U.S. NUCLEAR REGULATORY COMMISSION

DESIGN-SPECIFIC REVIEW STANDARD FOR NuScale SMR DESIGN

10.4.7 CONDENSATE AND FEEDWATER SYSTEM

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of power conversion systems

Secondary - None

I. AREAS OF REVIEW

The condensate and feedwater system (CFW) provides feedwater at the required temperature, pressure, and flow rate to the steam generators (SGs). Condensate is pumped from the main condenser hotwell by the condensate pumps, passes through the low- and intermediate-pressure feedwater heaters to the feedwater pumps, and then is pumped through the high-pressure feedwater heaters into the tube side of the helical coil steam generator.

The primary reviewer reviews the CFW from the condenser outlet up to the steam generator to ensure conformance to General Design Criteria (GDC) 2, 4, 5, 44, 45, and 46. There are also interfaces with the secondary water makeup system, the decay heat removal system (DHRS) and the condensate cleanup system. The CFW is used for normal shutdown. The portions of the CFW classified as safety-related includes the system that supplies initial feed flow to the DHRS and the feedwater piping from the SG inlet nozzles up to and including the outermost containment isolation valve. These portions of the system must be designed to ensure feedwater system isolation in accident situations (such as a feedwater line break) and containment isolation in cases in which the feedwater system could potentially become a containment bypass pathway (e.g., steam generator tube rupture).

The specific areas of review are as follows:

1. Review of the characteristics of the CFW with respect to the capability to supply adequate feedwater to the nuclear steam supply system, as required for normal operation and shutdown.

2. Determination that an acceptable design has been established for:

   A. The interface of the CFW with the NSSS module with regards to functional design requirements and seismic design classification. This includes provisions for manual connection and disconnection of the CFW module to the NSSS during module installation, refueling outages, or replacement or removal of NSSS module.

   B. The interfaces of the CFW with DHRS with regard to functional design requirements and seismic design classification.

ADAMS Accession No.ML15126A470

C. The interfaces of the CFW with secondary makeup and the condensate cleanup system with regard to functional design requirements and seismic design classification.

D. The feedwater system with regard to possible fluid flow instabilities (e.g., water hammer) during normal plant operation as well as during upset or accident conditions.

E. The detection of major system leaks that could affect the functional performance of safety-related equipment.

3. 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 structures, systems, and components (SSCs) related to this design-specific review standard (DSRS) section in accordance with Standard Review Plan (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 and appropriate subsections.

4. 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 license 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.

Review Interfaces

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

1. Review of flood protection is performed under DSRS Section 3.4.1.

2. Review of the protection against internally generated missiles outside containment is performed under DSRS Section 3.5.1.1.

3. Review of the protection against internally generated missiles inside containment that is performed under DSRS Section 3.5.1.2

4. Review of protection against missiles generated by natural phenomena, including tornados, is performed under DSRS Section 3.5.1.4.

5. Review of the SSCs to be protected against externally generated missiles is performed under DSRS Section 3.5.2.

6. Review of high- and moderate-energy pipe breaks is performed under SRP Section 3.6.1.

7. Review of the fire protection program is performed under SRP Section 9.5.1.1.

8. Review of the environmental qualification of mechanical and electrical equipment is performed under DSRS Section 3.11.

9. Determination that transients resulting from feedwater flow control malfunctions will not violate the primary system pressure boundary integrity criterion are performed under DSRS Sections 15.1.1 through 15.1.4.

10. Determination that the loss of normal feedwater flow will not violate the fuel damage criterion or the system pressure boundary integrity criterion is performed under DSRS Section 15.2.7.

11. Evaluation of the system power sources with respect to their capability to perform safety-related functions during normal, transient, and accident conditions is performed under DSRS Section 8.3.1.

12. Review of the acceptability of design analyses, procedures, and criteria used to establish the ability of seismic Category I structures housing the system and supporting systems to withstand the effects of natural phenomena such as the safe-shutdown earthquake (SSE), the probable maximum flood (PMF), and tornado missiles are performed under DSRS Sections 3.3.1, 3.3.2, 3.5.3, 3.7.1 through 3.7.3, and 3.8.5; and SRP Section 3.7.4.

13. Determination that the components, piping, and structures are designed in accordance with applicable codes and standards is performed under DSRS Section 3.9.1 and SRP Sections 3.9.3. The analysis includes a determination of the acceptability of design analyses, procedures, and criteria used to establish the adequacy of devices or restraints as they may relate to significant water hammers in system piping, and a review of test programs of components that may be affected by water hammers.

14. Determination of the acceptability of seismic and quality group classifications for system components is performed under DSRS Sections 3.2.1 and 3.2.2.

15. Review of the adequacy of the inservice testing program of pumps and valves is performed under DSRS Section 3.9.6.

16. Review of the adequacy of the containment isolation system and the acceptability of the containment leakage testing program, is performed under DSRS Sections 6.2.4 and 6.2.6.

17. Verification that preservice inspection requirements are met for system components is performed under DSRS Section 6.6.

18. Evaluation of feedwater system materials, including their selection and fabrication, fracture toughness of Class 2 and 3 components, and flow-accelerated corrosion is performed under DSRS Section 10.3.6.

19. Review of technical specifications is performed under DSRS Chapter 16.0.

20. Review of quality assurance programs is performed under SRP Chapter 17.0.

21. Review of the seismic qualification of Category I instrumentation and electrical equipment is performed under DSRS Section 3.10.

22. Review of the instrumentation and controls associated with the steam generator level control system is performed under DSRS Chapter 7 upon request of the primary reviewer.

23. Review of the probabilistic risk assessment performed under SRP Chapter 19.0 for potential risk significance of CFW elements.

II. ACCEPTANCE CRITERIA

Requirements

Acceptance criteria are based on meeting the relevant requirements of the following Commission regulations:

1. GDC 2, Design Bases for Protection Against Natural Phenomena.

2. GDC 4, Environmental and Dynamic Effects Design Bases.

3. GDC 5, Sharing of Structures, Systems, and Components.

4. GDC 44, Cooling Water.

5. GDC 45, Inspection of cooling water system.

6. GDC 46, Testing of cooling water system

7. Title 10 of the *Code of Federal Regulations* (CFR), Section 20.1406, as it relates to the detection and isolation of radioactive material in the CFW so as to minimize contamination of the associated systems, facility, and the environment; and also eventual decommissioning.

8. 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 operate in conformity with the DC, the provisions of the Atomic Energy Act (AEA), and the U.S. Nuclear Regulatory Commission’s (NRC's) rules and regulations;

9. 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 be

operated in conformity with the COL, the provisions of the AEA, and the NRC's rules and regulations.

DSRS Acceptance Criteria

Specific DSRS acceptance criteria acceptable to 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. Seismic Events. The applicant demonstrates how it meets the requirements of GDC 2 as they relate to demonstrating that SSCs important to safety will be designed to withstand the effects of natural phenomena such as earthquakes. Acceptance is based on conformance with the guidance of Regulatory Guide (RG) 1.29, Position C.1 for safety-related portions and Position C.2 for nonsafety-related portions.

2. Dynamic Effects. The applicant demonstrates how it meets the requirements of GDC 4, as related to protecting structures, systems and components against the dynamic effects associated with possible fluid flow instabilities (e.g., water hammers) during normal plant operation, as well as during abnormal and accident conditions, as they relate to meeting the guidance related to feedwater-control-induced water hammer. Guidance for water hammer prevention and mitigation is found in NUREG-0927, Revision 1.

   Failure of high-energy piping, such as feedwater piping can result in complex challenges to operating staff and the plant because of potential system interactions of high energy steam. Accordingly, material standards and inspection programs, shall incorporate adequate considerations to avoid erosion and corrosion. Guidance for acceptable inspection programs is found in Generic Letter (GL) 89-08 and in Electric Power Research Institute (EPRI) Report No. 1015425 (NSAC-202L-R3) "Recommendations for an Effective Flow-Accelerated Corrosion Program," August 2007.

3. Sharing of Structures, Systems, and Components. The applicant demonstrates how it meets the requirements of GDC 5 as they relate to demonstrating the capability of important to safety components in the CFW, which are shared by multiple units, to perform their required safety functions.

4. Heat Removal Capability. The applicant demonstrates how it meets the requirements of GDC 44, as related to the capability to transfer heat from SSCs important to safety to an ultimate heat sink, as they relate to demonstrating that the CFW is capable of providing heat removal under both normal operating and accident conditions. Sufficient redundancy of components is demonstrated so that under accident conditions the safety function can be performed assuming a single active component failure (which may be coincident with the loss of offsite power for certain events.) The system demonstrates capability to isolate components, subsystems, or piping if required so that the system safety function will be maintained.

5. Inspection. The applicant demonstrates how it meets the requirements of GDC 45 as they relate to demonstrating that the design contains provisions to permit periodic inservice inspection of system components and equipment.

6. Testing. The applicant demonstrates how it meets the requirements of GDC 46 as they relate to demonstrating that the design contains provisions to permit appropriate functional testing of the system and components to ensure structural integrity and leak-tightness, operability and performance of active components, and capability of the integrated system to function as intended during normal, shutdown, and accident conditions.

7. Flow Accelerated Corrosion. Piping system designs, including material standards and inspection programs, shall incorporate adequate considerations to avoid erosion and corrosion. Guidance for acceptable inspection programs is found in GL 89-08 and in EPRI Report No. 1015425 (NSAC-202L-R3)

Technical Rationale

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

1. GDC 2 requires that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes.

   This criterion applies to DSRS Section 10.4.7 because the review identifies safety-related and risk-significant CFW components and determines that they are designed to withstand the effects of earthquakes and other natural phenomena. CFW is isolated in the event of certain accidents. RG 1.29, Positions C.1 and C.2, provides guidance for determining compliance with this criterion.

   Meeting the requirements of this criterion provides a level of assurance that the capability to shutdown the reactor safety will be maintained during the most severe expected earthquake or other natural phenomena.

2. GDC 4 requires that SSCs important to safety shall be appropriately protected against dynamic effects that may result from equipment failures and from events and conditions outside the nuclear power unit.

   GDC 4 applies to DSRS Section 10.4.7 because the review verifies that safety-related and risk-significant CFW components are protected against the effects of high-energy pipe ruptures. CFW is isolated in the event of certain accidents. This review also considers the dynamic consequences of flow instabilities (specifically, water hammer) resulting from normal operation and during anticipated operational occurrences.

   Meeting the requirements of this criterion provides further assurance that the integrity of the feedwater piping will be maintained, thereby minimizing the likelihood of a loss-of-coolant accident (LOCA) that could cause fuel damage.

3. GDC 5 requires that SSCs important to safety shall not be shared by nuclear power units, unless it can be shown that such sharing will not significantly impair the ability to perform safety functions, including an orderly shutdown and cooldown of remaining units in the event of an accident in one unit.

   GDC 5 applies to DSRS Section 10.4.7 because the review determines whether safety-related and risk-significant CFW components are shared and, if so, evaluates the impact of that sharing on safety functions.

   Meeting the requirements of this criterion provides further assurance that all reactors at a multiple-unit site will be capable of completing normal shutdown in the event of a component failure in one reactor.

4. GDC 44 requires that a system be provided to transfer heat from SSCs important to safety to an ultimate heat sink. The safety function of this system shall be to transfer the specified combined heat load under normal operating and accident conditions. Suitable redundancy in components and features, as well as suitable interconnections, leak detection, and isolation capabilities, shall be provided to ensure that the system safety function can be accomplished for loss of either onsite or offsite power assuming a single failure.

   GDC 44 applies to DSRS Section 10.4.7 because the review establishes that the CFW is capable of providing heat removal from the reactor system during normal conditions. Meeting the requirements of this criterion provides a level of assurance that the capability for heat removal from the reactor will be retained during normal and accident conditions, thus protecting fuel cladding from elevated temperatures.

5. GDC 45 requires that the cooling water system shall be designed to permit appropriate periodic inspection of important components (e.g., heat exchangers and piping) to assure the integrity and capability of the system.

   GDC 45 applies to DSRS Section 10.4.7 because the CFW provides cooling water to the reactor or steam generators and because the CFW is isolated in the event of certain accidents. This review verifies that the feedwater system design facilitates inspection.

   Meeting the requirements of this criterion provides a level of assurance that the CFW will be able to perform its safety function in the event of an accident.

6. GDC 46 requires that the cooling water system shall be designed to permit appropriate periodic pressure and functional testing that will assure (a) the structural and leaktight integrity of cooling water system components, (b) the operability and the performance of the system's active components, and (c) the operability of the system as a whole and, under conditions as close to design as practical, the performance of the full operational sequence that brings the system into operation for reactor shutdown and for LOCAs, including operation of applicable portions of the protection system and the transfer between normal and emergency power sources. GDC 46 applies to DSRS Section 10.4.7 because the CFW provides the proper cooling water inventory for PWR steam

generators during normal operation. The CFW is isolated after a loss-of-feedwater accident has occurred.

Meeting the requirements of this criterion provides a level of assurance that the CFW will be able to perform reliably under normal operating conditions and will perform its safety function in the event of an accident.

7. The application demonstrates how it meets the requirements of 10 CFR 20.1406 as they relate to the interconnections between the CFW and other plant systems are designed to preclude CFW contamination of connecting systems, or the contamination of CFW by connections with interfacing radioactive systems.

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: Integral Pressurized Water 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 SMR framework. Using the graded approach described in NUREG-0800 Intro Part 2, the NRC staff may determine that, for certain structures, systems, and components (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 completion of the applicable ITAAC. The use of the selected programs to augment or replace traditional review procedures is described in Figure 1 of NUREG-0800, Introduction - Part 2. Examples of such programs that may be relevant to the graded approach for these SSCs include:

    - 10 CFR Part 50, Appendix A, General Design Criteria (GDC), Overall Requirements, Criteria 1 through 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 Non-Safety 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 design certification or combined license applications submitted under 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 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. The system has been designed to function as required for all modes of operation. The results of failure modes and effects analyses presented in the safety analysis report (SAR), if any, are used in making this determination.

4. The system piping is designed to preclude hydraulic instabilities from occurring in the piping for all modes of operation. As appropriate, the reviewer evaluates the results of model tests and analyses that are relied on to verify that water hammer will not occur, or proposed tests of the installed system that are intended to verify design adequacy.

   The feedwater control valve and controller design shall be verified to be stable and to be compatible with system(s) under imposed operating conditions (e.g., control functions required, range of control and pressure drop characteristics, valve stroke, trim, etc.). Test data or operating experience data shall be used where available. In addition, the applicant has committed to review plant operating and maintenance procedures to ensure that precautions for avoidance of steam/water hammer and water hammer occurrences have been provided.

   Guidance for water hammer prevention and mitigation is found in NUREG-0927.

5. The outermost containment isolation valves and all downstream piping to the nuclear steam supply system are designed in accordance with seismic Category I requirements. The review for seismic design and the review for seismic and quality group classification are performed as indicated in Subsection I of this DSRS section.

6. The CFW design, or other plant systems, provide the capability to detect and control leakage from the system.

7. The essential portion of the system has been designed so that system function will be maintained as required in the event of adverse environmental phenomena or loss of offsite power. The review for protection against natural phenomena is performed in the Chapter 3 DSRS sections. The reviewer evaluates the system, using engineering judgment and the results of failure modes and effects analyses, to determine that the failure of nonessential portions of the system or of other systems not designed to seismic Category I standards (and located close to essential portions of the system), will not preclude operation of the essential portions of the CFW. The reviewer shall also ensure that failure of nonseismic Category I structures that house, support, or are close to essential portions of the CFW will not preclude operation of the essential portions of the CFW.

8. Piping system designs, including material standards and inspection programs, incorporate adequate considerations to avoid erosion and corrosion. Guidance for acceptable inspection programs is found in GL 89-08 and in EPRI Report No. 1015425 (NSAC-202L-R3)

9. For multiple-unit sites, sharing of any CFW safety-related and risk-significant SSCs will not impair its ability to perform its intended safety function.

For review of a DC application, the reviewer should follow the above procedures to verify 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. DCs have referred to the FSAR as the design control document (DCD). 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 DCD.

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 review of ITAAC cannot be completed until after the completion of this section.

IV. EVALUATION FINDINGS

The reviewer verifies that the applicant has provided sufficient information and that the staff's technical review and analysis support conclusions of the following type to be included in the staff's SER. The reviewer also states the bases for those conclusions.

The CFW includes all components and equipment from the condenser outlet to the connections with the nuclear steam supply system and secondary makeup and cleanup system. Based on

the review of the applicants proposed design criteria, the design bases, and safety classification for the safety-related portions of the condensate and feedwater system and the requirements for system performance for all conditions of plant operation, the staff concludes that the design of the condensate and feedwater system and supporting systems is in conformance with the Commission regulations as set forth in GDCs 2, 4, 5, 44, 45, and 46. This conclusion is based on the following and the fact that programmatic requirements will provide assurance that the CFW will be designed, installed, and tested as described in the FSAR:

1. The applicant has met the requirements of GDC 2 with respect to safety-related portions of the system being capable of withstanding the effects of earthquakes by meeting RG 1.29, Position C.1 for the safety-related portions and Position C.2 for the nonsafety-related portions.

2. The applicant has met the requirements of GDC 4 with respect to the dynamic effects associated with possible fluid flow instabilities (e.g., water hammers) by having the feedwater system designed in accordance with the guidance contained in NUREG-0927 and thereby eliminating or reducing the possibility of water hammers in steam generators

   The applicant has adequately addressed feedwater control valve and controller designs with respect to water hammer potential and the applicant has committed to review operating and maintenance procedures to ensure that precautions taken will minimize, or avoid, water hammers.

3. The applicant has met the requirements of GDC 5 with respect to the capability of shared safety-related or risk significant systems and components perform required functions. The interconnections of the CFW between each unit are designed so that the capability to mitigate the consequences of an accident in either unit and to achieve safe-shutdown in that unit is retained without reducing the capability of the other unit to achieve safe-shutdown.

4. The applicant has met the requirements of GDC 44 with respect to cooling water by providing a redundant and isolable system capable of transferring heat loads from the reactor system to a heat sink under both normal operating and accident conditions. The applicant has demonstrated that the condensate and feedwater system can provide sufficient cooling water to transfer the heat load of the reactor system under normal operating conditions. The applicant has also demonstrated that portions of the system can be isolated during accidents that occur concurrently with loss of onsite or offsite power and a single failure so that the safety function of the system will not be compromised.

5. The applicant has met the requirements of GDC 45 with respect to inspection of cooling water systems by providing a feedwater system design that permits inservice inspection of safety-related components and equipment, including inspection of piping systems for erosion and corrosion, and inspection of feedwater nozzles for fatigue.

6. The applicant has met the requirements of GDC 46 with respect to testing of cooling water systems by providing a feedwater system design that permits operational

functional testing of the system and its components. Functional testing ensures structural integrity and leaktightness, operability, and performance of active components during normal, shutdown, and accident conditions.

The staff concludes that the design of the CFW conforms to all applicable GDCs and positions of the RG cited and is, therefore, acceptable. 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 DSRS 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 Standard Review Plan (SRP) revision in effect six 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 small modular reactor (SMR) designs, however, differ significantly from large light-water nuclear reactor 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 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 (ML102510405) (SRM). 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 pre-application activities. Accordingly, the staff has developed the content of the DSRS as an alternative method for the evaluation of 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 in order to address new design or siting assumptions.

VI. REFERENCES

1. 10 CFR Part 20.1406, 'Minimization of Contamination."
2. 10 CFR Part 50, Appendix A, GDC 2, "Design Bases for Protection Against Natural Phenomena."
3. 10 CFR Part 50, Appendix A, GDC 4, "Environmental and Dynamic Effects Design Bases."
4. 10 CFR Part 50, Appendix A, GDC 5, "Sharing of Structures, Systems, and Components."
5. 10 CFR Part 50, Appendix A, GDC 44, "Cooling Water."
6. 10 CFR Part 50, Appendix A, GDC 45, "Inspection of Cooling Water System."
7. 10 CFR Part 50, Appendix A, GDC 46, "Testing of Cooling Water System."
8. RG 1.29, "Seismic Design Classification."
9. RG 1.68, "Initial Test Programs for Water-Cooled Nuclear Power Plants."
10. RG 1.68.1, Rev. 2 "Initial Test Program of Condensate and Feedwater Systems for Light-Water Reactors. ."
11.
12. RG 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."
13. GL 89-08, "Erosion/Corrosion-Induced Pipe Wall Thinning."
14. NUREG-0927, Revision 1, "Evaluation of Water Hammer Occurrences in Nuclear Power Plants," March 1984.
15. EPRI Report No. 1015425 "Recommendations for an Effective Flow-Accelerated Corrosion Program" (NSAC-202L-R3), August 2007.
16. 10 CFR 52.47, "Contents of applications."
17. 10 CFR 52.80(a), "Issuance of combined licenses."