SRR-RP-2009-00558-007

STANDARDS/REQUIREMENTS IDENTIFICATION DOCUMENT

FUNCTIONAL AREA 07.0

ENGINEERING PROGRAM (U)

November 12, 2019
Revision 19-06

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Savannah River Site
Aiken, SC 29808

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY UNDER CONTRACT NO. DE-AC09-09SR22505

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07.00 ENGINEERING PROGRAM

Standards/Requirements Identification Document (S/RID) Functional Area 00, S/RID Purpose and Development, contains general information on the development (including the type of source documents considered), assessment, approval, and maintenance of the Savannah River Remediation LLC (SRR) S/RID which is pertinent to the understanding of this S/RID functional area. The reader should refer to S/RID Functional Area 00 for a complete understanding of this S/RID functional area.

The scope of the Engineering Program S/RID Functional Area encompasses the planning and execution of engineering studies and designs for construction and the inspection of construction for compliance with design contract documents.

This functional area identifies design criteria based on regulations, codes, industry standards, and industry and government methods and practices. It does not prescribe how to meet these criteria. A primary focus of the Engineering Program S/RID Functional Area is adherence to the Federal mandate, Public Law 104-113, to utilize National Codes and Standards as the governing requirements.

The Engineering Program S/RID Functional Area incorporates the requirements of DOE O 420.1C, **Change 2**, Facility Safety, and those provided in OSQA-15-0081 concerning Natural Phenomena Hazards. Some of the original requirements have been modified for Savannah River Nuclear Solutions, LLC (SRNS), and therefore SRR, using the SRNS request for concurrence of interpretations or additional guidance provided to United States Department of Energy-Savannah River (DOE-SR) via SRNS-U1000-2013-00102. DOE-SR concurrence in part with the SRNS positions was provided with exceptions, comments, and clarifications in OSQA-14-0044.

Clarifications annotated in the requirements text in Table 1 using “Modified for **LW Contractor** use" reference letters SRNS-U1000-2013-00102 approved by OSQA-14-0044 and **SRNS-F2000-2019-00016 approved by PAD-19-033**. In addition, the letters noted above are referenced in the remarks section in Table 2 for the affected requirements.

07.01 MANAGEMENT AND ADMINISTRATION

Aspects of Management and Administration elements directly related to design activities are addressed in Section 07.02. All other elements are dealt with through other S/RID functional areas as identified in Section 07.03.

07.02 DESIGN

Requirements for the design process, design criteria, design products, and design review and verification are specified in this sub-element. General requirements for design are that detail design requirements be implemented through the establishment of site-specific performance criteria and a performance measurement system.

1. Design Process
The design process converts the performance requirements into design criteria and then into design drawings and ultimately contract drawings and specifications that are used to implement the design in construction. A key aspect of the design process is the preparation of calculations that demonstrate compliance of the design with criteria derived from codes, standards, and regulations. The requirements of the design process are included in DOE O 420.1C, **Change 2**, as well as building codes, state laws, and Public Law 104-113, and are specified in this sub-element.

2. Design Criteria
The design criteria forms the basis for the design. It consists of the requirements for each design and any parameters or limitations that must be specified to allow the engineering program to carry out its responsibilities with respect to producing a design that meets the needs of the facility. Design criteria include codes, standards, and regulations pertinent to the design concept and consider natural phenomena (e.g., high winds, tornadoes, seismic events). Requirements for the design criteria are specified in this sub-element.

DOE O 420.1C, **Change 2**, Nuclear Safety Design Criteria (Attachment 2, Chapter I)
This chapter applies to the design and construction of:

(1) New hazard category 1, 2, and 3 nuclear facilities, as defined by 10 Code of Federal Regulations (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 (Note: See DOE Standard (STD)-1189-2016, Integration of Safety into the Design Process, for criteria and discussion on major modifications).

This chapter does not impose requirements on existing facilities, except for major modifications to those facilities (DOE-STD-1189-2016 provides definition and examples of major modifications). 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.

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.

DOE O 420.1C, **Change 2**, Natural Phenomena Hazards Mitigation (Attachment 2, Chapter IV)

The objective of DOE O 420.1C, **Change 2**, Natural Phenomena Hazards Mitigation, Attachment 2, Chapter IV, is to establish requirements for DOE 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).

Requirements in this chapter apply to all government-owned and government-leased nuclear and nonnuclear facilities and sites. Design requirements (Sections 3.a, 3.b, and 3.c,) apply to new facilities, major modifications, and modifications that may be warranted based on periodic NPH assessment and upgrade requirements.

DOE O 420.1C, **Change 2**, Design Criteria for Safety Structures, Systems, and Components (Attachment 3)

The objective of DOE O 420.1C, **Change 2**, Design Criteria for Safety Structures, Systems, and Components, Attachment 3, is to establish requirements for the design and construction of safety-class and safety-significant safety structures, systems, and components (SSCs) by identifying an applicable set of industry codes and standards, as well as DOE design criteria, standards, and directives (listed in Attachment 4 of DOE O 420.1C, **Change 2**, Facility Safety). 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.

This attachment provides requirements for the design and construction of SSCs and 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.

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.

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. Design Products
Design products consist of drawings, procurement specifications, engineering calculations, and other engineering documentation necessary to procure, construct, operate, and maintain the facility. Requirements for design products are specified in this sub-element.

4. Design Review and Verification
Specific requirements for engineering design review and verification are specified in this sub-element. Designs can be verified by methods such as design reviews, alternate calculations, or testing. The Nuclear Process and Safety and Management Systems S/RID Functional Areas describe additional requirements associated with the Nuclear Safety Program interface with the design process and Documented Safety Analysis (DSA)/Technical Safety Requirement (TSR) development, Unreviewed Safety Question (USQ) determinations, and independent safety review.

5. Design Change Controls
Design changes include those changes that are initiated by the design authority and those that are the result of requests or actions of other organizational units including the operations and maintenance functional areas. Design changes may also arise from the installation process. Controls are provided in the Configuration Management S/RID Functional Area to ensure approval of design changes. The Design Change Control process is an integral part of the overall configuration management function.

6. Design Life
Requirements for the evaluation of aging mechanisms and the identification of actions necessary to achieve desired lifetime of systems, structures, and components are included in the design criteria sub-element and the Configuration Management S/RID Functional Area.

07.03 KEY INTERFACES

The Engineering Program S/RID Functional Area interfaces with essentially all other functional areas to some degree, in both programmatic and technical functional areas. The following functional areas have a major interface with the Engineering Program:

07.03.01 Management Systems

The Engineering Program interfaces with Management Systems S/RID Functional Area primarily in the areas of Operational Readiness Reviews. Such requirements are specified in detail in the Management Systems S/RID Functional Area 01, Section 01.07.

07.03.02 Configuration Management

The Configuration Management S/RID Functional Area contains requirements for the System Engineer Program, the Design Change Control process for nuclear hazards category 1, 2 and 3 facilities, and the development and maintaining of the technical baseline. The Engineering Program contains requirements specific to activities of design. The Configuration Management S/RID Functional Area contains operational requirements for maintaining design life. These are integral parts of the overall engineering process. See the Configuration Management S/RID Functional Area 03 for more detail.

07.03.03 Quality Assurance

The Quality Assurance S/RID Functional Area establishes oversight requirements that impact many requirements found in the Engineering Program. Oversight requirements relating to the Engineering Program are in most of the sub-elements of the Quality Assurance S/RID Functional Area 02. However, specific requirements relating to design are in sub-element 02.07, entitled "Design."

07.03.04 Maintenance

The Maintenance S/RID Functional Area identifies requirements that relate to the development of a Site Maintenance Implementation Plan. Sound engineering judgment and knowledge of the facility are essential in the development of such documents. For detail relating to the Site Maintenance Implementation Plan see the Maintenance S/RID Functional Area 10.

07.03.05 Construction Program

The Engineering Program interfaces with the Construction Program S/RID Functional Area in the areas of scheduling, estimating, design reviews, and construction inspection. The construction program is responsible for implementing the engineering program's design drawings and specifications. Refer to the Construction Program S/RID Functional Area 08 for the specification of these requirements.

07.03.06 Fire Protection

The Fire Protection S/RID Functional Area evaluates the fire hazards and defines the design features that are necessary to mitigate those hazards. Refer to the Fire Protection S/RID Functional Area 12 for the specification of these requirements. The Engineering Program ensures that those design features are incorporated into the design.

07.03.07 Waste Management

There is a series of public laws that affect design relating to the Waste Management S/RID Functional Area. The primary purpose of this functional area is to manage and remediate waste and minimize releases to the environment and to assure that the health of workers and the public is not compromised. Design requirements for monitoring of releases are also presented in the Waste Management S/RID Functional Area 16.

07.03.08 Nuclear and Process Safety

The Nuclear and Process Safety S/RID Functional Area contains the controls for DSA preparation, identifying and analyzing credible accidents, and performing dose calculations needed for the DSA. The Engineering Program recognizes the need for engineering support to this process and the need to ensure that designs are consistent with the DSA and other TSRs and commitments. Refer to the Nuclear and Process Safety S/RID Functional Area 18 for the specification of these requirements.

07.03.09 Environmental Protection

The Environmental Protection S/RID Functional Area interfaces with the Engineering Program in the areas of developing data necessary for the preparation of National Environmental Policy Act documents, licenses, and permits. Refer to the Environmental Protection S/RID Functional Area 20 for the specification of these requirements.

07.04 DOCUMENTS

07.04.01 Reference Documents

10 CFR 436	FEDERAL ENERGY MANAGEMENT AND PLANNING PROGRAMS
10 CFR 851	WORKER SAFETY AND HEALTH PROGRAM, 1/17/2018
DOE LETTER OSQA-15-0081	SAVANNAH RIVER REMEDIATION LLC (SRR) CANCELLED DIRECTIVE IMPLEMENTATION INSTRUCTIONS (DII) GUIDANCE, 4/8/2015
DOEM435.1-1	RADIOACTIVE WASTE MANAGEMENT MANUAL, ADMIN CHANGE 2, 6/8/2011
DOEO420.1C	FACILITY SAFETY, CHANGE 2, 7/26/2018
Public Law 104-113	NATIONAL TECHNOLOGY TRANSFER AND ADVANCEMENT ACT OF 1995
Public Law 109-58	ENERGY POLICY ACT OF 2005, 8/8/2005
SC-Code, Title 40 Ch. 22	ENGINEERS AND LAND SURVEYORS

TABLE 1 FORMAT AND CONTENT

S/RID Requirement Number	Unique number for each requirement that links the statement to the ES&H Configuration Guide
Source Document	Number of the source document
Source Document Requirement Number	Unique reference from the source document.
Requirement Text	Requirement statement

Facility Categories *

Requirement applicability is shown in relation to the following facility categories:

Nuclear HC-1,2,3	Representing nuclear hazard category 1, 2 and 3 facilities (as defined by DOE Standard 1027-92) and includes any facility(s) required to support a nuclear facility(s).
Radiological	Representing facilities below Hazard Category 3 but still contain quantities of radioactive material at or above the Reportable Quantity value as specified in 40 CFR 302.4, Appendix B.
High Hazard Chemical	Representing facilities with radiological hazards below 40 CFR 302.4 thresholds for radiological materials, but with any chemical hazard at or above threshold quantities listed in 29 CFR 1910.119 or 40 CFR 68. These facilities may also contain nuclear materials exempt from the nuclear facility definition, e.g., check and calibration sources, radioactive sources in research and experimental and analytical laboratory activities, electron microscopes, and x-ray machines, as defined by 10 CFR 830.3.
Low Hazard Chemical	Representing facilities with radiological hazards below 40 CFR 302.4 thresholds, but with chemical hazards both below 29 CFR 1910.119 or 40 CFR 68 thresholds and at or above reportable quantities in 40 CFR 302.4. These facilities may also contain nuclear materials exempt from the nuclear facility definition, e.g., check and calibration sources, radioactive sources in research and experimental and analytical laboratory activities, electron microscopes, and x-ray machines, as defined by 10 CFR 830.3.
Other Industrial	Representing facilities with all radiological and chemical hazards below 40 CFR 302.4 thresholds. These facilities may also contain nuclear materials exempt from the nuclear facility definition, e.g., check and calibration sources, radioactive sources in research and experimental and analytical laboratory activities, electron microscopes, and x-ray machines, as defined by 10 CFR 830.3.
Facility Specific	These are requirements that are applicable to specific facilities. Facility identification is included in this column, when applicable.

Phase I Compliance Approach

Common	Implementation of these requirements is covered by common procedures and policies.
Facility Specific	Implementation of these requirements is covered by facility specific procedures.

* Refer to the “SRR Facilities List” contained in Functional Area 00 for the category for specific SRR facilities/bldgs.

TABLE 1 - S/RID FUNCTIONAL AREA 07 (ENGINEERING PROGRAM) REQUIREMENTS

S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.040	SC-Code, Title 40 Ch. 22	All	Comply with the 1976 Code of Laws and South Carolina - Title 40, Chapter 22 entitled "Engineers and Land Surveyors."	X	X	X	X	X		X	
07.02.041	Public Law 104-113	All	Use national consensus standards to meet DOE policy objectives and mission requirements. These standards shall be invoked for the design and construction of DOE facilities.	X	X	X	X	X		X	
07.02.044	10 CFR 436	All	Comply with the Code of Federal Regulations for life cycle cost analysis requirements.	X	X	X	X	X		X	
07.02.052	DOEM435.1-1	Ch. 2, 3, 4 Engineering	In complying with the provisions of this manual for design of radioactive waste management facilities, determinations regarding the acceptability of design should include comparison with existing safety basis information, if available. All new construction shall, as a minimum, comply with facility design input functional and performance requirements including: 1) instrumentation and control systems to provide volume inventory data and to prevent spills, leaks, and overflows from tanks or confinements systems, and 2) monitoring and/or leak detection capabilities to provide detection of failed confinement and/or other abnormal conditions. Additionally: 3) Low Level Waste facilities shall be sited to a) achieve long-term stability and to minimize required active maintenance following final closure and b) minimize the contact of waste with water during and after disposal. 4) High level Waste facilities shall also include Facilities for Receipt and Retrieval systems. Note: (1) The wording of this requirement has been modified from DOE M 435.1-1 for SRS application. Sections Ch. 2-p.(2)(g), (i) & (j); Ch. 3-m(2)(d) &(e); and Ch. 4-m.(1)(c),(2)(d) & (e), (3)(c) & (d) of the source document are incorporated into this general engineering requirement. (2) All specific source document requirements of Note (1) are also found as requirements 16.12.009, 16.12.011, 16.12.012, 16.12.018, 16.12.019, 16.12.022, 16.12.027, 16.12.028, 16.12.032, and 16.12.033 in S/RID Functional Area 16, respectively.	X	X					X	
07.02.079	DOE LETTER OSQA-15-0081	Encl.1.1	1. For facilities classified as Performance Category 2 (with hazardous material) and Performance Category 3 or higher (see DOE-STD-1021 for classification guidance): -Provide, install, and/or maintain instrumentation to detect and record the occurrence and severity of seismic events by ensuring that several representative facilities spread over the SRS shall have such instrumentation.	X	X	X	X	X		X	

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				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.080	DOE LETTER OSQA-15-0081	Encl.1.2	2. For added conservatism, increase the seismic safety margin of new SDC-3 & SDC-4/PC-3 SSCs and SDC-5/PC-4 SSCs facilities (structures or segments of structures), systems, and components by: -including a load factor of 1.2 with the seismic load component in the applicable load combinations for the evaluation of structural elements. -including a load factor of 1.2 for in-structure floor response spectra generated for the qualification of SDC-3 & SDC-4/PC-3 or SDC-5/PC-4 systems, equipment, or components. -increase the computed dynamic settlement (profiles) from any stability, liquefaction, or partial liquefaction analysis by a factor of 1.2 before determining the corresponding imposed structural loads for use in the evaluation of structures. Note: 1.2 Load factor - DOE still has a commitment to the DNFSB for providing conservatism in the design of new nuclear facilities (DOE Letter "DOE Savannah River Site (SRS) Actions Taken to Increase Seismic Safety Margin", November 1999) so the 1.2 load factor must remain. This commitment was centered on the DNFSB's technical acceptance of the current SRS PC-3 design spectra in SRS Standard 01060. The continued need for the 1.2 load factor will be revisited upon the completion of the update to the SRS probabilistic seismic hazard analysis (**estimated** Spring **2021**).	X	X	X	X	X		X	
07.02.104	10 CFR 851	Sub.C App.A. 4(a)	Appendix A to Part 851—Worker Safety and Health Functional Areas This appendix establishes the mandatory requirements for implementing the applicable functional areas required by paragraph 851.24. Pressure Safety Contractors must establish safety policies and procedures to ensure that pressure systems are designed, fabricated, tested, inspected, maintained, repaired, and operated by trained and qualified personnel in accordance with applicable and sound engineering principles. Note: Paragraph 851.24 is found as Requirement 01.04.162 in FA 01.	X	X	X	X	X		X	

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				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.105	10 CFR 851	Sub.C App.A. 4(b)	Pressure Safety Contractors must ensure that all pressure vessels, boilers, air receivers, and supporting piping systems conform to: (1) The applicable American Society of Mechanical Engineers (ASME) boilers and pressure vessel codes (BPVC), including applicable code cases as indicated in paragraphs (b)(1)(i) through (xxxii) of this section: (i) BPVC.I–2015, Section I—Rules for Construction of Power Boilers (incorporated by reference, see 851.27); (ii) BPVC.II.A–2015, Section II-Materials, Part A—Ferrous Material Specifications (Beginning to SA–450) (incorporated by reference, see 851.27); (iii) BPVC.II.A–2015, Section II—Materials, Part A—Ferrous Material Specifications (SA– 451 to End) (incorporated by reference, see 851.27); (iv) BPVC.II.B–2015, Section II—Materials, Part B—Nonferrous Material Specifications (incorporated by reference, see 851.27); (v) BPVC.II.C–2015, Section II—Materials, Part C-Specification for Welding Rods; Electrodes, and Filler Metals (incorporated by reference, see 851.27); (vi) BPVC.II.D.C–2015, Section II— Materials, Part D—Properties (Customary) (incorporated by reference, see 851.27); (vii) BPVC.II.D.M–2015, Section II— Materials, Part D—Properties (Metric) (incorporated by reference, see 851.27); (viii) BPVC.III.A–2015, Section III—Rules for Construction of Nuclear Facility Components, Appendices (incorporated by reference, see 851.27); (ix) BPVC.III.1.NB–2015, Section III—Rules for Construction of Nuclear Facility Components, Division I—Subsection NB, Class 1 Components (incorporated by reference, see 851.27); (x) BPVC.III.1.NC–2015, Section III—Rules for Construction of Nuclear Facility Components, Division I—Subsection NC, Class 2 Components (incorporated by reference, see 851.27); (xi) BPVC.III.1.ND–2015, Section III—Rules for Construction of Nuclear Facility Components, Division I—Subsection ND, Class 3 Components (incorporated by reference, see 851.27); (xii) BPVC.III.1.NE–2015, Section III— Rules for Construction of Nuclear Facility Components, Division I—Subsection NE, Class MC Components (incorporated by reference, see 851.27); (xiii) BPVC.III.1.NF–2015, Section III— Rules for Construction of Nuclear Facility Components, Division I—Subsection NF, Supports (incorporated by reference, see 851.27);	X	X	X	X	X		X	

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07.02.105	10 CFR 851	Sub.C.App.A. 4(b) (cont'd)	(xiv) BPVC.III.1.NG–2015, Section III— Rules for Construction of Nuclear Facility Components, Division I—Subsection NG, Core Support Structures (incorporated by reference, see 851.27); (xv) BPVC.III.1.NH–2015, Section III— Rules for Construction of Nuclear Facility Components, Division I—Subsection NH, Class 1 Components in Elevated Temperature Service (incorporated by reference, see 851.27); (xvi) BPVC.III.NCA–2015, Section III— Rules for Construction of Nuclear Facility; Components, Subsection NCA, General Requirements for Division 1 and Division 2 (incorporated by reference, see 851.27); (xvii) BPVC.III.2–2015, Section III—Rules for Construction of Nuclear Facility Components, Division 2, Code for Concrete Containments (incorporated by reference, see 851.27); (xviii) BPVC.III.3–2015, Section III—Rules for Construction of Nuclear Facility Components, Division 3, Containment for Transportation and Storage of Spent Nuclear Fuel and High Level Radioactive Material and Waste (incorporated by reference, see 851.27); (xix) BPVC.III.5–2015, Section III—Rules for Construction of Nuclear Facility Components, Division 5, High Temperature Reactors (incorporated by reference, see 851.27); (xx) BPVC.IV–2015, Section IV, Rules for Construction of Heating Boilers (incorporated by reference, see 851.27); (xxi) BPVC.V–2015, Section V, Nondestructive Examination (incorporated by reference, see 851.27); (xxii) BPVC.VI–2015, Section VI, Recommended Rules for the Care and Operation of Heating Boilers (incorporated by reference, see 851.27); (xxiii) BPVC.VII–2015, Section VII, Recommended Guidelines for the Care of Power Boilers (incorporated by reference, see 851.27); (xxiv) BPVC.VIII.1–2015, Section VIII— Rules for Construction of Pressure Vessels, Division 1 (incorporated by reference, see 851.27); (xxv) BPVC.VIII.2–2015, Section VIII— Rules for Construction of Pressure Vessels, Division 2, Alternative Rules (incorporated by reference, see 851.27); (xxvi) BPVC.VIII.3–2015, Section VIII— Rules for Construction of Pressure Vessels, Division 3, Alternative Rules for Construction of High Pressure Vessels (incorporated by reference, see 851.27); (xxvii) BPVC.IX–2015, Section IX— Welding, Brazing and Fusing Qualifications, Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators (incorporated by reference, see 851.27);	X	X	X	X	X		X	

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07.02.105	10 CFR 851	Sub.C.App.A. 4(b) (cont'd)	(xxviii) BPVC.X–2015, Section X, Fiber— Reinforced Plastic Pressure Vessels (incorporated by reference, see 851.27); (xxix) BPVC.XI–2015, Section XI, Rules for Inservice Inspection of Nuclear Power Plant Components (incorporated by reference, see 851.27); (xxx) BPVC.XII–2015, Section XII, Rules for Construction and Continued Service of Transport Tanks (incorporated by reference, see 851.27); (xxxi) BPVC.CC.BPV–2015, Code Cases, Boilers and Pressure Vessels (incorporated by reference, see 851.27); and (xxxii) BPVC.CC.NC–2015, Code Cases, Nuclear Components (incorporated by reference, see 851.27). (2) The applicable ASME B31 code for pressure piping as indicated in this paragraph; and or as indicated in paragraph (b)(3) of this section: (i) B31.1–2016, Power Piping (incorporated by reference, see 851.27); (ii) B31.3–2014, Process Piping (incorporated by reference, see 851.27); (iii) B31.4–2016, Pipeline Transportation Systems for Liquids and Slurries (incorporated by reference, see 851.27); (iv) B31.5–2016, Refrigeration Piping and Heat Transfer Components (incorporated by reference, see 851.27); (v) B31.8–2016, Gas Transmission and Distribution Piping Systems (incorporated by reference, see 851.27); (vi) B31.8S–2014, Managing System Integrity of Gas Pipelines (incorporated by reference, see 851.27); (vii) B31.9–2014, Building Services Piping (incorporated by reference, see 851.27); and (viii) B31.G–2012, Manual for Determining the Remaining Strength of Corroded Pipelines (incorporated by reference, see 851.27). (3) The strictest applicable state and local codes. Note: In accordance with the guidance in DOE G 440.1-1B, Change 1, Worker Safety and Health Program for DOE (Including the National Nuclear Security Administration) Federal and Contractor Employees, 3/22/2013, the Liquid Waste Contractor has adopted the following successor standards which have been determined as providing equal or greater worker protection: ASME B31.3 - 2016 ASME Boiler and Pressure Vessel Code – 2017 **ASME B31.1 - 2018** **ASME B31.G - 2012 (R2017)**	X	X	X	X	X		X	

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				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.106	10 CFR 851	Sub.C.App.A. 4(c)	Pressure Safety When national consensus codes are not applicable (because of pressure range, vessel geometry, use of special materials, etc.), contractors must implement measures to provide equivalent protection and ensure a level of safety greater than or equal to the level of protection afforded by the ASME or applicable state or local code. Measures must include the following: (1) Design drawings, sketches, and calculations must be reviewed and approved by a qualified independent design professional (i.e., professional engineer). Documented organizational peer review is acceptable. (2) Qualified personnel must be used to perform examinations and inspections of materials, in-process fabrications, nondestructive tests, and acceptance test. (3) Documentation, traceability, and accountability must be maintained for each unique pressure vessel or system, including descriptions of design, pressure conditions, testing, inspection, operation, repair, and maintenance. Note: DOE clarifies this requirement on Page 6914 of the Federal Register Vol. 71, No. 27 dated Thursday, February 9, 2006, 10 CFR 850 and 10 CFR 851 as follows: “DOE notes that documented organizational peer review is acceptable for the design drawings, sketches, and calculations that must be reviewed and approved by a professional engineer.”	X	X	X	X	X		X	
07.02.107	Public Law 109-58	Sec. 104	Comply with the requirements of Section 104 with reference to Sections 131, 135, and 136 of Public Law 109-58 by utilizing Energy Star products (i.e., products rated for energy efficiency under an Energy Star program) or Federal Energy Management Program (FEMP) designated products, as part of new designs when practical, while still meeting other design, schedule, and lifecycle cost considerations.	X	X	X	X	X		X	
07.02.108	Public Law 109-58	Sec. 109	Comply with Section 109 and Section 103 of Public Law 109-58 by designing, if life-cycle cost effective, new Federal buildings to achieve energy consumption levels at least 30% below those of the current version of the ASHRAE standard. In addition, sustainable design or equivalent (e.g. pollution prevention) principles will be applied to the siting, design, and construction of all new and replacement buildings. All existing Federal buildings will comply, if lifecycle cost effective, with energy reductions goals per Section 102 and electric metering per Section 103 as defined by DOE O 430.2 (latest version) and any associated performance agreements. Note: DOE O 430.2 has been superseded by DOE O 436.1.	X	X	X	X	X		X	

TABLE 1 - S/RID FUNCTIONAL AREA 07 (ENGINEERING PROGRAM) REQUIREMENTS

S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.109	Public Law 109-58	Sec. 108	Comply with requirements of Section 108 of Public Law 109-58 by using recovered mineral components, when practical, in procured cement/concrete mixes.	X	X	X	X	X		X	
07.02.110	DOEO420.1C	Att. 1.1.a-d	1. GENERAL REQUIREMENTS. a. This CRD establishes facility safety requirements for design, construction, operation, management, decontamination, decommissioning and demolition of DOE sites or 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 DOE O 420.1C. 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, **DOE O 413.3B, Chg. 5,** Program and Project Management for the Acquisition of Capital Assets requires nuclear projects to establish and maintain a Code of Record (COR) early in project design for identifying 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.** d. Contractors must satisfy the requirements (i.e., mandatory statements) in DOE technical standards and 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. Modified for **LW Contractor** use by SRNS-U1000-2013-00102 and OSQA-14-0044: During development of the implementation of this Order, the Department will work with the Contractors and carefully review the Order to identify those Standards or parts of Standards that are considered mandatory. Notes: 1) Att. 1.1.e-f is included in FA 18 (18.03.01.101).	X	X	X	X	X		X	

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S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.111	DOEO420.1C	Att. 1.2	2. RELIEF FROM REQUIREMENTS, CODES AND STANDARDS. a. Requests for equivalencies and exemptions to the requirements of this attachment are processed in accordance with DOE O 251.1**D** Departmental Directives Program. For such equivalencies and exemptions, DOE O 251.1**D** requires approval, in consultation with the Office of Primary Interest, by the **responsible Head of Departmental Element** or designee, or in the case of NNSA, by the Administrator or designee. **Because this Order affects nuclear safety, requests for advice from the Office of Primary Interest (i.e., Office of Nuclear Safety) on proposed equivalencies and exemptions for nuclear facilities should allow 45 days, in accordance with DOE O 251.1D**. Requests for equivalencies and exemptions **to the requirements of this attachment** must be provided to the responsible contracting officer **to facilitate DOE review. (Note: The requirements in this paragraph also address the requirements of this attachment, and those in Attachments 2 and 3, that relate to** DOE technical standards and industry codes and standards **that are invoked as required methods.)** 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 F**ield **E**lement **or designee.** Modified for **LW Contractor** use by SRNS-U1000-2013-00102 and OSQA-14-0044: The Department recognizes that existing procedures (WSRC-TM-95-1, SRS Engineering Standards Manual: Responsibilities and Requirements) and direction (Letter Craig to Foster, Letter of Direction for Delegation of Limited Functions Related to Title 10 Code of Federal Regulation (CFR)851 and Department of Energy (DOE) Order (O) 420.1C, Change 1, WDED-17-21 dated September 29, 2017) have delegated certain de-minimis authority to the Contractors. If the need arises for additional authorities for equivalencies, the Department will work with the Contractors to come to an agreeable solution.	X	X	X	X	X		X	
07.02.112	DOEO420.1C	Att. 2.Ch. I.3.a.(1).	3. REQUIREMENTS. a. Integration of Safety with Design. (1) **Safety analysis and supporting design must be developed and integrated in accordance with DOE-STD-1189-2016.**	X						X	

TABLE 1 - S/RID FUNCTIONAL AREA 07 (ENGINEERING PROGRAM) REQUIREMENTS

S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.113	DOEO420.1C	Att. 2.Ch. I.3.a.(2).	3. REQUIREMENTS. a. Integration of Safety with Design. (2) 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-1186-20**16**, Specific Administrative Controls, for details on specific administrative controls.)	X						X	
07.02.114	DOEO420.1C	Att. 2.Ch. I.3.b.(1).	3. REQUIREMENTS. 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.	X						X	

TABLE 1 - S/RID FUNCTIONAL AREA 07 (ENGINEERING PROGRAM) REQUIREMENTS

S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.115	DOEO420.1C	Att. 2.Ch. I.3.b.(2).	3. REQUIREMENTS. b. Nuclear Facility Design. (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 Head of Departmental Element** 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; (g) using equipment in combination with administrative controls that— 1 restrict deviation from normal operations; 2 monitor facility conditions during and after an event; and, 3 provide for response to accidents to achieve a safe condition; (h) providing means to monitor accident releases as required for emergency response (see DOE O 151.1**D**, Comprehensive Emergency Management System, for detailed requirements); and, (i) establishing emergency plans for minimizing the effects of an accident (see DOE O 151.1**D** for detailed requirements).	X						X	

TABLE 1 - S/RID FUNCTIONAL AREA 07 (ENGINEERING PROGRAM) REQUIREMENTS

S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.116	DOEO420.1C	Att. 2.Ch. I.3.b.(3).	3. REQUIREMENTS. b. Nuclear Facility Design. (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. **(Note 4)** Alternate confinement approaches may be acceptable if a technical evaluation demonstrates 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 420.1C, Facility Safety. **Some facilities where the only radioactive hazard/material is tritium have determined there is no benefit from an active confinement ventilation system.** **(Note 4: The safety classification (if any) of the ventilation system is determined by the facility DSA.)**	X						X	

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S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.117	DOEO420.1C	Att. 2.Ch. I.3.b.(4).	3. REQUIREMENTS. b. Nuclear Facility Design. (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 as low as reasonably achievable; **and** (d) provide **hazard** controls **for prevention and mitigation of hazardous material releases and for defense in depth,** consistent with the hierarchy described in DOE-STD-1189-20**16.**	X						X	
07.02.118	DOEO420.1C	Att. 2.Ch. I.3.b.(5).	3. REQUIREMENTS. b. Nuclear Facility Design. (5) Facility process systems must be designed to minimize waste production and mixing of radioactive and non-radioactive wastes.	X						X	
07.02.119	DOEO420.1C	Att. 2.Ch. I.3.b.(6).	3. REQUIREMENTS. b. Nuclear Facility Design. (6) Safety-SSCs and safety software must be designed to perform their safety functions when called upon.	X						X	

TABLE 1 - S/RID FUNCTIONAL AREA 07 (ENGINEERING PROGRAM) REQUIREMENTS

S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.120	DOEO420.1C	Att. 2.Ch. I.3.b.(7).	3. REQUIREMENTS. b. Nuclear Facility Design. (7) Active safety-class systems must be designed to meet single failure **(Note 5)** criterion. (Note **5**: IEEE-Std-379-20**14**, IEEE Standard Application of the Single-Failure Criterion to Nuclear Power Generating Station Safety Systems, provides a definition of single failure criterion. ANS 58.9-2002 (R 2009), Single Failure Criteria for Light Water Reactor Safety-Related Fluid Systems, provides additional guidance for single failure criteria for mechanical systems.) **Modified for LW Contractor use by SRNS-F2000-2019-00016 and PAD-19-033:** **The Contractor has the responsibility for determining the 'applicable' sections of ANS 58.9 with concurrence from DOE-SR.**	X						X	
07.02.121	DOEO420.1C	Att. 2.Ch. I.3.b.(8).	3. REQUIREMENTS. b. Nuclear Facility Design. (8) DOE G 420.1-1A **Nonreactor Nuclear Safety Design Criteria for Use with DOE O 420.1C, Facility Safety** provides an acceptable method to meet the requirements stated in this chapter	X						X	
07.02.123	DOEO420 1C	Att. 2.Ch. I.3.b.(**9**).	3. REQUIREMENTS. b. Nuclear Facility Design. (**9**) Critical experiments facilities must be designed and operated in accordance with American National Standards Institute (ANSI) and the American Nuclear Society (ANS) standards, ANSI/ANS-1-2000, Conduct of Critical Experiments, ANSI/ANS-14.1-2004 **(R2014),** Operation of Fast Pulse Reactors, **Nonreactor Nuclear Safety Design Criteria for Use with DOE O 420.1C, Facility Safety**. Note: Not applicable at SRS. Included for continuity.								
07.02.124	DOEO420 1C	Att. 2.Ch. I.3.b.(**10**).	3. REQUIREMENTS. b. Nuclear Facility Design. **(10)** Facility design must also be integrated with other design requirements, as applicable, including explosive safety, industrial safety, and nuclear explosive safety (if applicable).	X						X	

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S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.125	DOEO420.1C	Att. 2.Ch. IV.3.a.	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.	X						X	
07.02.126	DOEO420.1C	Att. 2.Ch. IV.3.b.	3. REQUIREMENTS. b. NPH Design Criteria. **The design of** new facilities and major modifications must **be developed with** the applicable requirements and criteria contained in DOE-STD-1020-20**16**, Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities. (Note: Requirements for non-nuclear facilities are described in Section **2.2** of DOE-STD-1020-20**16**.) Note: Existing facilities will continue to use Performance Category language as opposed to NDC language of DOE-**STD**-1020-20**16**. However, if there is a mission change requiring a major modification or upgrade necessary due to a change in NPH demands, the existing facilities will have to use NDC language of DOE-**STD**-1020-20**16**.	X	X	X	X	X		X	
07.02.127	DOEO420.1C	Att. 2.Ch. IV.3.c.	3. REQUIREMENTS. 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.	X						X	

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S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.128	DOEO420.1C	Att. 2.Ch. IV.3.d.	3. REQUIREMENTS. 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 10 years **and whenever** significant changes in **NPH** data, criteria, and assessment methods that would warrant updating the assessments. Section 9.0 of DOE-STD-1020-20**16** contain**s** criteria and guidance for performing these reviews. The review results, along with any recommended update actions, must be submitted to the **DOE H**ead **of -F**ield **E**lement for approval. If no update is necessary, this result must be documented following the review. (2) 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 **DOE H**ead **of F**ield **E**lement for approval. Section**s** 9.3 **and 9.4** of DOE-STD-1020-20**16** contain guidance on performing upgrade evaluations.	X	X	X	X	X		X	
07.02.129	DOEO420.1C	Att. 2.Ch. IV.3.e.	3. REQUIREMENTS. e. Seismic Detection. DOE sites with nuclear or hazardous materials must have instrumentation or other means to detect and record the occurrence and severity of seismic events	X	X	X	X	X		X	
07.02.130	DOEO420.1C	Att. 2.Ch. IV.3.f.	3. REQUIREMENTS. f. Post-Natural Phenomena Procedures. Facilities or sites with hazardous materials must have procedures for inspecting facilities for damage from severe NPH events and placing a facility into a safe configuration when damage has occurred.	X	X	X	X	X		X	
07.02.131	DOEO420.1C	Att. 3.3.a (1).	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.	X						X	

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				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.132	DOEO420.1C	Att. 3.3.a (2).	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. (2) System Reliability. (a) The single failure criterion, requirements, and design analysis identified in Institute of Electrical and Electronics Engineers (IEEE) standard (Std) 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 as described in DOE-Standard (STD)-1189-2016. 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. **Modified for LW Contractor use by SRNS-F2000-2019-00016 and PAD-19-033:** **SRR has the responsibility for determining the 'applicable' sections of IEEE 379-2014 with concurrence from DOE-SR. Only those portions of IEEE 379-2014 determined to be applicable are then 'invoked'. Any subsequent equivalency or exemption, after the applicability of the code is established, for a new facility or major modification can be included in a Safety Design Strategy (see requirement 07.02.138 below) or would have to be processed using the methods outlined in DOEO 251.1D.**	X						X	

TABLE 1 - S/RID FUNCTIONAL AREA 07 (ENGINEERING PROGRAM) REQUIREMENTS

S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.133	DOEO420.1C	Att. 3.3.a (3).	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. (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 Std 323-2003 **(R2008),** IEEE Standard Criteria for Qualifying Class IE Equipment for Nuclear Power Generating Stations must be used to ensure environmental qualifications of safety-class SSCs, **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 as described in DOE-STD-1189-2016.** (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. **Modified for LW Contractor use by SRNS-F2000-2019-00016 and PAD-19-033:** **SRR has the responsibility for determining the 'applicable' sections of IEEE Std 323-2003 (R2008) with concurrence from DOE-SR. Only those portions of IEEE Std 323-2003 (R2008) determined to be applicable are then 'invoked'. Any subsequent equivalency or exemption, after the applicability of the code is established, for a new facility or major modification can be included in a Safety Design Strategy (see requirement 07.02.138 below) or would have to be processed using the methods outlined in DOEO 251.1D.** **Modified for LW Contractor** use by SRNS-U1000-2013-00102 and OSQA-14-0044: Step 3.a.(3)(a & b) address requirements pertaining to qualify Safety Class and Safety Significant SSCs for the environmental conditions in which they operate. IEEE Std 323-2003 **(R2008)**, IEEE Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations is cited as an acceptable method to qualify the design of Safety Class SSCs. Step 3.a.(3)(b) states manufacturers' recommendations or other appropriate methods are to be used to qualify the design of Safety Significant SSCs. Table 6 of Attachment 3 incorrectly cites IEEE 323-**2003 (R2008)** as a requirement for both Safety Significant and Safety Class SSCs. Therefore, the use of IEEE 323-2003 **(R2008)** is not mandatory for Safety Significant systems.	X						X	

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07.02.134	DOEO420.1C	Att. 3.3.a (4).	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. (4) Safe Failure Modes. The facility design must provide reliable safe conditions and sufficient confinement of hazardous material during and after all design basis accidents (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. **Modified for LW Contractor use by SRNS-F2000-2019-00016 and PAD-19-033: At both the facility and SSC level, the design must ensure that the most probable modes of failure (e.g., failure to open vice failure to close) will increase the likelihood of a safe condition, unless that failure would result in additional or increased hazards, substantial financial loss or be immediately detected by diagnostics.**	X						X	

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07.02.135	DOEO420.1C	Att. 3.3.a (5).	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. (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 Std 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 in accordance with the process for obtaining DOE review and approval of the applicability of codes and standards as described in DOE-STD-1189-2016**. This **application** includes a design to ensure that both direct and indirect impacts of design basis accidents (e.g., fire, seismic) will not cause failure of safety functions. **Modified for LW Contractor use by SRNS-F2000-2019-00016 and PAD-19-033:** **SRR has the responsibility for determining the 'applicable' sections of IEEE 384-2008 with concurrence from DOE-SR. Only those portions of IEEE 384-2008 determined to be applicable are then 'invoked'. Any subsequent equivalency or exemption, after the applicability of the code is established, for a new facility or major modification can be included in a Safety Design Strategy (see requirement 07.02.138 below) or would have to be processed using the methods outlined in DOEO 251.1D.** **Modified for LW Contractor** use by SRNS-U1000-2013-00102 and OSQA-14-0044: Step 3.a.(5)(b) should be broadly interpreted to require evaluation of the need to physically separate or protect safety related SSCs from the failure of non-safety related SSCs. Although the Order step cites application of IEEE Std 384-2008, IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits as a source for physical and electrical separation methods, Tables 5 and 6 of that attachment shows IEEE 384-2008 is only applicable to Safety Class electrical systems. The use of IEEE 384-2008 is not mandatory for Safety Significant electrical systems.	X						X	

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				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.136	DOEO420.1C	Att. 3.3.a (6).	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. (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.	X						X	
07.02.137	DOEO420.1C	Att. 3.3.a (7).	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. (7) Quality Assurance. A quality assurance program must be established that satisfies 10 C.F.R. Part 830, Subpart A, Quality Assurance Requirements, and DOE Order (O) 414.1D, **Admin Chg. 1,** Quality Assurance, 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.	X						X	

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S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.138	DOEO420.1C	Att. 3.3.b.(1).	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.** b. Specific Design Criteria and Use of National Codes and Standard. 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 industry codes and standards are considered applicable when they provide relevant design requirements for the safety-SSCs that are being designed (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 H**ead **of F**ield **E**lement. (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. **The process for obtaining DOE review and approval of the applicability of codes and standards is described in DOE-STD-1189-2016.** **The Safety Design Strategy developed in accordance with DOE-STD-1189-2016 may be used to specify provisions for relief (exemptions and equivalencies) from identified, applicable design and construction codes and standards. If the Safety Design Strategy is not used to specify relief provisions**, the process for obtaining relief (i.e., equivalencies or exemptions) from applicable requirements in applicable DOE technical standards and industry codes and standards is described in Attachment 1 of DOE O 420.1C. (Note: Relief is not necessary for requirements within an applicable industry code or standard where the requirements are not relevant to the design or construction. **Relief from Order 420.1C requirements, including requirements to follow invoked standards, would still be required to follow Attachment 1, Section 2.a, unless the requirements specifically relate to satisfying DOE technical standards and industry codes and standards that have been identified as applicable.)**	X						X	

TABLE 1 - S/RID FUNCTIONAL AREA 07 (ENGINEERING PROGRAM) REQUIREMENTS

S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
DOEO420.1 C-Chg1	Att. 3.3.b.(1).	07.02.138 (cont'd)	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.** 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 DOE O 420.1C for additional codes and standards). (1) Structural. Table 1 provides relevant codes and standards. Attachment 2, Chapter IV of DOE O 420.1C provides additional natural phenomena hazards (NPH) design requirements. (For Table 1 see DOE O 420.1C) Note: See DOE-STD-1020-20**16, Natural Phenomena Hazards Analysis and Design Criteria for DOE Facilities, for further discussion on selection and use of codes for structural design of SSCs.** **Modified for LW Contractor use by SRNS-F2000-2019-00016 and PAD-19-033: For new facilities and major modifications to existing facilities which will have a Safety Design Strategy (SDS), the SDS (developed in accordance with DOE-STD-1189-2016) can be used to obtain relief (exemptions and equivalencies) from codes and standards including 'invoked' standards or to document the determination of applicability (e.g., ISA and IEEE nuclear industry safety class standards).**								
07.02.139	DOEO420.1C	Att. 3.3.b.(2).	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.** b. Specific Design Criteria and Use of National Codes and Standard. Note: See Att. 3.3.b.(1). above for amplifying information. (2) Mechanical and Process Equipment. Table 2 provides relevant codes and standards. (For Table 2 see DOE O 420.1C)	X						X	

TABLE 1 - S/RID FUNCTIONAL AREA 07 (ENGINEERING PROGRAM) REQUIREMENTS

S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.140	DOEO420.1C	Att. 3.3.b.(3).	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.** b. Specific Design Criteria and Use of National Codes and Standard. Note: See Att. 3.3.b.(1). above for amplifying information. (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 420.1C, Facility Safety, and DOE Handbook-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**. (For Table 3 see DOE O 420.1C)	X						X	
07.02.141	DOEO420.1C	Att. 3.3.b.(4).	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.** b. Specific Design Criteria and Use of National Codes and Standard. Note: See Att. 3.3.b.(1). above for amplifying information. (4) Mechanical Handling Equipment. Table 4 provides relevant codes and standards. (For Table 4 see DOE O 420.1C)	X						X	
07.02.142	DOEO420.1C	Att. 3.3.b.(5).	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.** b. Specific Design Criteria and Use of National Codes and Standard. Note: See Att. 3.3.b.(1). above for amplifying information. (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. (For Tables 5 and 6 (and list of ANSI/IEEE standards) see DOE O 420.1C)	X						X	

TABLE 1 - S/RID FUNCTIONAL AREA 07 (ENGINEERING PROGRAM) REQUIREMENTS

S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.143	DOEO420.1C	Att. 3.3.b.(6).	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.** b. Specific Design Criteria and Use of National Codes and Standard. Note: See Att. 3.3.b.(1). above for amplifying information. (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. (For Table 7 see DOE O 420.1C) **Modified for LW Contractor** use by SRNS-U1000-2013-00102 and OSQA-14-0044: Table 7 lists ISA TR84.00.06 as a code/standard for both SS and SC Instrumentation, Control and Alarm Components. ISA TR84.00.06 is a technical report and not a code or standard. As a technical report it does not have requirements. If SRR chooses to utilize safety related instrument buses in a future design, SRR will, at that time, evaluate the need to have a Nationally Recognized Testing Laboratory (NRTL) certify those instrument buses.	X						X	

TABLE 1 - S/RID FUNCTIONAL AREA 07 (ENGINEERING PROGRAM) REQUIREMENTS

S/RID Requirement Number	Source Document	Source Document Reqt Number	Requirement Text	SRR Applicability						Phase I Compliance	
				Nuclear HC-1,2,3	Radi-ological	High Hazard Chemical	Low Hazard Chemical	Other Industrial	Facility Specific	Common	Facility Specific
07.02.144	DOEO420.1C	Att. 3.3.b.(7).	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.** b. Specific Design Criteria and Use of National Codes and Standard. Note: See Att. 3.3.b.(1). above for amplifying information. (7) Fire Protection Systems. DOE-STD-1066-20**16** 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-1066-20**16**. Fire protection system designs are also required to address the applicable design requirements for similar safety systems provided in this attachment.	X						X	