



U.S. NUCLEAR REGULATORY COMMISSION

DESIGN-SPECIFIC REVIEW STANDARD for NuScale SMR DESIGN

6.6 INSERVICE INSPECTION AND TESTING OF CLASS 2 AND 3 COMPONENTS

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of the inspection, testing, evaluation, and repair of mechanical equipment and components

Secondary - Organization responsible for the review of probabilistic risk assessment (PRA), if a risk-informed Inservice Inspection Program is submitted

I. AREAS OF REVIEW

Inservice Inspection (ISI) Programs are based on the requirements of 10 CFR 50.55a, which requires that Code Class components meet the applicable inspection requirements set forth in Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (ASME Code). ISI includes preservice examinations before initial plant startup, as required by Articles IWC-2200, IWD-2200, IWE/IWL-2200, and IWF-2200 of ASME Code Section XI. ISI also includes periodic testing requirements set forth in ASME Code Section XI. Pressure, hydrostatic and leak tests for Code Class 2 and 3 components are addressed in ASME Code Section XI, Articles IWC-5000 and IWD-5000, and acceptance test alternatives to examinations for supports (other than dynamic restraints) for Code Class 2 and 3 components are addressed in Section XI, Article IWF-1200. However, inservice testing (IST) requirements for Code Class 2 and 3 components such as pumps, valves and dynamic restraints are set forth in the ASME Code for Operation and Maintenance of Nuclear Power Plants (ASME OM Code) and are addressed in the review performed under NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (SRP) Section 3.9.6, "Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints."

This design-specific review standard (DSRS) does not address those unique aspects of the NuScale design that may limit the effective use of ASME Code Section XI to ensure the safe operation of the plant. These unique aspects will be addressed by the applicant and reviewed by the staff on a case-by-case basis. When innovative designs are applied to ASME Code components, it is the responsibility of the applicant to assure that the corresponding ASME Code Section XI inspection requirements are evaluated for sufficiency and supplemented as necessary to ensure that structural and leak-tight integrity is maintained. The applicant should also assure that all SSCs that require ISI, including those that are not addressed in ASME Code Section XI, are appropriately inspected and tested commensurate with the importance of the safety functions to be performed.

The specific areas of review are as follows:

1. Components Subject to Examination. The descriptive information in the applicant's technical submittal is reviewed to establish that all ASME Code Class 2 and Class 3

components, as defined in ASME Code Section III, Article NCA-2000, "Classification of Components," subject to examination are included in the ISI Program. Such components include safety-related components and may also include nonsafety-related, risk-significant components that are subject to the regulatory treatment of nonsafety systems (RTNSS), based on the selection criteria in Section C.IV.9.3 of Regulatory Guide (RG) 1.206.

2. Accessibility. The descriptive information, including drawings, is reviewed to establish that the ASME Code Section XI, Article IWA-1500, "Accessibility," provisions for system accessibility are included in the applicant's layout and design of these systems.
3. Examination Categories and Methods. The required examination categories and methods included in Articles IWA-2000, IWC-2000, IWD-2000, and IWF-2000, "Examination and Inspection," of ASME Code Section XI are reviewed.
4. Inspection and Testing Intervals. The required examinations, inspections, and tests listed in the applicant's technical submittal and/or plant technical specifications or short-term availability controls are reviewed and compared to the requirements in ASME Code Section XI, Articles IWA-2000, IWC-2000, IWD-2000, and IWF-2000, to verify that they will be performed within the designated inspection interval.
5. Evaluation of Examination Results. The information concerning repair procedures is reviewed for compliance with ASME Code Section XI, Article IWA-4000, "Repair/Replacement Activities." The information concerning evaluation of examination results is reviewed for compliance with ASME Code Section XI, Articles IWC-3000 and IWD-3000, "Acceptance Standards," and IWF-3000, "Standards for Examination Evaluations." If the applicable ASME Code edition states that these requirements are in the course of preparation, the review should address suitable alternative provisions, such as those provided in ASME Code Section XI, Article IWB-3000, or those in later approved editions of the Code, as proposed by the applicant.
6. System Pressure Tests. The pressure test program is reviewed for compliance with ASME Code Section XI, Articles IWC-5000 and IWD-5000, "System Pressure Tests," to establish that leakage and signs of structural distress are inspected as required by the ASME Code.
7. Structural Supports: The ISI Program for examinations or alternative tests for fixed structural supports is reviewed for compliance with ASME Code Section XI, Article IWF-1200, "Component Supports Subject to Examination and Test," to establish that signs of structural distress are inspected as required by the ASME Code.
8. Code Exemptions from Examination. The ASME Code exemptions, as permitted by ASME Code Section XI, Articles IWC-1220 and IWD-1220, "Components Exempt from Examination," and IWF-1230, "Supports Exempt from Examination," are reviewed.
9. Relief Requests. Relief requests intended to be used are reviewed.
10. Code Cases. The acceptability of any ASME Code Section XI or ASME OM Code Cases that the applicant may have invoked in connection with the ISI Programs will be verified.

11. Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC). For design certification (DC) and combined license (COL) reviews, the staff reviews the applicant's proposed ITAAC associated with the SSCs related to this DSRS section in accordance with SRP Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria." The staff recognizes that the review of ITAAC cannot be completed until after the rest of this portion of the application has been reviewed against acceptance criteria contained in this DSRS section. Furthermore, the staff reviews the ITAAC to ensure that all SSCs in this area of review are identified and addressed as appropriate, in accordance with SRP Section 14.3.
12. COL Action Items and Certification Requirements and Restrictions. For a DC application, the review will also address COL action items and requirements and restrictions (e.g., interface requirements and site parameters).

For a COL application referencing a DC, a COL applicant must address COL action items (referred to as COL information in certain DCs) included in the referenced DC. Additionally, a COL applicant must address requirements and restrictions (e.g., interface requirements and site parameters) included in the referenced DC.
13. Operational Program Description and Implementation. For a COL application, the staff reviews the preservice inspection (PSI) and ISI program description and the proposed implementation milestones. The staff also reviews the applicant's technical submittal Table 13.4-x to ensure that the PSI and ISI Program and associated milestones are included.
14. For a COL application, the staff reviews the Containment Inspection Program submitted under DSRS Sections 3.8.X or 6.6 to assure the program meets the requirements of IWE/IWL-2200.
15. Risk-Informed ISI Programs. Risk-informed ISI programs may be submitted for U.S. Nuclear Regulatory Commission (NRC) staff review and authorization as an alternative to the regulations pursuant to 10 CFR 50.55a(z). The risk informed program is reviewed to verify that the applicant or licensee has demonstrated that either the program provides an acceptable level of quality and safety or that compliance with the current regulations would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Review Interfaces

Other SRP and DSRS sections interface with this section as follows:

1. The review of the adequacy of programs for assuring the integrity of bolting and threaded fasteners is performed under SRP Section 3.13, "Threaded Fasteners."
2. The review to ensure that systems and components are appropriately classified in accordance with regulatory requirements and NRC quality group classification guidance, including verification that quality group B and C components meet the requirements for Code Class 2 and 3 components, respectively, is performed under SRP Section 3.2.2, "System Quality Group Classification," and SRP Section 5.2.1.1, "Compliance with the Codes and Standards Rule, 10 CFR 50.55a."

3. The review of the design and ITAAC for ASME Code Class 1, 2, and 3 supports is performed under SRP Section 3.9.3, "ASME Code Class 1, 2, and 3 Components, and Component Supports, and Core Support Structures."
4. The review of the IST Programs for pumps, valves, and dynamic restraints that are designated as ASME Code Class 1, 2, or 3 or are otherwise designated as safety-related is performed under SRP Section 3.9.6, "Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints."
6. The review of PSI and ISI requirements for ASME Code Class 1 components of the reactor coolant pressure boundary is performed under SRP Section 5.2.4, "Reactor Coolant Pressure Boundary Inservice Inspection and Testing."
7. The review of the ISI requirements for steam generator tubes is performed under DSRS Section 5.4.2.2, "Steam Generator Program."
8. The review of plant programs for surveillance, testing, inspection, and maintenance of safety-related and/or risk-significant cooling water systems is performed under DSRS Section 5.4.7, "Residual Heat Removal (RHR) System"; DSRS Section 6.2.2, "Containment Heat Removal Systems"; DSRS Section 6.3, "Emergency Core Cooling System"; SRP Section 9.2.5, "Ultimate Heat Sink" and its associated refill system, DSRS Section 9.3.4, "Chemical and Volume Control System (PWR) Including Boron Recovery System"; and SRP Section 9.2.2, "Reactor Auxiliary Cooling Water Systems." These programs are coordinated with the ISI Programs reviewed under this DSRS section, SRP Section 3.9.3, SRP Section 3.9.6, and with the risk-informed assessment under the DSRS sections identified in the interface number 4 above.
9. The reviews of required quality assurance controls for inspection and testing activities and of the associated procedural controls for monitoring equipment performance and conditions are performed under SRP Section 17.5.
10. The augmented ISI program, as specified in SRP Section 3.6.2, that provides assurance against postulated piping failures of high-energy fluid systems between containment isolation valves is reviewed.
11. For COL reviews of operational programs, the review of the applicant's implementation plan is performed under SRP Section 13.4, "Operational Programs."
12. For COL reviews of technical specifications and short-term availability controls, the review of the applicant's implementation of ISI in surveillance requirements and administrative controls such as procedures, programs, and manuals for ISI Programs is performed under DSRS Section 16, "Technical Specifications."
13. The review of the risk significance of SSCs is performed under SRP Section 19.

II. ACCEPTANCE CRITERIA

Requirements

Acceptance criteria are based on meeting the relevant requirements of the following Commission regulations, including the general design criteria (GDC) in Appendix A to 10 CFR Part 50:

1. 10 CFR 50.36, as it pertains to surveillance requirements and administrative controls, using procedures and record keeping for periodic inspections and testing implementing the ASME Code for Class 2 and 3 systems and components.
2. 10 CFR 50.65, as it pertains to monitoring the performance or condition of SSCs against licensee-established goals in a manner sufficient to provide reasonable assurance that the safety-related and risk-significant SSCs are capable of fulfilling their intended functions where licensee-established goals are to be commensurate with safety and, where practical, take into account industrywide operating experience reflected in codes and standards
3. 10 CFR 50.55a, as it pertains to specification of the preservice and periodic inspection and testing requirements of the ASME Code and the ASME OM Code for Class 2 and 3 systems and components, 10 CFR 50.55a(g), which stipulates ISI requirements
4. GDC 36, as it pertains to designing the emergency core cooling system (ECCS) to permit appropriate periodic inspection of important safety components
5. GDC 37, as it pertains to designing the ECCS to permit appropriate testing to assure structural integrity, leak tightness, and the operability of the system
6. GDC 39, as it pertains to designing the containment heat removal system to permit inspection of important components
7. GDC 40, as it pertains to designing the containment heat removal system to permit appropriate pressure and functional testing
8. GDC 42, as it pertains to designing the containment atmosphere cleanup systems to permit an appropriate inspection of important components (i.e., hydrogen recombiners, containment atmosphere sampling lines, and isolation valves)
9. GDC 43, as it pertains to designing the containment atmosphere cleanup systems to permit appropriate periodic functional testing to assure the structural integrity of components and the operability and performance of components of the system
10. GDC 45, as it pertains to designing the cooling water systems to permit appropriate periodic inspection and testing of important components. (i.e., pumps, valves, piping, and heat exchangers, as appropriate, under this DSRS section or under SRP Section 3.9.6)
11. GDC 46, as it pertains to designing the cooling water systems to permit appropriate pressure and functional testing to assure structural and leaktight integrity of its

components and operability of active components (i.e., pumps and valves) (see SRP Section 3.9.6)

12. 10 CFR Part 50, Appendix B, as it pertains to inspections, tests, and associated procedural controls and documentation of results to assure the quality of the ISI Program implementation.
13. 10 CFR 52.47(b)(1), which requires that a DC application contain the proposed ITAAC that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a facility that incorporates the DC has been constructed and will be operated in conformity with the DC, the provisions of the Atomic Energy Act (AEA), and the NRC's regulations
14. 10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the AEA, and the NRC's regulations
15. 10 CFR 50.55a(g)(3), which requires that Class 1, 2, and 3 components (including supports) be designed and provided with access to enable the performance of inservice examinations of these components and to meet the preservice examination requirements set forth in the additions and addenda of Section XI of the ASME Boiler and Pressure Vessel Code incorporated by reference in paragraph (a)(1)) of 10 CFR 50.55a or the optional ASME Code Cases listed in NRC RG 1.147, Revision 17

DSRS Acceptance Criteria

Specific DSRS acceptance criteria that meet the relevant requirements of the NRC's regulations identified above are set forth below. The DSRS is not a substitute for the NRC's regulations, and compliance with it is not required. As an alternative, and as described in more detail below, an applicant may identify the differences between a DSRS section and the design features (DC and COL applications only), analytical techniques, and procedural measures proposed in an application and discuss how the proposed alternative provides an acceptable method of complying with the NRC regulations that underlie the DSRS acceptance criteria.

1. Components Subject to Inspection. The applicant's definition of ASME Code Class 2 and 3 components and systems subject to an ISI Program is acceptable if it is in agreement with the NRC quality group classification system or the definitions in ASME Code Section III, Article NCA-2000. The classification of components by the applicant is subject to review under SRP Section 3.2.2 for compliance with safety criteria pertaining to component classification. Where a specific item will be subject to inspection requirements different in any way from the ASME Code Section XI requirements corresponding to the item's Code Class, the exceptions for the item, including the ISI requirements to be applied, should be clearly identified and described. Exceptions involving less stringent inspection requirements for Code Class 2 or 3 items, other than those required by ASME Code Section XI, must be adequately justified. (Refer to SRP Section 3.2.2 or ASME Code Section III, Article NCA-2000.)

2. Accessibility. The design and arrangement of Class 2 and 3 systems must include allowances for adequate clearances to conduct the examinations specified in ASME Code Section XI, Articles IWC-2000, IWD-2000, and IWF-2000, at the frequency specified. The design and arrangement of system components are acceptable, if adequate clearance is provided in accordance with ASME Code Section XI, Article IWA-1500, and 10 CFR 50.55a(g)(3). Special design considerations are given to those systems that are intended to be examined during normal reactor operation.
3. Examination Categories and Methods. The examination categories and requirements specified in the applicant's technical submittal are acceptable if they are in agreement with the rules of ASME Code Section XI, Articles IWA-2000, IWC-2000, IWD-2000, IWE/IWL-2000, and IWF-2000. Every area subject to examination should fall within one or more of the examination categories and must be examined at least to the extent specified.

The applicant's examination techniques and procedures used for PSI and ISI are acceptable if they are in agreement with the following criteria:

- A. The methods, techniques, and procedures for visual, surface, or volumetric examination are in accordance with ASME Code Section XI, Article IWA-2000.
 - B. Alternative examination methods, combination of methods, or newly developed techniques other those given in A. above are acceptable, provided that the results are equivalent or superior. The acceptance standards for these alternative methods are given in ASME Code Section XI, Articles IWC-3000, IWD-3000, and IWF-3000.
 - C. The methods, procedures, and requirements regarding qualification of personnel performing ultrasonic examination reflect the guidance provided in Appendix VII, "Qualification of Nondestructive Examination Personnel for Ultrasonic Examination," to Division 1 of ASME Code Section XI.
 - D. Performance demonstration for ultrasonic examination procedures, equipment, and personnel used to detect and size flaws are in accordance with the requirements of Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems," to ASME Code Section XI, Division 1.
4. Inspection Intervals. The ISI program schedule provided in the applicant's technical submittal is acceptable, if the required examinations and pressure tests are specified for completion during each interval (hereinafter designated as the "inspection interval"), as required by ASME Code Section XI, Articles IWA-2000, IWC-2000, IWD-2000, and IWF-2000.
 5. Evaluation of Examination Results. The methods for evaluating examination results are reviewed for compliance with Articles IWC-3000, IWD-3000, and IWF-3000 in the Code. If the applicable edition of the ASME Code states that these articles are in the course of preparation, the rules of Article IWB-3000 shall apply. The repair procedures are acceptable, if they are in compliance with ASME Code Section XI, Article IWA-4000.

6. System Pressure Tests. The program provided in the applicant's technical submittal for Class 2 and 3 system pressure testing is acceptable, if it meets the criteria of ASME Code Section XI, Articles IWC-5000 and IWD-5000.
7. Structural Supports: The program provided in the applicant's technical submittal for examinations or alternative tests for fixed structural supports of Class 2 and 3 SSCs is acceptable, if it meets the criteria of ASME Code Section XI, Article IWF-1200.
8. Augmented ISI To Protect Against Postulated Piping Failures. The augmented ISI Program for high-energy fluid system piping between containment isolation valves is acceptable, if it specifies the following requirements:
 - A. Protective measures, structures, and guard pipes should not prevent the access required to conduct the inservice examinations specified in Division 1 of ASME Code Section XI.
 - B. For those portions of high-energy fluid system piping between containment isolation valves, the extent of inservice examination completed during each inspection interval should provide 100 percent volumetric examination of circumferential and longitudinal pipe welds within the boundary of these portions of piping.
 - C. For those portions of high-energy fluid system piping enclosed in guard pipes, inspection ports should be provided in the guard pipes to permit the required examination of circumferential pipe welds. Inspection ports should not be located in that portion of the guard pipe passing through the annulus of dual barrier containment structures.
 - D. The areas subject to examination should be defined in accordance with ASME Code Section XI, Article IWC-2000, Examination Category C-F for Class-2 piping welds.
9. Code Exemptions. The exemptions from ASME Code examination requirements identified by the applicant are acceptable, if they have been permitted by ASME Code Section XI, Articles IWC-1220, IWD-1220, or IWF-1230.
10. Relief Requests. At the DC or COL application stage, there should be no requests for relief from the ASME Code Section XI examination requirements that are found to be impractical, due to the limitations of design, geometry, or materials of construction of components that are evaluated in accordance with 10 CFR 50.55a. Interferences due to design, geometry, and materials of construction must be eliminated during the design stages to enable the performance of PSI/ISI examinations, in accordance with the regulations.
11. Code Cases. The exemptions from ASME Code examination requirements identified by the applicant or licensee are acceptable if they have been permitted by appropriate ASME Code Cases. If a Risk Informed ISI program is to be used at a later date, the appropriate ASME Code Case should be specified.
12. Operational Programs. For COL reviews, the description of the operational program and proposed implementation milestones for the PSI and ISI Programs for Class 2 and 3

components are reviewed in accordance with the requirements of 10 CFR 50.55a, "Codes and Standards." The implementation milestone for the ISI Program is when the plant enters into commercial operation.

13. Risk-Informed ISI Program. When submitting a risk informed ISI program, the applicant or licensee should provide all information necessary to meet the other DSRS acceptance criteria in this DSRS, including:
 - A. Components Subject to Inspection
 - B. Accessibility
 - C. Examination Categories and Methods
 - D. Inspection Intervals
 - E. Evaluation of Examination Results
 - F. System Pressure Tests
 - G. Structural Supports
 - H. Augmented ISI
 - I. Code Exemptions
 - J. Relief Requests
 - K. Code Cases
 - L. Proposed Implementation Milestones

As an alternative to the requirements of 10 CFR 50.55a, a risk-informed ISI Program is acceptable if it clearly demonstrates one of the following:

- A. The proposed alternative provides an acceptable level of quality and safety in comparison to the current requirements.
- B. Compliance with the current regulations would result in hardship or unusual difficulty without a compensating increase in the level of quality and safety.

Therefore, when describing each ISI program area, the applicant should include the following information for each case in which the program requirements are proposed as an alternative to the requirements of 10 CFR 50.55a or ASME Code Section XI:

- A. The requirement(s) for which the alternative is requested
- B. The proposed alternative(s)
- C. The basis for seeking authorization of the alternative

Technical Rationale

The technical rationale for applying these acceptance criteria to the areas of review addressed by this DSRS section is discussed in the following paragraphs:

1. Consistent with the provisions of 10 CFR 50.65(a); GDC 1; and 10 CFR Part 50, Appendix B, as related to performance and condition monitoring requirements and quality assurance controls for inspections and testing, 10 CFR 50.55a requires, in paragraph (a)(1), that SSCs be designed, fabricated, erected, constructed, tested, inspected, and maintained to quality standards commensurate with the importance of the safety function to be performed. Throughout the service life of a pressurized-water-cooled nuclear power reactor, its Code Class 2 and Class 3 systems

and components must meet the requirements of ASME Code Section XI and of the ASME OM Code. Regulations in 10 CFR 50.55a(g) address ISI requirements, while 10 CFR 50.55a(f) addresses IST requirements. ASME Code Section XI defines, for each Code Class, the time interval for ISI, the scope of the inspection activity, the inspection sample, the sample selection methodology, the method of inspection, the acceptance criteria for various types and sizes of material flaws identified during the inspection, and various other related technical details required for properly performing the required ISI activity. Compliance with the requirements of 10 CFR 50.55a ensures that periodic inspections will be performed on all Class 2 and Class 3 components for the purpose of detecting incipient degradations, leakage, indications of mechanical or structural distress caused by aging, fatigue, or corrosion, before jeopardizing the ability of the affected systems or components to perform their intended safety functions. Periodic inservice testing (such as pressure, hydrostatic and leak tests) are addressed in the ASME Code requirements for Class 2 and 3 components at ASME Code Section XI, Articles IWC-5000 and IWD-5000; testing is also an alternative acceptance option for Code Class supports (excluding dynamic restraints) under ASME Code Section XI, Article IWF-1200. Inservice testing of Class 2 and 3 pumps, valves, and dynamic restraints are addressed in the ASME OM Code and are reviewed under SRP Section 3.9.6.

2. GDC 36, 37, 39, 40, 42, 43, 45, and 46 require that the respective safety-related or risk-significant systems addressed by these criteria be designed such that they permit periodic inspection, pressure testing, and functional testing of system components and piping. Specific functional classes of components for each of the safety systems addressed are identified in the GDC. The ISI programs for Class 2 and Class 3 components rely upon these design provisions to allow performance of ISI and, where required, IST. Compliance with these GDC ensures that the design of the safety systems will allow accessibility of important components, so that periodic inspections can be performed that detect degradation, leakage, signs of mechanical or structural distress caused by aging, and fatigue or corrosion, before jeopardizing the ability of the systems to perform their intended safety-related or risk-significant functions.

III. REVIEW PROCEDURES

These review procedures are based on the identified DSRS acceptance criteria. For deviations from these acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives provide an acceptable method of complying with the relevant NRC requirements identified in Subsection II.

1. Selected Programs and Guidance—In accordance with the guidance in NUREG-0800, "Introduction – Part 2: Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: Light-Water Small Modular Reactor Edition" (NUREG-0800, Intro Part 2), as applied to this DSRS section, the staff will review the information proposed by the applicant to evaluate whether it meets the acceptance criteria described in Subsection II of this DSRS. As noted in NUREG-0800, Intro Part 2, the NRC requirements that must be met by an SSC do not change under the small modular reactor (SMR) framework. Using the graded approach described in NUREG-0800, Intro Part 2, the NRC staff may determine that, for certain SSCs, the applicant's basis for compliance with other selected NRC requirements may help demonstrate satisfaction of the applicable acceptance criteria for that SSC in lieu of detailed independent analyses.

The design-basis capabilities of specific SSCs would be verified, where applicable, as part of completing the applicable ITAAC. The use of the selected programs to augment or replace traditional review procedures is shown in Figure 1 of NUREG-0800, Intro Part 2. Examples of such programs that may be relevant to the graded approach for these SSCs include:

- 10 CFR Part 50, Appendix A, GDC, Overall Requirements, Criteria 1–5
- 10 CFR Part 50, Appendix B, Quality Assurance (QA) Program
- 10 CFR 50.49, Environmental Qualification of Electrical Equipment (EQ) Program
- 10 CFR 50.55a, Code Design, Inservice Inspection, and Inservice Testing (ISI/IST) Programs
- 10 CFR 50.65, Maintenance Rule requirements
- Reliability Assurance Program (RAP)
- 10 CFR 50.36, “Technical Specifications”
- Availability Controls for SSCs Subject to Regulatory Treatment of Nonsafety Systems (RTNSS)
- Initial Test Program (ITP)
- Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)

This list of examples is not intended to be all inclusive. It is the responsibility of the technical reviewers to determine whether the information in the application, including the degree to which the applicant seeks to rely on such selected programs and guidance, demonstrates that all acceptance criteria have been met to support the safety finding for a particular SSC.

2. In accordance with 10 CFR 52.47(a)(8), (21), and (22), and 10 CFR 52.79(a)(17), (20), and (37), for DC or COL applications submitted under 10 CFR Part 52, the applicant is required to (1) address the proposed technical resolution of unresolved safety issues and medium- and high-priority generic safety issues, which are identified in the version of NUREG-0933, “Resolution of Generic Safety Issues,” current on the date up to 6 months before the docket date of the application and which are technically relevant to the design, (2) demonstrate how the operating experience insights have been incorporated into the plant design, and (3) provide information necessary to demonstrate compliance with any technically relevant portions of the Three Mile Island requirements set forth in 10 CFR 50.34(f), except paragraphs (f)(1)(xii), (f)(2)(ix), and (f)(3)(v), for a DC application, and except paragraphs (f)(1)(xii), (f)(2)(ix), (f)(2)(xxv), and (f)(3)(v), for a COL application. These cross-cutting review areas should be addressed by the reviewer for each technical subsection and relevant conclusions documented in the corresponding safety evaluation report (SER) section.

3. Components Subject to Inspection. The applicant's component and system classifications, the corresponding proposed inspection or test requirements for each classification, and the proposed exceptions are reviewed for agreement with the acceptance criteria of Subsection II.1 of the DSRS acceptance criteria in this DSRS section as the basis for determining the acceptability of component inclusion in the ISI Programs.
4. Accessibility. The design and arrangement of Class 2 and 3 systems are reviewed in terms of accessibility for ISI to establish that the design is in conformance with the acceptance criteria of Subsection II.2 of the DSRS acceptance criteria in this DSRS section. No remote inspection program is required for ASME Code Class 2 or 3 components. Limitations due to design, materials of construction, and geometry are to be eliminated to enable the performance of inservice examinations.
5. Examination Categories and Methods. The reviewer verifies that the examination categories and methods, as described by the applicant's technical submittal, are in conformance with the acceptance criteria in Subsection II.3 of this DSRS section.

The reviewer verifies that the training and requalification requirements of the applicant's ISI Programs are in conformance with applicable portions of ASME Code Section XI and/or the ASME OM Code, where the latter is applicable to the plant's Expert Panel for inservice testing. Qualification of personnel performing ultrasonic examinations should contain the elements of Appendix VII to ASME Code Section XI.

The reviewer verifies that the ultrasonic examination systems required by the applicant's ISI Program meet the requirements of Appendix VIII to Division 1 of ASME Code Section XI, in accordance with the implementation requirements of 10 CFR 50.55a.

The reviewer also verifies that an appropriate long-term monitoring program for potential wall thinning of high-energy piping by erosion or corrosion, pursuant to Generic Letter 89-08 and NUREG-1344, has been incorporated into the ISI program.

6. Inspection Intervals. The ISI program for Class 2 and 3 components in the IST Program in the administrative controls of the plant technical specifications is reviewed to establish that each area and component in the program is inspected on a schedule in conformance with the acceptance criteria in Subsection II.4 of this DSRS section.
7. Evaluation of Examination Results. The reviewer verifies that the applicant's technical submittal describes methods for evaluating examination results in accordance with the acceptance criteria in Subsection II.5 of this DSRS section.
8. System Pressure Test. The reviewer verifies that the applicant's technical submittal describes the system pressure test program in accordance with the acceptance criteria in Subsection II.6 of this DSRS section.
9. Structural Supports: The reviewer verifies that the applicant's technical submittal describes the examinations or alternative tests for fixed structural supports of Class 2 and 3 SSCs, in accordance with the acceptance criteria in Subsection II.7 of this DSRS section. Dynamic restraints are reviewed under SRP Section 3.9.6.

10. Augmented ISI To Protect Against Postulated Piping Failures. The reviewer verifies that the applicant's technical submittal describes an augmented ISI Program that meets the acceptance criteria identified in Subsection II.8 of this DSRS section.
11. Code Exemptions. The reviewer verifies that the exemptions from ASME Code examinations identified by the applicant or licensee are in accordance with the acceptance criteria identified in Subsection II.9 of this DSRS section.
12. Relief Requests. There should not be a need for a DC or COL applicant to request relief from an ASME Code Section XI requirement based on limitations of the design, geometry, or materials of construction, because any deficiencies should be addressed during the design stages. Regulations in 10 CFR 50.55a require Class 2 and 3 components (including their supports) to be designed and provided with access to perform preservice and inservice examinations in accordance with the ASME Code.
13. Operational Programs. The reviewer verifies that the PSI and ISI Programs are fully described and that implementation milestones have been identified. The reviewer verifies that the programs and implementation milestones are included in the applicant's technical submittal, Table 13.4-x.

Implementation of this program will be inspected in accordance with NRC Inspection Manual Chapter IMC-2504, "Construction Inspection Program—Non-ITAAC Inspections."

14. The reviewer verifies that the design, including requirements and restrictions (e.g., interface requirements and site parameters), set forth in the final safety analysis report (FSAR) meets the acceptance criteria. The reviewer should also consider the appropriateness of identified COL action items. The reviewer may identify additional COL action items; however, to ensure these COL action items are addressed during a COL application, they should be added to the design control document.

For review of a COL application, the scope of the review is dependent on whether the COL applicant references a DC, an early site permit (ESP), or other NRC approvals (e.g., manufacturing license, site suitability report, or topical report).

For review of both DC and COL applications, SRP Section 14.3 should be followed for the review of ITAAC. The ITAAC review cannot be completed until after the completion of this section.

15. The reviewer assures that inspection of the containment in accordance with IWE/IWL is part of the operational program and is discussed either in this section or Section 3.8.
16. Risk-Informed ISI. The ISI program reviewer verifies that the applicant's (or licensee's) technical submittal describes a risk-informed ISI Program that meets the acceptance criteria identified in Subsection II.13 of this DSRS section. The PRA reviewer verifies that the probabilistic risk analyses are suitable and that risk insights have been appropriately implemented.

IV. EVALUATION FINDINGS

The reviewer verifies that the applicant has provided sufficient information and that the staff's technical review and analysis, as augmented by the application of programmatic requirements, in accordance with the staff's technical review approach in the DSRS Introduction, support conclusions of the following type to be included in the staff's SER. The reviewer also states the bases for those conclusions.

To ensure that no deleterious defects develop during service in ASME Code Class 2 and 3 system components, the reactor containment, selected welds, and weld heat-affected zones are inspected before reactor startup and periodically throughout the life of the plant. In addition, Code Class 2 and 3 systems receive visual inspections while the systems are pressurized to detect leakage, signs of mechanical or structural distress, and corrosion.

The applicant (licensee) has stated that the inservice inspection and test (ISI) Program will comply (complies) with the rules published in 10 CFR 50.55a, and ASME Code Section XI, () Edition, including addenda through the () Addenda. The ISI program will consist of a PSI plan and an ISI plan.

The staff concludes that the ISI program is acceptable and meets the inspection and pressure/leak testing requirements of GDC 36, 37, 39, 40, 42, 43, 45, and 46 and 10 CFR 50.55a. This conclusion is based on the applicant or licensee meeting the requirements of ASME Code Section XI, as reviewed by the staff and determined to be appropriate for this application.

The applicant-described PSI and ISI, Programs for Class 2 and 3 components and containment and implementation milestones in the applicant's technical submittal Table 13.4-x are in conformance with 10 CFR 50.55a.

For DC and COL reviews, the findings will also summarize the staff's evaluation of requirements and restrictions (e.g., interface requirements and site parameters) and COL action items relevant to this DSRS section.

In addition, to the extent that the review is not discussed in other SER sections, the findings will summarize the staff's evaluation of the ITAAC, including design acceptance criteria, as applicable.

V. IMPLEMENTATION

The regulations in 10 CFR 52.17(a)(1)(xii), 10 CFR 52.47(a)(9), and 10 CFR 52.79(a)(41) establish requirements for applications for ESPs, DCs, and COLs, respectively. These regulations require the application to include an evaluation of the site (ESP), standard plant design (DC), or facility (COL) against the SRP revision in effect 6 months before the docket date of the application. While the SRP provides generic guidance, the staff developed the SRP guidance based on the staff's experience in reviewing applications for construction permits and operating licenses for large light-water nuclear power reactors. The proposed SMR designs, however, differ significantly from large light-water nuclear power plant designs.

In view of the differences between the designs of SMRs and the designs of large light-water power reactors, the Commission issued Staff Requirements Memorandum (SRM)-COMGBJ-10-0004/COMGEA-10-0001, "Use of Risk Insights To Enhance the Safety Focus of Small Modular Reactor Reviews," dated August 31, 2010. In the SRM, the

Commission directed the staff to develop risk-informed licensing review plans for each of the SMR design reviews, including plans for the associated preapplication activities. Accordingly, the staff has developed the content of the DSRS as an alternative method for evaluating a NuScale-specific application submitted pursuant to 10 CFR Part 52, and the staff has determined that each application may address the DSRS in lieu of addressing the SRP, with specified exceptions. These exceptions include particular review areas in which the DSRS directs reviewers to consult the SRP and others in which the SRP is used for the review. If an applicant chooses to address the DSRS, the application should identify and describe all differences between the design features (DC and COL applications only), analytical techniques, and procedural measures proposed in an application and the guidance of the applicable DSRS section (or SRP section, as specified in the DSRS), and discuss how the proposed alternative provides an acceptable method of complying with the regulations that underlie the DSRS acceptance criteria.

The staff has accepted the content of the DSRS as an alternative method for evaluating whether an application complies with NRC regulations for NuScale SMR applications, provided that the application does not deviate significantly from the design and siting assumptions made by the NRC staff while preparing the DSRS. If the design or siting assumptions in a NuScale application deviate significantly from the design and siting assumptions the staff used in preparing the DSRS, the staff will use the more general guidance in the SRP as specified in 10 CFR 52.17(a)(1)(xii), 10 CFR 52.47(a)(9), or 10 CFR 52.79(a)(41), depending on the type of application. Alternatively, the staff may supplement the DSRS section by adding appropriate criteria to address new design or siting assumptions.

VI. REFERENCES

1. 10 CFR 50.36, "Technical Specifications."
2. 10 CFR 50.55a, "Codes and Standards."
3. 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."
4. 10 CFR Part 50, Appendix A, GDC 1, "Quality Standards and Records."
5. 10 CFR Part 50, Appendix A, GDC 36, "Inspection of Emergency Core Cooling System"
6. 10 CFR Part 50, Appendix A, GDC 37, "Testing of Emergency Core Cooling System."
7. 10 CFR Part 50, Appendix A, GDC 39, "Inspection of Containment Heat Removal System."
8. 10 CFR Part 50, Appendix A, GDC 40, "Testing of Containment Heat Removal System."
9. 10 CFR Part 50, Appendix A, GDC 42, "Inspection of Containment Atmosphere Cleanup Systems."
10. 10 CFR Part 50, Appendix A, GDC 43, "Testing of Containment Atmosphere Cleanup Systems."
11. 10 CFR Part 50, Appendix A, GDC 45, "Inspection of Cooling Water Systems."

12. 10 CFR Part 50, Appendix A, GDC 46, "Testing of Cooling Water System."
13. 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants."
14. 10 CFR 52.47, "Contents of Applications; Technical Information."
15. 10 CFR 52.79, "Contents of Applications; Technical Information in Final Safety Analysis Report."
16. 10 CFR 52.80, "Contents of Applications; Additional Technical Information."
17. RG 1.68, "Initial Test Programs for Water-Cooled Nuclear Power Plants."
18. RG 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."
19. RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)."
20. RG 1.215, "Guidance for ITAAC Closure under 10 CFR Part 52."
21. NUREG-1344, "Erosion/Corrosion Induced Pipe Wall Thinning in U.S. Nuclear Power Plants."
22. NRC Generic Letter No. 89-08, "Letter to All Holders of Operating Licenses or Construction Permits for Nuclear Power Plants, "Erosion/Corrosion-Induced Pipe Wall Thinning."
23. ASME Boiler and Pressure Vessel Code, Section III, "Rules for Construction of Nuclear Facility Components," Article NCA-2000, "Classification of Components," American Society of Mechanical Engineers.
24. ASME Boiler and Pressure Vessel Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," Division 1, "Rules for Inspection and Testing of Components of Light-Water Cooled Plants," American Society of Mechanical Engineers.
25. ASME Code for Operation and Maintenance of Nuclear Power Plants, Division," American Society of Mechanical Engineers.
26. NRC Inspection Manual Chapter IMC-2504, "Construction Inspection Program— Inspection of Construction and Operational Programs," October 15, 2009.