *Safety Software Guide*

DOE G 420.1-1, *Nonreactor Nuclear Safety Design Criteria and Explosive Safety Criteria Guide for use with DOE O 420.1B, Facility Safety*

DOE G 421.1-2, *Implementation Guide for use in Developing Documented Safety Analyses to Meet Subpart B, 10 CFR 830*

DOE G 423.1-1, *Implementation Guide for use in Developing Technical Safety Requirements*

DOE G 424.1-1, *Implementation Guide for use in Addressing Unreviewed Safety Question Requirements*

DOE M 360.1-1B, *Federal Employee Training Manual*

DOE O 414.1D, *Quality Assurance*

DOE O 420.1B, *Facility Safety*

DOE O 420.1C, *Facility Safety*

DOE O 426.1, *Federal Technical Capability*

DOE-HDBK-1080-97, *Guide to Good Practices for Oral Examinations*

DOE-HDBK-1205-97, *Guide to Good Practices for the Design, Development, and Implementation of Examinations*

DOE-STD-1020, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities*

DOE-STD-1021, *Natural Phenomena Hazards Performance Categorization Guidelines for Structures, Systems, and Components*

DOE-STD-1022, *Natural Phenomena Hazards Characterization Criteria*

DOE-STD-1023, *Natural Phenomena Hazards Assessment Criteria*

DOE-STD-1073, *Configuration Management*

DOE-STD-1104, *Review and Approval of Nuclear Facility Safety Basis Documents*

DOE-STD-1146, *DOE Standard: General Technical Base Qualification Standard*

DOE-STD-1189, *Integration of Safety into the Design Process*

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Other Reading

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CONCLUDING MATERIAL

Review Activity:
EM
NNSA
NE
SC
EA
AU

Preparing Activity:
DOE ORP

Project Number:
TRNG-0080

Field and Operations Offices:
CBFO
CH
ID
OH
OR
ORP
RL
SR

Site/Field Offices:
Argonne Site Office
Brookhaven Site Office
Fermi Site Office
Kansas City Field Office
Livermore Field Office
Los Alamos Field Office
Nevada Field Office
NNSA Production Office-Pantex
Princeton Area Office
Savannah River Field Office
Sandia Field Office
NNSA Production Office-Y-12