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

ORDER

NE O 420.1

Approved: August 2025
Chg 1(LtdChg): February 2026

SUBJECT: FACILITY SAFETY

1. OBJECTIVE. To establish facility and programmatic safety requirements for the Department of Energy (DOE), Office of Nuclear Energy (NE), including advanced nuclear reactors and other nuclear facilities authorized by DOE NE, for:

   a. Nuclear safety design criteria;

   b. Fire protection;

   c. Criticality safety;

   d. Natural phenomena hazards (NPH) mitigation.

   Configuration Management Facility safety requirements for explosive, chemical, and industrial hazards are contained in other DOE rules and directives.

2. CANCELS/SUPERSEDES.

   This Order applies in lieu of DOE O 420.1C (current version) with respect to the facilities and activities covered by Section 3 below. Cancellation of a directive does not, by itself, modify or otherwise affect any contractual or regulatory obligation to comply with the directive. Contractor Requirements Documents (CRDs) that have been incorporated into a contract remain in effect throughout the term of the contract unless and until the contract or regulatory commitment is modified to either eliminate requirements that are no longer applicable or substitute a new set of requirements.

3. APPLICABILITY.

   a. Departmental Elements. This Order applies to all Departmental elements including NNSA, and their associated field element(s),[1] to the extent they are involved with facilities and activities described in paragraph 3.b.

   b. NE Facilities and Activities. Except as stated in paragraph 3.d., this Order applies to all facilities and activities under the responsibility NE, including nuclear facilities and nuclear activities authorized by NE. Such nuclear activities include the design,

[1] Operations offices, service centers, site offices, area offices, field offices, government-owned government-operated facilities, and regional offices of federally-staffed laboratories that report directly to a DOE Headquarters office.

construction, management, operation, decontamination, decommissioning, or demolition of nuclear facilities.

c. Contractors. Except as stated in paragraph 3.d., this Order sets forth conditions to be applied to contractors performing work that involves facilities and activities described in paragraph 3.b. The CRD must be included in contracts under which the contractor is involved with such facilities and activities.

d. Equivalencies and Exemptions.

1) Exemption. In accordance with the responsibilities and authorities assigned by Executive Order 12344, codified at 50 United States Code (U.S.C.) sections 2406 and 2511, and to ensure consistency throughout the joint Navy/DOE Naval Nuclear Propulsion Program, the Deputy Administrator for Naval Reactors (Director) implements and oversees requirements and practices pertaining to this directive for activities under the Director's cognizance, as deemed appropriate.

2) Exemption. This Order does not apply to activities regulated by either the Nuclear Regulatory Commission (NRC) or the authorities of a State under an agreement with the NRC per the Atomic Energy Act of 1954, as amended (AEA).

3) Other Equivalencies/Exemptions. Any other equivalency or exemption to this Order requires the approval of the DOE Head of Field Element or NE's Safety Basis Approval Authority (SBAA) (for a hazard category 1, 2, or 3 facility). Requests for equivalencies/exemptions will be adjudicated by the DOE Head of Field Element/SBAA (for a hazard category 1, 2, or 3 facility) within 14 calendar days of receipt of a substantially complete request.

4. REQUIREMENTS. DOE elements must:

a. Approve and oversee contractor programs, as specified in Section 5 of this Order.

b. Implement the requirements in Attachment 1 of this Order for government-owned government-operated facilities.

c. Document any operational responsibilities that are assigned to the contractor regarding the Authority Having Jurisdiction (AHJ) for matters involving fire protection as defined by the National Fire Protection Association (NFPA) codes.

d. Document any authorities associated with the building code official, as defined in DOE-STD-1066-2023, *Fire Protection*, that are assigned to the contractor.

e. Establish an integrated site-wide wildland fire management plan for federally owned sites, consistent with the relevant portions of the *Federal Wildland Fire*

Management Policy.

f. Review and approve safety basis and safety design basis documents in accordance with DOE-STD-1104-2016, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents*.

5. RESPONSIBILITIES.

a. Assistant Secretary of Nuclear Energy.

(1) Ensure that the requirements of this Order and the CRD are implemented for facilities, activities, or programs under their cognizance.

(2) Approve the basis for not including multiple physical barriers to prevent or mitigate the unintended release of radioactive materials to the environment, as part of the hazard category 1, 2, and 3 nuclear facility designs, where justified by sound technical basis.

(3) Review and approve safety basis and safety design basis documents in accordance with DOE-STD-1104-2016.

b. DOE Head of Field Element/Safety Basis Approval Authority.

(1) Ensure that the facilities, activities, and programs under their purview operate in compliance with the requirements of this Order and the CRD.

(2) Review, and where justified, approve equivalencies and exemptions to the requirements of this Order.

(3) Identify contracts to which the CRD applies and notify contracting officers when contracts are affected by this Order.

(4) Review and, where justified, approve equivalencies to DOE technical standards and industry codes and standards determined to be applicable to the facility design or operations.

(5) Review contractor emergency services organization baseline needs assessments (BNAs) that meet the requirements in Attachment 2, Chapter II, Section 3.e.(1) of this Order.

(6) Review contractor Wildland Fire Management Plans that meet the requirements in Attachment 2, Chapter II, Section 3.g. of this Order.

(7) Review contractor fire protection programs.

(8) Fulfill the roles and responsibilities for the AHJ for matters involving fire protection, as defined by the NFPA, including documentation of any delegation or assignment of related responsibilities (See Section 5.2.4 of DOE-STD-1066-2023, for further discussion of delegations).

(9) Fulfill the roles and responsibilities for the building code official, as defined in DOE-STD-1066-2023, including documentation of any delegation or assignment of related responsibilities.

(10) Perform responsibilities of 'owner,' or other equivalent term in the application of DOE technical standards or industry codes and standards, including documentation of any delegation or assignment of related responsibilities.

(11) Review the contractor's criticality safety program documentation, ensure that it meets requirements in Chapter III of Attachment 2 of this Order. (This may be accomplished through the safety basis documentation review and approval process.)

(12) Approve periodic NPH assessment evaluations, any recommended update actions, and any recommended upgrade plans, in accordance with Chapter IV of Attachment 2 of this Order.

(13) Consistent with NE O 226.1, establish and implement an appropriate self-assessment and oversight program for the elements of this Order.

(14) Review and approve safety basis and safety design basis documents in accordance with DOE-STD-1104-2016.

c. Contracting Officers.

Incorporate the CRD, or its requirements, into affected contracts and procurement requests in a timely manner when notified.

6. REFERENCED STANDARDS. The following DOE technical standards and industry standards provide methods for this Order in accordance with the applicability and conditions described within this Order. Alternatives to these standards may be utilized with the approval of the SBAA.

a. DOE Standard (STD)-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*. This DOE technical standard is required to be used for specified new non-reactor hazard category 1, 2, and 3 nuclear facilities and major modifications to hazard category 1, 2, and 3 non-reactor nuclear facilities.

b. DOE-STD-1104-2016, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents*. This DOE technical standard is required to be used by DOE personnel for review and approval of safety basis and safety design basis documents. See Section 4 for specific requirements.

c. NE-STD-1020-2025, Chg. 1, *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities*. This DOE technical standard should be used for developing the NPH design of new facilities and major modifications. See Attachment 2, Chapter IV of this Order for additional allowances and guidance for using NE-STD-1020-2025, Chg. 1.

d. American National Standards Institute (ANSI)/American Nuclear Society (ANS)-8 Nuclear Criticality Safety Standards in effect as of the issuance of DOE O 420.1C, chg. 3 (November 2019). This set of industry standards is required to be satisfied or alternatives are required to be approved by the SBAA by Criticality Safety Programs for facilities and activities with the potential for inadvertent criticalities, unless otherwise modified and approved by DOE. See Attachment 2, Chapter III for specific requirements.

e. Institute of Electrical and Electronics Engineers (IEEE) 379-2014, *IEEE Standard for Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems*. This industry standard should be applied to the design of safety-class structures, systems, and components (SSCs) for new nuclear facilities and major modifications, unless another applicable standard is approved by DOE. See Attachment 3 for specific requirements.

f. IEEE 323-2003 (R2008), *IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations*. This industry standard should be used to ensure environmental qualifications of safety-class SSCs for new nuclear facilities and major modifications, unless another applicable standard is approved by DOE. See Attachment 3 for specific requirements.

g. IEEE 384-2008, *IEEE Standard Criteria for Independence of Class IE Equipment and Circuits*. This industry standard should be used for new nuclear facilities and major modifications for physical and electrical separation methods, including the use of separation distance, barriers, electrical isolation devices, or any combination thereof, unless another applicable standard is approved by DOE. See Attachment 3 for specific requirements.

7. APPLICABLE STANDARDS. An applicable DOE technical standard or industry code or standard is one for which it has been determined by the contractor that it will be used or will be applied for a specific facility/site to meet the design, construction, and operational requirements described in this Order. This Order provides the process for determining which standards will be applicable (as described in the Attachments to this Order). DOE approves the contractor's list of applicable DOE technical standards or industry codes or standards via different means, including approval of safety design documents, the fire protection program, and inclusion of the DOE technical standards or industry codes or standards in the contract.

Once a standard is identified as applicable, this Order requires that the applicable requirements of the applicable standards be followed unless relief is obtained.

Together, the applicable standards, and any other applicable DOE requirement documents, along with any exemptions and equivalencies, make up the "Code of Record" for a given project or design, and reflect DOE's commitment to standard-based safety management.

8. REFERENCES AND ACRONYMS. References and acronyms can be found in Attachment 4 of this Order.

9. CONTACT. Questions concerning this Order should be addressed to the Office of Nuclear Energy.

BY ORDER OF THE SECRETARY OF ENERGY:

JAMES P. DANLY
Deputy Secretary

ATTACHMENT 1
CONTRACTOR REQUIREMENTS
DOCUMENT NE O 420.1, *FACILITY SAFETY*

This Contractor Requirements Document (CRD) includes requirements outlined in Attachments 2 and 3 of Department of Energy (DOE) Nuclear Energy (NE) Order (O) 420.1, *Facility Safety*, referenced in and made a part of this CRD, and which provide program requirements and/or information applicable to contracts in which this CRD is inserted.

1. GENERAL REQUIREMENTS.

   a. This CRD establishes facility safety requirements for design, construction, operation, management, decontamination, decommissioning, and demolition of DOE sites or facilities, including NE authorized Advanced Reactor and related facilities. Regardless of the performer of the work, the contractors are responsible for complying with the requirements of this CRD. The contractors are responsible for flowing down the requirements of this CRD to subcontractors at any tier, to the extent necessary, to ensure the contractors' compliance with the requirements.

   b. Contractors must satisfy the requirements set forth in Attachments 2 and 3 of NE O 420.1.

   c. For design and construction activities, contractors must identify the applicable industry codes and standards, including the *International Building Code* (IBC), and the applicable DOE requirements and technical standards. If approved by the responsible DOE Head of the Field Element, state, regional, and local building codes may be used in lieu of the IBC upon contractor submission of documentation providing a basis that demonstrates that implementation of the substituted code for the specific application will meet or exceed the level of protection that would have been provided by the IBC. Additionally, nuclear projects shall establish and maintain a Code of Record (COR) early in project design for identifying applicable industry codes and standards. The COR shall also identify proposed exemptions from and equivalencies to applicable industry codes and standards. For leased facilities that are not nuclear hazard category 1, 2, or 3 facilities, the requirements of this paragraph apply to the extent determined by the DOE Head of Field Element/SBAA.

   d. Contractors should satisfy the requirements in DOE technical standards and recommended industry codes and standards that are identified as applicable in accordance with Section 1.c. above, unless relief is approved in accordance with Section 2, below.

2. RELIEF FROM REQUIREMENTS, CODES AND STANDARDS.

   a. Requests for equivalencies and exemptions to the requirements of this attachment are processed by the DOE Head of Field Element/Safety Basis Approval Authority (for a hazard category 1, 2, or 3 facility).

   b. Equivalencies to DOE technical standards and industry codes and standards determined to be applicable to the facility design or operations must demonstrate an equivalent level of safety (i.e., meets or exceeds the level of protection) and be approved by the DOE Head of Field Element/Safety Basis Approval Authority (for a hazard category 1, 2, or, 3 facility) or designee.

3. REFERENCES AND ACRONYMS. Attachment 4 of NE O 420.1 provides a list of references and acronyms. Reference documents that may be helpful in implementing this Order include rules, directives, guidance, DOE technical standards, and industry codes and standards.

ATTACHMENT 2
FACILITY SAFETY REQUIREMENTS

This attachment provides information and/or requirements associated with the Nuclear Energy (NE) Order (O) 420.1, *Facility Safety*, as well as information and/or requirements applicable to contracts into which the associated Contractor Requirements Document (CRD), (see Attachment 1 of NE O 420.1) is inserted.

ATTACHMENT 2, CHAPTER I
NUCLEAR SAFETY DESIGN CRITERIA

1. OBJECTIVE. To establish requirements for safety design of DOE hazard category 1 and 2, and 3 nuclear facilities to support implementation of DOE Policy (P) 420.2 and DOE P 420.3.

   The requirements of this chapter (and the criteria in Attachment 3 of NE O 420.1) support implementation of the requirements for hazard category 1, 2, and 3 nuclear facilities in 10 CFR Part 830, *Nuclear Safety Management*, Subpart B, Safety Basis Requirements.

2. APPLICABILITY.

   a. This chapter applies to the design and construction of:

      (1) new hazard category 1, 2, and 3 nuclear facilities, as defined by 10 CFR Part 830; and

      (2) major modifications to hazard category 1, 2, and 3 nuclear facilities, as defined in 10 CFR Part 830, that could substantially change the facility safety basis.

   b. This chapter does not impose requirements on existing facilities, except for major modifications[3] to those facilities. The requirements of this chapter may be used to develop comparisons of existing facilities to the requirements for new facilities, as one aide to judgment when evaluating the costs and benefits of non-mandatory upgrades to existing facilities.

   c. Except for the requirements of Section 3.b.(3), this chapter does not apply to nuclear deactivation or decontamination and decommissioning activities at end-of-facility-life if the safety analysis demonstrates that adequate protection is provided consistent with the requirements of 10 CFR Part 830 through alternate means and it is not cost beneficial to apply the provisions of this chapter for the limited remaining life of the activity.

3. REQUIREMENTS.

   a. Integration of Safety with Design.

      (1) Safety analyses must be used to:

         (a) identify safety class and safety significant structures, systems, and components (SSCs) needed to fulfill the safety functions in order to prevent and/or mitigate design basis accidents (DBAs), including natural and man-induced hazards and events;

         (b) identify the safety functional requirements of the safety class and safety significant SSCs; and

(c) identify specific administrative controls (SACs) needed to fulfill safety functions. (Note: See DOE-STD-1186-2016, Specific Administrative Controls).

b. Nuclear Facility Design.

(1) The nuclear facility design must include multiple layers of protection (as part of the design defense-in-depth) to prevent or mitigate the unintended release of radioactive materials into the environment.

(2) Defense-in-depth must include all of the following:

(a) choosing an appropriate site;

(b) minimizing the quantity of material-at-risk;

(c) applying conservative design margins;

(d) applying quality assurance;

(e) using successive/multiple physical barriers for protection against radioactive releases (Note: If an exemption to having multiple barriers is required, it is the responsibility of the Safety Basis Approval Authority to approve, or disapprove, the exemption for not including multiple physical barriers);

(f) using multiple means to ensure safety functions are met by—

1 controlling processes;

2 maintaining processes in safe status;

3 providing preventive and/or mitigative controls for accidents with the potential for radiological releases; and

4 providing means for monitoring facility conditions to support recovery from upset or accident conditions;

5 using equipment in combination with administrative controls that—

a restrict deviation from normal operations;

b monitor facility conditions during and after an event; and

c provide for response to accidents to achieve a safe condition;

6 providing means to monitor accident releases as required for emergency response (see NE O 151.1,

Comprehensive Emergency Management System, for detailed requirements); and

7 establishing emergency plans for minimizing the effects of an accident (see NE O 151.1 for detailed requirements).

(3) Hazard category 1, 2, and 3 nuclear facilities with uncontained radioactive materials (as opposed to materials determined by safety analyses to be adequately contained within qualified drums, grout, or vitrified materials) must have the means to confine the uncontained radioactive materials to minimize their potential release in facility effluents during normal operations and during and following accidents, up to and including DBAs. Confinement design must include the following:

(a) For a specific nuclear facility, the number, arrangement, and characteristics of confinement barriers as determined on a case-by case basis.

(b) The type, quantity, form, and conditions for dispersing the radioactive material in the confinement system design.

(c) An active confinement ventilation system as the preferred design approach for nuclear facilities with potential for radiological release.[4] Alternate confinement approaches may be acceptable if a technical evaluation demonstrates either that the alternate confinement approach results in very high assurance of the confinement of radioactive materials or that an active confinement system provides no benefits.

Guidance for confinement ventilation systems and evaluation of the alternatives is provided in DOE Guide (G) 420.1-1A, *Nonreactor Nuclear Safety Design Guide for Use with DOE O 420.1, Facility Safety*.

[4] The safety classification (if any) of the ventilation system is determined by the facility DSA.

(4) Hazard category 1, 2, and 3 nuclear facilities must be designed to:

(a) facilitate safe deactivation, decommissioning, decontamination, and demolition at the end of facility life, including incorporation of design considerations during the operational period that facilitate future decontamination and decommissioning;

(b) facilitate inspections, testing, maintenance, repair, and replacement of safety SSCs as part of a reliability, maintainability, and availability program with the objective of maintaining the facility in a safe state;

(c) keep occupational radiation exposures within regulatory limits and

(d) provide hazard controls for prevention and mitigation of hazardous material releases and for defense in depth.

(5) Facility process systems must be designed to minimize waste production and mixing of radioactive and non-radioactive wastes.

(6) Safety SSCs and safety software must be designed to perform their safety functions when called upon.

(7) Active safety class systems must be designed to meet single failure[5] criterion.

(8) Facility design must also be integrated with other design requirements, as applicable, including applicable building codes and proposed standards.

[5] IEEE 379-2014, *IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems*, provides a definition of the single failure criterion. ANS 58.9-2002 (R2009), *Single Failure Criteria for Light Water Reactor Safety-Related Fluid Systems*, provides additional guidance for single failure criteria for mechanical systems.

ATTACHMENT 2, CHAPTER II.
FIRE PROTECTION

1. OBJECTIVE. To establish requirements for comprehensive fire protection programs for DOE facilities and emergency response organizations to:

   a. Minimize the likelihood of occurrence of a fire-related event;

   b. Minimize the consequence of a fire-related event affecting the public, workers, environment, property and missions.

2. APPLICABILITY. This chapter applies to organizations that have responsibility for the design, construction, maintenance, or operation of government-owned or government-leased facilities and contractor-owned or contractor-leased facilities used for DOE mission purposes and associated facilities authorized by DOE.

3. REQUIREMENTS.

   a. General Fire Protection Program Requirements.

      (a) Codes and Standards. The codes and standards determined to be applicable, including DOE technical standards, the building code, National Fire Protection Association (NFPA) codes and standards, and other industry codes and standards, must be identified in the fire protection and emergency response programs. Facilities, and major modifications thereto, must be constructed to meet applicable codes and standards that are in effect when design criteria are approved (otherwise known as the Code of Record, or COR).

      (b) Provisions of subsequent editions of codes or standards (promulgated after the COR is established) are mandatory only to the extent that they are explicitly stated to be applicable to existing facilities.

      (c) Conflicts between NE O 420.1; NFPA codes and standards; and the applicable building code must be resolved as follows:

         1 Requirements of NE O 420.1 take precedence over all NFPA and building code requirements and are subject to the relief requirements of NE O 420.1.

         2 Conflicts between NFPA requirements and the applicable building code requirements are resolved by the DOE Head of Field Element/Safety Basis Approval Authority (for a hazard category 1, 2, or 3 facility)

   b. Fire Protection Program Administration.

(1) Documentation. A documented fire protection program that includes the elements and requirements identified in this chapter for design; operations; emergency response; fire analysis and assessments; wildland fire; and specific fire protection program criteria must be developed, implemented, and maintained by the contractor. Contractor must submit this documented fire protection program to the DOE Head of Field Element/Safety Basis Approval Authority (for a hazard category 1, 2, or 3 facility) for review.

(2) Fire Protection Methods. Fire Protection Programs must describe the methods used to implement the requirements of this chapter. DOE-STD-1066-2023 is the applicable standard for use at DOE facilities.

c. Design.

(1) Design Process. The facility design process shall ensure that fire protection program requirements are documented and incorporated into plans and specifications for design of new facilities and modifications to existing facilities.

(2) Protection Thresholds.[6]

(a) New facilities (non-relocatable) housing safety SSCs must be of Type I or Type II construction, as defined in the applicable building codes.

(b) Automatic fire suppression systems must be provided throughout facilities in which any of the following conditions exist, evaluation of the suppression need should follow this hierarchy:

1 where required by safety basis document (for example, to prevent loss of safety functions or provide defense-in-depth);

2 as determined by the fire hazards analysis;

3 significant life safety hazards (as per building code);

4 Where automatic fire suppression systems may mitigate unacceptable mission or program interruption ;

(c) For property protection, multiple fire protection approaches, such as a fire suppression system and a fire detection and alarm system, must be provided in areas where the MPFL to a DOE owned or leased facility exceeds $300 million (in 2025 dollars) (refer to DOE-STD-1066-2023).

(d) For property protection, fire areas must be established such that the MPFL to a DOE owned or leased facility for each fire area does not exceed $412 million (in 2025 dollars). Fire walls or other separation approaches may be used to meet this requirement.

[6] Some of the requirements in this section on protection thresholds may not apply to portions of subterranean facilities that otherwise meet the requirements in Appendix D of DOE-STD-1066-2023.

(3) Fire Protection and Life Safety Systems.

(a) Fire Suppression. The inadvertent operation or failure of fire suppression systems must not result in the loss of vital safety functions of safety class or safety significant systems as determined by the DSA. (Note: This requirement addresses proper design of the fire suppression system to ensure it does not significantly impair safety capability and is not intended to drive need for redundancy in safety significant system design.)

(b) Fire Barriers. Complete fire-rated construction and barriers, commensurate with the applicable codes and/or safety basis requirements, must be provided to isolate hazardous areas and minimize fire spread and loss potential consistent with limits as established in this chapter. Fire barrier locations and construction must be documented.

(c) Fire Detection. Automatic fire detection must be provided to the extent required by applicable industry codes and standards.

(d) Life Safety. Requirements for life safety and means of egress are provided in codes and standards, such as the *International Building Code* (IBC), and NFPA 101, *Life Safety Code.*

(e) Water Supply and Distribution. A reliable and adequate water supply and distribution system must be provided for fire suppression, as documented through appropriate analysis.

(f) Emergency Notification. A means to notify responders and building occupants of a fire must be provided (e.g., fire alarm signaling system and/or site-wide mass notification capabilities for major incidents affecting the site).

(4) Special Hazards. Fire protection systems or features, and appropriate procedures to address fire and related hazards that are special or unique to DOE and not addressed by industry codes and standards, must be established.

d. Operations.

(1) Criteria and Procedures. Comprehensive, written fire protection criteria and procedures must be established to implement the fire protection program requirements that include:

(a) site-specific requirements;

(b) staff organization, resources, training, and roles and

responsibilities;

(c) inspection, testing, and maintenance of fire protection systems;

(d) use and storage of combustible, flammable, radioactive, and hazardous materials;

(e) a "hot-work" control program;

(f) identification and tracking of fire protection system impairments;

(g) fire prevention measures (e.g., reduced combustible loading, hot-work procedures, ignition source controls);

(h) facility and Fire Hazards Analysis (FHA) assessment programs;

(i) design and construction oversight; and

(j) equivalencies, exemptions, modifications, and variances processes.

(2) Implementation. To ensure effective implementation of these requirements, the following elements must be addressed.

(a) Staffing. The contractor must ensure it has access to qualified, trained fire protection staff (that includes fire protection engineers (FPEs), technicians, and firefighting personnel) needed to implement the requirements of this chapter.

(b) Design Review. Documented review of plans, specifications, procedures, and acceptance tests must be conducted by an FPE (Note: A definition for FPE is provided in DOE-STD-1066-2023). A process must be established to oversee fire protection-related activities from the initiation of design to final acceptance.

(c) Equivalencies and Exemptions. A process must be established for developing and requesting AHJ approval of fire protection equivalencies and exemptions to fire protection requirements. Records of technical justification must be maintained and reevaluated for appropriateness as activities or operations change.

(d) Assigned Authority. If assigned, the contractor must document the level of authority to execute the duties and responsibilities of the AHJ, in accordance with the contractor's overall fire protection and emergency response programs.

e. Emergency Response. Provide emergency response capabilities, as necessary, to meet site needs as established by the BNA, safety basis requirements, and applicable regulations, codes and standards.

(1) Baseline Needs Assessment. A BNA of the fire protection and emergency response organization must be conducted, and the BNA must:

(a) establish capabilities to provide:

1 effective response to extinguish fires;

2 emergency medical, rescue and hazardous materials response; and

3 staffing, apparatus, facilities, equipment, training, pre-incident plans, mutual aid, and procedures.

(b) reflect applicable requirements of NFPA codes and standards, and DOE direction;

(c) be submitted to the DOE Head of Field Element/Safety Basis Approval Authority (for a hazard category 1, 2, or 3 facility) for review;

(d) be reviewed at least every three years, or whenever a significant new hazard that is not covered by the current BNA is introduced, and be updated as appropriate (Note: If no update is necessary, this result must be documented following the review) and submitted to the DOE Head of Field Element/Safety Basis Approval Authority (for a hazard category 1, 2, or 3 facility) for review; and,

(e) be incorporated into site emergency plans, FHAs, and safety basis documentation.

(2) Pre-Incident Plans. Pre-incident strategies, plans, and standard operating procedures must be established to enhance the effectiveness of manual fire suppression activities, including areas within or adjacent to, moderator-controlled areas. The criticality safety staff must review pre-incident plans and procedures related to moderator-controlled areas.

(3) Manual Fire Suppression Activities.

(a) Physical access and appropriate equipment that is accessible for effective manual firefighting intervention must be provided.

(b) Procedures governing the use of fire-fighting water or other neutron moderating materials to suppress fire within, or adjacent to, moderation controlled areas must be established and reviewed by a criticality subject matter expert prior to release.

(c) Procedures governing firefighting techniques to be used during deactivation, decontamination, and demolition phases must be established, when applicable.

(d) Where no alternative exists to criticality safety restrictions on the use of water for fire suppression, the need for such restrictions must be fully documented with written technical justification.

f. Fire Hazard Analyses and Facility Assessments.

(1) Fire Hazards Analyses. FHAs, using a graded approach, must be conducted for the following cases:

(a) all hazard category 1, 2, and 3 nuclear facilities and major modifications thereto;

(b) facilities that represent unique fire safety risks;

(c) new facilities or modifications to existing facilities with value greater than $300 million (in 2025 dollars).

(d) The FHAs must be:

1 performed under the direction of an FPE;

2 reviewed every three years by an FPE and revised as appropriate (Note: If no revision is necessary, this result must be documented following the review);

3 revised when−

a changes to the facility structure or layout, processes, occupancy, safety basis documentation, or BNA impacts the analysis in the FHA;

b a modification to an associated facility or process adds a significant new fire safety risk; or,

c the periodic (three-year) review identifies the need for changes; and

d integrated into safety basis documentation.

(2) Facility Assessments. Fire protection assessments must be conducted for DOE -owned and -leased facilities:

(a) annually, or at a frequency with appropriate justification approved by the DOE Head of Field Element/Safety Basis Approval Authority (for a hazard category 1, 2, or 3 facility), for facilities with a replacement value in excess of $300 million (in 2025 dollars), nuclear reactor facilities, or those facilities in which vital programs are involved, as defined by the responsible DOE authority; and,

(b) at least every three years, or at a frequency with appropriate justification approved by the DOE Head of Field Element/Safety Basis Approval Authority (for a hazard category 1, 2, or 3 facility), for all remaining facilities with a replacement value in excess of $15 million (in 2025 dollars).

g. Wildland Fire. For facilities on federal land, an integrated site-wide wildland fire management plan, consistent with the *Federal Wildland Fire Management Policy*, must be developed, provided to DOE Head of Field Element/Safety Basis Approval Authority (for a hazard category 1, 2, or 3 facility) for review, and implemented in accordance with the relevant portions of the NFPA 1140, *Standard for Wildland Fire Protection*.

ATTACHMENT 2, CHAPTER III.
NUCLEAR CRITICALITY SAFETY

1. OBJECTIVE. To establish requirements for developing and implementing nuclear criticality safety programs (CSPs) for nuclear facilities and activities, including materials transportation activities, which provides reasonable expectation of adequate protection to the public, workers, and the environment.

2. APPLICABILITY. This chapter is applicable to DOE elements and DOE contractors with responsibility for nuclear facilities and activities that involve or will potentially involve radionuclides in such quantities that are equal to or greater than the single parameter limits for fissionable materials listed in ANSI/ANS-8.1-2014, *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors*, and ANSI/ANS-8.15-2014, *Nuclear Criticality Safety Control of Selected Actinide Nuclides*. These limits must be adjusted where process conditions could credibly involve moderators or reflectors that are more effective than light water.

3. REQUIREMENTS.

   a. A CSP document must be developed and maintained that describes how the contractor will implement the requirements and standards in this chapter. The CSP, DSA, or SDS must describe nonreactor nuclear facility activities (e.g. fissile material storage and handling) within the scope of the CSP, and reactor activities excluded from the CSP, as applicable.

   b. The CSP document must describe how the contractor will satisfy the requirements of the ANSI/ANS-8 series of nuclear criticality safety standards in effect as of the issuance of DOE Order 420.1C, Chg. 3 (November 2019), unless otherwise modified and approved by the Safety Basis Approval Authority.

   c. The CSP document must be submitted to the DOE Safety Basis Approval Authority. The CSP may be submitted in the DSA.

   d. Criticality safety evaluations must be conducted in accordance with DOE-STD-3007-2017, *Preparing Criticality Safety Evaluations at DOE Nonreactor Nuclear Facilities*, or by other documented methods approved by the DOE Safety Basis Approval Authority.

   e. Fissile Material Accumulation Control. Facilities that conduct operations using fissionable material in a form that could inadvertently accumulate in significant quantities must include procedures for detecting and characterizing accumulations. The following national standards provide relevant guidance for procedure development: ASTM C1455-14e1, *Standard Test Method for Nondestructive Assay of Special Nuclear Material Holdup Using Gamma-Ray Spectroscopic Methods*, and any other nondestructive assay consensus or DOE standards applicable to the measurement technique selected.

f. Criticality safety evaluations must show that entire processes involving fissionable materials will remain subcritical under normal and credible abnormal conditions.

g. The criteria and process for developing the guidelines for firefighting in areas within or adjacent to moderator-controlled areas must be coordinated with firefighting pre-incident plans and procedures.

ATTACHMENT 2, CHAPTER IV.
NATURAL PHENOMENA HAZARDS MITIGATION

1. OBJECTIVE. To establish requirements for facility design, construction, and operations to protect the public, workers, and the environment from the impact of natural phenomena hazards (NPH) events (e.g., earthquake, wind, flood, lightning, snow, and volcanic eruption).

2. APPLICABILITY. Requirements in this chapter apply to nuclear and nonnuclear facilities and sites. Design requirements (Sections 3.a, 3.b, and 3.c, below) apply to new facilities, major modifications, and modifications that may be warranted based on periodic NPH assessment and upgrade requirements. For contractors' leased facilities that are not nuclear hazard category 1, 2, or 3 facilities, the requirements of this chapter apply to the extent determined by the DOE Head of Field Element.

3. REQUIREMENTS.

   a. General. Facilities must be designed, constructed, maintained, and operated to ensure that SSCs will be able to perform their intended safety functions effectively under the combined effects of NPH and normal loads defined in the applicable building codes contained in facilities' CORs. Nuclear facility safety functions that the SSCs must perform during and after an NPH event must be defined in the facility's safety basis documentation. Safety functions include:

      (1) confinement/containment of hazardous materials;

      (2) protection of occupants and co-located workers of the facility and the public;

      (3) continued operation of essential facilities and equipment;

      (4) safe shutdown of hazardous facilities and equipment; and

      (5) maintenance of personnel access to areas needed for responding to accidents during NPH events.

   b. NPH Design Criteria. The design of new facilities and major modifications must be developed in accordance with the applicable requirements and criteria contained in NE-STD-1020-2025, Chg. 1, *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities*. (Note: Requirements for non-nuclear facilities are described in Section 2.2 of NE-STD-1020-2025, Chg. 1.)

      Exception: SDC-3 SSC may be designed, including site characterization and probabilistic seismic hazard analysis, per the NE-STD-1020-2025, Chg. 1, rules for SDC 2 SSC except with use of an importance factor I=2.0. Alternatively, they may be designed per NE-STD-1020-2025, Chg. 1.

c. NPH Accident Analysis. The NPH analysis supporting design and construction of facilities and safety SSCs must be documented and include evaluation of:

(1) potential damage to and failure of safety SSCs resulting from both direct and indirect NPH events; and,

(2) common cause/effect and interactions resulting from failures of other nearby facilities or other SSCs in the same facility caused by or induced by an NPH event.

d. Review and Upgrade Requirements for Existing DOE Nuclear Facilities (Hazard Category 1, 2, and 3).

(1) Existing facility or site NPH assessments must be reviewed at least once every 20 years and whenever significant changes in NPH data, criteria, and assessment methods warrant updating the assessments. Section 9.2 of NE-STD-1020-2025, Chg. 1, contains criteria and guidance for performing these reviews. The review results, along with any recommended updated actions, must be submitted to the DOE Head of Field Element for approval. If no update is necessary, this result must be documented following the review.

(2) As a modification to the procedure in NE-STD-1020-2025, Chg. 1, if the mean hazard of an updated NPH assessment is within one standard deviation of the mean hazard of the NPH assessment of record, then no further evaluation is required.

(3) If a new assessment of NPH indicates deficiencies in existing SSC design, a plan for upgrades must be developed and implemented on a prioritized schedule, based on the safety significance of the upgrades, time or funding constraints, and mission requirements. The upgrade plans must also be submitted to the Safety Basis Approval Authority for approval. Sections 9.3 and 9.4 of NE-STD-1020-2025, Chg. 1, contain guidance on performing upgrade evaluations.

e. Seismic Detection. Sites with nuclear or hazardous materials must have instrumentation or other means to detect and record the occurrence and severity of seismic events.

f. Post-Natural Phenomena Procedures. Facilities or sites with hazardous materials must have procedures for responding to damage from severe NPH events and placing a facility into a safe configuration when damage has occurred.

ATTACHMENT 2, CHAPTER V.
CONFIGURATION MANAGEMENT PROGRAM

1. OBJECTIVE. To establish requirements for a configuration management program for hazard category 1, 2, and 3 nuclear facilities.

2. APPLICABILITY. Requirements of this chapter apply to all hazard category 1, 2, and 3 nuclear facilities .:

3. REQUIREMENTS.

Configuration Management.

(1) A documented configuration management program must be established and implemented that ensures consistency among system requirements and performance criteria, system documentation, and physical configuration of the systems within the scope of the program. DOE-STD-1073-2016, Configuration Management, describes an acceptable methodology for establishing configuration management programs. The configuration management program must address:

(a) system design documentation;

(b) system assessments;

(c) control of maintenance;

(d) change control; and

(e) aging degradation and technical obsolescence.

(2) System design documents and supporting documents must be identified and kept current using formal change control and work control processes. DOE-STD-3024-2011, *Content of System Design Descriptions*, describes a methodology to achieve this function. Design documentation must include:

(a) system requirements and performance criteria essential to performance of the system's safety functions;

(b) the basis for system requirements; and

(c) a description of how the current system configuration satisfies the requirements and performance criteria.

(3) System assessments must include periodic reviews of system operability, reliability, and material condition. Reviews must assess the system for:

(a) the ability to perform design and safety functions;

(b) physical configuration as compared to system documentation; and

(c) system and component performance in comparison to established performance criteria.

(4) System maintenance and repair and modification must be controlled through a formal change control process to ensure that changes are not inadvertently introduced and that required system performance is not compromised. Post maintenance or modification testing must be conducted to confirm continued capability to fulfill system requirements.

ATTACHMENT 3
DESIGN CRITERIA FOR SAFETY STRUCTURES, SYSTEMS, AND COMPONENTS

This attachment provides requirements for the design and construction of safety structures, systems, and components (SSCs).

1. OBJECTIVE. To establish requirements for the design and construction of safety SSCs, both safety class and safety significant, by identifying an applicable set of industry codes and standards, as well as Department of Energy (DOE) design criteria, standards, and directives. Compliance with these requirements will ensure reliable performance of the safety function of safety SSCs under those conditions and events for which they are intended.

2. APPLICABILITY.

   a. This attachment applies to the design and construction of:

      (1) new hazard category 1, 2, and 3 nuclear facilities as defined by 10 CFR Part 830, *Nuclear Safety Management*; and

      (2) major modifications to hazard category 1, 2, and 3 nuclear facilities, as defined in 10 CFR Part 830, that substantially change the facility safety basis.

   b. This attachment does not impose requirements on existing facilities, except for major modifications to those facilities. The requirements of this attachment may be used to develop comparisons of existing facilities to the requirements for new facilities.

   c. This attachment does not apply to nuclear deactivation or decontamination and decommissioning activities at end-of-facility-life, if the safety analysis demonstrates that adequate protection is provided consistent with the requirements of 10 CFR Part 830 through alternate means and it is not cost-beneficial to apply the provisions of this attachment for the limited remaining life of the activity.

3. REQUIREMENTS. Safety SSCs must be designed, commensurate with the importance of the safety functions performed, to perform their safety functions when called upon, as determined by the safety analysis.

   a. General Design Criteria.

      (1) Conservative Design Margin. Safety SSCs must be designed with appropriate margins of safety, as defined in applicable DOE or industry codes and standards.

(2) System Reliability.

(a) The single failure criterion, requirements, and design analysis identified in Institute of Electrical and Electronics Engineers (IEEE) 379-2014, *IEEE Standard for Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems*, must be applied to safety class SSCs during the design process as the primary method of achieving reliability, unless another applicable standard is approved by DOE in accordance with the process for obtaining DOE review and approval of the applicability of codes and standards. ANSI/ANS 58.9-2002 (R2015), *Single Failure Criteria for LWR Safety-Related Fluid Systems*, may be used in defining the scope of active safety class mechanical SSCs.

(b) Safety significant SSCs must be designed to reliably perform all their safety functions. This can be achieved through a number of means, including use of redundant systems/components, increased testing frequency, high reliability components, and diagnostic coverage (e.g., on-line testing; monitoring of component and system performance; and monitoring of various failure modes). DOE-STD-1195-2011, *Design of Safety Significant Safety Instrumented Systems Used at DOE Nonreactor Nuclear Facilities*, provides an acceptable method for achieving high reliability of safety significant safety instrumented systems.

(3) Environmental Qualification.

(a) Safety class SSCs must be designed to perform all safety functions with no failure mechanism that could lead to common cause failures under postulated service conditions. The requirements of IEEE 323-2003 (R2008), *IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations,* must be used to ensure environmental qualifications of safety class SSCs, unless another applicable standard is approved by the Safety Basis Approval Authority .

(b) Safety significant SSCs located in a harsh environment must be evaluated to establish qualified life. This may be accomplished using manufacturers' recommendations or other appropriate methods.

(4) Safe Failure Modes. The facility design must provide reliable safe conditions and sufficient confinement of hazardous material during and after all DBAs. At both the facility- and SSC-level, the design must ensure that most probable modes of failure (e.g., failure to open versus failure to close) will increase the likelihood of a safe condition.

(5) Support System and Interface Design.

(a) Support SSCs must be designed as safety class or safety significant SSCs if their failures prevent safety SSCs or specific administrative controls (SACs) from performing their safety functions.

(b) Interfaces—such as pressure retention boundaries, electrical supply, instrumentation, cooling water, and other support systems—may exist between safety SSCs and non-safety SSCs. These interfaces must be evaluated to identify SSC failures that would prevent safety SSCs from performing their intended safety function. IEEE 384-2008, *IEEE Standard Criteria for Independence of Class IE Equipment and Circuits*, must be used for physical and electrical separation methods, including the use of separation distance, barriers, electrical isolation devices, or any combination thereof, unless another applicable standard is approved by DOE. This application includes a design to ensure that both direct and indirect impacts of DBAs (e.g., fire, seismic) will not cause failure of safety functions.

(6) Protection Against Fire. Safety class systems must be designed with redundancy or other means, such that safety function is maintained for any postulated fire events that credit the safety class systems.

(7) Quality Assurance. A quality assurance program must be established that satisfies 10 CFR Part 830, Subpart A, "Quality Assurance Requirements," early in the project, such that safety SSCs and their associated support systems are designed, procured, fabricated, erected, and tested to standards and quality requirements commensurate with their importance to safety.

b. Specific Design Criteria and Use of National Codes and Standards. The selection and use of an appropriate set of applicable codes and standards establishes design criteria to provide assurance that the SSCs are designed to reliably perform their intended functions. The DOE technical standards and industry codes and standards identified below, which are widely used for nuclear facility design and construction, must be evaluated for applicability.

DOE technical standards and applicable codes and standards are considered necessary when they provide relevant design requirements for the safety SSCs that are being designed and are agreed upon in the COR (i.e., they provide design requirements that are needed to ensure that desired SSC functions are achieved, and these requirements are appropriate for the design materials, configuration, and service conditions).

Further, the use of specific codes and standards may be directed by the DOE Safety Basis Approval Authority. (Note: The stated applicability of industry codes and

standards (e.g., for nuclear reactors) should not be used to narrowly interpret relevancy for SSC design.)

Before using these codes and standards, their application to specific DOE design(s) must be reviewed. Once a code or standard is identified as applicable, the applicable requirements (i.e., mandatory statements) must be applied in the design unless an equivalent approach is documented in the COR and approved by the Safety Basis Approval Authority.

The Nuclear Safety Design Agreement or the Preliminary Documented Safety Analysis developed in accordance with DOE-STD-1271-2025 may be used to specify provisions for relief (exemptions and equivalencies) from identified, applicable design and construction codes and standards. The set of codes and standards identified below is not meant to be all-inclusive. It is expected that design of SSCs will require selection of additional codes and standards beyond those identified below. For example, unique design features, detailed design considerations, and release of advancements may drive selection of additional codes and standards. Facility designers must identify the complete set of codes and standards necessary to meet the general design criteria identified above (see also Attachment 4 of NE O 420.1 for additional codes and standards).

(1) Structural. Table 1 provides relevant codes and standards. Attachment 2, Chapter IV of NE O 420.1 provides additional natural phenomena hazards (NPH) design requirements.

Table 1: Codes for Safety Significant and Safety Class Structures

Structures	Safety Significant	Safety Class
Concrete	ACI-318; ACI-349	ACI-349
Steel	ANSI/AISC 360; AISC 325; ANSI/AISC N690	ANSI/AISC N690

Note: See NE-STD-1020-2025, Chg. 1, *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities*, for further discussion on selection and use of codes for structural design of SSCs.

(2) Mechanical and Process Equipment. Table 2 provides relevant codes and standards.

Table 2: Codes for Safety Significant and Safety Class Process Equipment

Process Equipment	Safety Significant	Safety Class
Reactor Vessel and Internal Support	**ASME BPVC, Section III**	**ASME BPVC, Section III**

Structures		
Pressure vessels	ASME BPVC, Section VIII, Division 1 or 2	ASME BPVC, Section VIII, Division 1 or 2
Tanks (0-15 psig)	API-620; ASME BPVC Section VIII, Division 1 or 2	API-620; ASME BPVC, Section VIII, Division 1 or 2
Tanks (containing flammable liquids)	API-620; API-650; Applicable NFPA codes and standards	API-620; API-650; Applicable NFPA codes and standards
Tanks (atmospheric pressure)	API-650; AWWA D100	API-650; AWWA D100
Pumps	ASME B73.1, B73.2; ASME BPVC, Section VIII; AWWA D100; Hydraulic Institute Standards, as applicable	ASME B73.1, B73.2; ASME BPVC, Section VIII; AWWA D100; Hydraulic Institute Standards, as applicable
Piping	ASME B31.3	ASME B31.3
Valves	ASME B16.5; B31.3; ANSI N278.1	ASME B16.5; B31.3; ANSI N278.1
Heat Exchangers	ASHRAE Handbook; ASME BPVC, Section VIII, Division 1; TEMA B, C, or R	ASHRAE Handbook; ASME BPVC, Section VIII, Division 1; TEMA B, C, or R
Gloveboxes	ASTM C852; AGS-G006	ASTM C852; AGS-G006

(3) Ventilation. Table 3 provides relevant codes and standards.

Appendix A of DOE Guide (G) 420.1-1A, *Nonreactor Nuclear Safety Design Criteria for use with DOE O 420.1, Facility Safety*, and DOE-HDBK-1169-2003, *Nuclear Air Cleaning Handbook*, provide guidance for confinement ventilation systems design and performance criteria. Alternate methods must be approved by DOE Heads of Field Element.

Table 3: Codes for Safety Significant and Safety Class Ventilation System Components

Ventilation	**Safety Significant**	**Safety Class**

Ducts	ASME AG-1	ASME AG-1
Fans	ASHRAE Handbook; ASME AG-1	ASHRAE Handbook; ASME AG-1
Filtration	ASME AG-1; DOE-STD-3020-2015	ASME AG-1; DOE-STD-3020-2015
Balance of system for confinement ventilation	ASME AG-1	ASME AG-1
Off-gas treatment	ASME AG-1	ASME AG-1

(4) Mechanical Handling Equipment. Table 4 provides relevant codes and standards.

Table 4: Codes for Safety Significant and Safety Class Handling Equipment

Handling Equipment	Safety Significant	Safety Class
Cranes	Applicable CMAA standards; ASME NOG-1; ASME NUM-1; ASME B30.2; DOE-STD-1090-2011	Applicable CMAA standards; ASME NOG-1; ASME NUM-1; ASME B30.2; DOE-STD-1090-2011
Other equipment	ASME B30 Series: DOE-STD-1090-2011	ASME B30 Series; DOE-STD-1090-2011

(5) Electrical. Tables 5 and 6 provide relevant codes and standards.

Note: ANSI/IEEE standards, below, define requirements for the manufacturing, installation, and testing of commercial reactor Safety-Class 1E electrical systems and components. While these requirements may not be directly applicable to nonreactor nuclear facilities, these standards contain useful and significant information that should be considered.

Table 5: Codes for Safety Significant and Safety Class Electrical Systems

Electrical	Safety Significant	Safety Class
Hardware	Applicable NFPA codes and standards; IES HB-10; IEEE C2, C37; IEEE-80, -141, -142, -242, -399, -446, 493, -577	Applicable NFPA codes and standards; IES HB-10; IEEE C2, C37; IEEE-80, -141, -142, -242, -308, -338, -379, -384, -399, -493, -577

Table 6: IEEE Standards used for Both Safety Significant and Safety Class Electrical Systems, as appropriate

Electrical	Safety Significant and Safety Class
Guidance standards for use as applicable for specific hardware	IEEE-323, -334, -336, -344, -352, -379, -382, -383, -387, -420, -450, -484, -493, -535, -603, -627, -628, -649, -650, -833, -946

(6) Instrumentation, Control, and Alarm Systems. The design of safety class instrumentation and control systems must incorporate sufficient independence, redundancy, diversity, and separation to ensure that all safety-related functions associated with such equipment can be performed. Safety significant components must be evaluated as to the need for redundancy on a case-by-case basis. DOE-STD-1195-2011 provides an acceptable method for achieving high reliability of safety significant safety instrumented systems.

Table 7 provides relevant codes and standards. The codes and standards for electrical systems (in Tables 5 and 6) may also be applicable to design of instrumentation and control systems and need to be evaluated in this context.

Table 7: Codes for Safety Significant and Safety Class Instrumentation, Control, and Alarm Components.

Instruments, Controls, and Alarms	Safety Significant	Safety Class
Hardware	Applicable NFPA codes and standards; ANSI/ANS-8.3, -58.8, -N13.1, -N323D; ANSI/ISA-Series including ISA 67.04.01 and ISA TR 84.00.06; IEEE-C2, -N42.18, -1023, -1050; -7-4.3.2; and DOE-STD-1195-2011	Applicable NFPA codes and standards; ANSI/ANS-8.3, 58.8, -N13.1, ANSI-N323D; ANSI/ISA-Series including ISA 67.04.01 and ISA TR 84.00.06; IEEE-C2, -N42.18, -603, -1023, -1050, -7-4.3.2

(7) Fire Protection Systems. DOE-STD-1066-2023, *Fire Protection*, provides acceptable methods for the design of fire protection systems. Design requirements for safety class and safety significant fire barriers, water supplies, and wet pipe sprinkler systems are provided in Appendix A of DOE-STD-1066-2023. Fire protection system designs are also required to

address the applicable design requirements for similar safety systems provided in this attachment.

c. Nuclear Reactor Safety Design Criteria. Nuclear reactors are an important class of DOE facilities that require special attention to design criteria and standards to ensure safe design and operations.

(1) The Code of Record for existing DOE nuclear reactors has been established by their designs. When a major modification is made to an existing reactor, the existing Code of Record is the starting point for the design of the major modification.

(2) For any new DOE nuclear reactor, a set of reactor design codes and standards must be established in accordance with the Nuclear Safety Design Agreement required by DOE-STD-1271-2025, existing industry codes and standards should be used to the extent possible.

ATTACHMENT 4
REFERENCES AND ACRONYMS

1. REFERENCES. The following reference documents and information sources are cited to assist in implementing this Order. This attachment does not provide a complete listing of industry codes and standards that may be needed.

   a. Public Law (Pub. L.).

      (1) Pub. L. 83-703, *Atomic Energy Act of 1954*, as amended.

      (2) Pub. L. 94-580, *Resource Conservation and Recovery Act of 1976* (RCRA), as amended.

      (3) Pub. L. 106-65, *National Defense Authorization Act for Fiscal Year 2000*, as amended.

   b. Executive Orders (E.O.) and Federal Policies.

      (1) E.O. 12344, Naval Nuclear Propulsion Program, 02-01-1982.

      (2) Federal Wildland Fire Management Policy, National Interagency Fire Center, 1995 (R 2001).

      (3) Secretarial Delegation Order Number 00-033.00C, 08-12-2016.

   c. Code of Federal Regulations (CFR).

      (1) 10 CFR Part 830, Nuclear Safety Management.

      (2) 10 CFR Part 835, Occupational Radiation Protection.

      (3) 10 CFR Part 851, Worker Safety and Health Program.

      (4) 29 CFR Part 1910, Occupational Safety and Health Standards.

      (5) 29 CFR Part 1926, Safety and Health Regulations for Construction.

      (6) 48 CFR Part 970, Section 970.5223-1, “Integration of Environment, Safety, and Health into Work Planning and Execution.”

   d. DOE Directives.

      (1) DOE P 420.1, *Department of Energy Nuclear Safety Policy*, 02-08-11.

      (2) NE O 151.1, *Comprehensive Emergency Management System*, 8-11-16.

(3) NE O 226.1, *Implementation of Department of Energy Oversight Policy*.

(4) NE O 227.1, *Independent Oversight Program*.

(5) NE O 414.1 *Quality Assurance*.

(6) DOE O 420.2C, *Safety of Accelerator Facilities*, 07-21-11.

(7) NE O 426.2, *Personnel Selection, Training*, *Qualification, and Certification Requirements for DOE Nuclear Facilities*.

(8) NE O 433.1, *Maintenance Management Program for DOE Nuclear Facilities*.

(9) NE O 435.1 , *Radioactive Waste Management*.

(10) DOE G 414.1-2B Chg. 2, Quality Assurance Program Guide, 05-08-13.

(11) DOE G 414.1-4, *Safety Software Guide for use with 10 CFR 830 Subpart A, Quality Assurance Requirements, and DOE O 414.1C, Quality Assurance*, 11-03-10.

(12) DOE G 420.1-1A, *Nonreactor Nuclear Safety Design Criteria for Use with DOE O 420.1, Facility Safety*, 12-04-12.

e. DOE Technical Standards (STDs).

(1) NE-STD-1020-2025, Chg. 1, *Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities*.

(2) NE-STD-1027-2025, *Hazard Categorization of DOE Nuclear Facilities*.

(3) DOE-STD-1066-2023, *Fire Protection*.

(4) DOE-STD-1073-2016, *Configuration Management*.

(5) DOE-STD-1090-2011, *Hoisting and Rigging*. (Formerly Hoisting and Rigging Manual).

(6) DOE-STD-1098-2008, *Radiological Control*.

(7) DOE-STD-1104-2016, *Review and Approval of Nuclear Facility Safety Basis and Safety Design Basis Documents*.

(8) DOE-STD-1128-2013, *Guide of Good Practices for Occupational Radiological Protection in Plutonium Facilities*.

(9) DOE-STD-1158-2010, *Self-Assessment Standard for DOE Contractor Criticality Safety Programs*.

(10) DOE-STD-1186-2016, *Specific Administrative Controls.*

(11) DOE-STD-1195-2011, *Design of Safety Significant Safety Instrumented Systems Used at DOE Nonreactor Nuclear Facilities*.

(12) DOE-STD-1212-2012, *Explosives Safety*.

(13) DOE-STD-1271-2025, *Authorization Pathway for Nuclear Facilities.*

(14) DOE-STD-1628-2013, *Development of Probabilistic Risk Assessments for Nuclear Safety Applications*.

(15) DOE-STD-3007-2017, *Preparing Criticality Safety Evaluations at DOE Nonreactor Nuclear Facilities*.

(16) DOE-STD-3009-94, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented Safety Analyses*, Chg. Notice 3, March 2006.

(17) DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*.

(18) DOE-STD-3020-2015, *Specifications for HEPA Filters Used by DOE Contractors.*

(19) DOE-STD-3024-2011, *Content of System Design Descriptions.*

f. DOE Handbooks (HDBKs).

(1) DOE-HDBK-1132-1999, *Design Considerations*.

(2) DOE-HDBK-1163-2003, *Integration of Multiple Hazard Analysis Requirements and Activities.*

(3) DOE-HDBK-1169-2003, *Nuclear Air Cleaning Handbook.*

g. Department of Defense.

MIL-STD-1472F, *Department of Defense Design Criteria Standard: Human Engineering*, August 1999.

h. American Concrete Institute (ACI).

ACI 349-06, Code *Requirements for Nuclear Safety-Related Concrete Structures (ACI 349-06) and Commentary*, 2006.

i. American Conference of Governmental Industrial Hygienists (ACGIH).

ACGIH 2096, *Industrial Ventilation: A Manual of Recommended Practices for Design*, January 2010.

j. American Glovebox Society (AGS).

AGS-G006-2005, *Standard of Practice for the Design and Fabrication of Nuclear Application Gloveboxes*, 2005.

k. American National Standards Institute (ANSI).

(1) ANSI N13.1-2011, *Guide to Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities*, 2011.

(2) ANSI N43.2-2001 (R2010), *Radiation Safety for X-ray Diffraction and Fluorescence Analysis Equipment*, 2001.

(3) ANSI N278.1-1975 (R1992), *Self-Operated and Power-Operated Safety-Related Valves Functional Specification Standard*, 1975.

(4) ANSI N323D-2002, *American National Standard for Installed Radiation Protection Instrumentation*, 2002.

(5) ANSI/AIHA Z9.2-2012, *Fundamentals Governing the Design and Operation of Local Exhaust Ventilation Systems*, 2012.

(6) ANSI Z358.1-2009, *American National Standard for Emergency Eyewash and Shower Equipment,* 2009.

l. American National Standards Institute/American Institute of Steel Construction (AISC).

(1) AISC 325:2011, *Steel Construction Manual*, 2011.

(2) ANSI/AISC 360:10, *Specification for Structural Steel Buildings*, 2010.

(3) ANSI/AISC N690-12, *Specification for Safety-Related Steel Structures for Nuclear Facilities*, 2012.

m. American National Standards Institute/American Nuclear Society (ANS).

(1) ANSI/ANS-1-2000 (R2007) (R2012), *Conduct of Critical Experiments*, 2000.

(2) ANSI/ANS-6.4.2-2006, *Specification for Radiation Shielding Materials*, 2006.

(3) ANSI/ANS-8 Series Standards.

(4) ANSI/ANS-8.1-2014 (R2018), *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors*, 2014.

(5) ANSI/ANS-8.3-1997 (R2017), *Criticality Accident Alarm System*, 1997.

(6) ANSI/ANS-8.15-2014 (R2019), *Nuclear Criticality Safety Control of Selected Actinide Nuclides*, 2014.

(7) ANSI/ANS-14.1-2004 (R2009) (R2014), *Operation of Fast Pulse Reactors*, 2004.

(8) ANSI/ANS-58.8-1994 (R2001) (R2008), *Time Response Design Criteria for Safety-Related Operator Actions,* 1994.

(9) ANSI/ANS-58.9-2002 (R2015), *Single Failure Criteria for LWR Safety-Related Fluid Systems*, 1981.

n. American National Standards Institute/International Society of Automation (ISA).

(1) ANSI/ISA 7.0.01-1996, *Quality Standard for Instrument Air*, 1996.

(2) ANSI/ISA 18.1-1979 (R2004), *Annunciator Sequences and Specifications*, 1979.

(3) ANSI/ISA 67.01.01-2002 (R2007), *Transducer and Transmitter Installation for Nuclear Safety Applications*, 2002.

(4) ANSI/ISA S67.02.01-1999, *Nuclear-Safety-Related Instrument Sensing Line Piping and Tubing Standard for Use in Nuclear Power Plants*, 1999.

(5) ANSI/ISA 67.04.01-2006 (R2011), *Setpoints for Nuclear Safety-Related Instrumentation*, 2006.

o. American Petroleum Institute (API).

(1) API-620, *Design and Construction of Large, Welded, Low-Pressure Storage Tanks*, 2013.

(2) API-650, *Welded Tanks for Oil Storage*, 2013.

p. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).

(1) ASHRAE Handbook, *Fundamentals* (Inch-Pound Edition), 2013.

(2) ASHRAE Standard 62.1-2010, *Ventilation for Acceptable Indoor Air*

Quality, 2010.

q. American Society of Mechanical Engineers (ASME).

(1) ASME AG-1-2015, *Code on Nuclear Air and Gas Treatment*, 2015.

(2) ASME BPVC, *Boiler and Pressure Vessel Code*, 2015.

(3) ASME B16.5-2013, *Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard*, 2013.

(4) ASME B30.2-2011, *Overhead and Gantry Cranes (Top Running Bridge, Single or Multiple Girder*, Top Running Trolley Hoist), 2011.

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ACRONYMS.

AHJ	Authority Having Jurisdiction
ANS	American Nuclear Society
ANSI	American National Standards Institute
BNA	Baseline Needs Assessment
CD	Critical Decision
CFR	Code of Federal Regulations
COR	Code of Record
CRD	Contractor Requirements Document
CSE	Cognizant System Engineer
CSP	Criticality Safety Program
DBA	Design Basis Accident
DOE	Department of Energy
DSA	Documented Safety Analysis
FHA	Fire Hazards Analysis
FPE	Fire Protection Engineer
G	Guide
IBC	International Building Code
IEEE	Institute of Electrical and Electronics Engineers
M	Manual
MPFL	Maximum Possible Fire Loss
NFPA	National Fire Protection Association
NPH	Natural Phenomena Hazards
O	Order
P	Policy
SAC	Specific Administrative Controls
SSC	Structures, Systems, and Components
STD	Standard