NuScale Power™

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June 26, 2017

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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**SUBJECT:** NuScale Power, LLC Submittal of Changes to Final Safety Analysis Report Sections 1.8, 1.9 and 10.3.6

**REFERENCE:** Letter from NuScale Power, LLC to Nuclear Regulatory Connission, "NuScale Power, LLC Submittal of the NuScale Standard Plant Design Certification Application," dated December 31, 2016 (ML17013A229)

During a May 16, 2017 public teleconference with Anthony Markley of the NRC staff, NuScale Power, LLC (NuScale) discussed potential updates to Final Safety Analysis Report (FSAR) Sections 1.8, 1.9 and 10.3.6. As a result of this discussion, NuScale revised the subject FSAR sections. The Enclosure to this letter provides a mark-up of the FSAR pages incorporating revisions to FSAR Sections 1.8, 1.9 and 10.3.6, in redline/strikeout format. NuScale will include this change as part of a future revision to the NuScale Design Certification Application.

This letter makes no regulatory commitments or revisions to any existing regulatory commitments.

Please feel free to contact Darrell Gardner at 980-349-4829 or at dgardner@nuscalepower.com if you have any questions.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

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Enclosure: Changes to Final Safety Analysis Report Sections 1.8, 1.9 and 10.3.6

**Enclosure:**

Changes to Final Safety Analysis Report Sections 1.8, 1.9 and 10.3.6

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**Table 1.8-2: Combined License Information Items (Continued)**

| Item No. | Description of COL Information Item | Section |
|---|---|---|
| COL Item 10.2-2: | A COL Applicant that references the NuScale Power Plant design certification will describe how the functional requirements for turbine overspeed are met for the vendor specific turbine design and will provide a schematic of the turbine control system and protection systems. | 10.2 |
| COL Item 10.2-3: | A COL Applicant that references the NuScale Power Plant design certification will perform an evaluation of the probability of turbine missile generation. The report provides a calculation of the probability of turbine missile generation using established methods and industry guidance applicable to the fabrication technology employed. The analysis is a comprehensive report containing a description of turbine fabrication methods, material quality and properties, and required maintenance and inspections that addresses:<br>a) the calculated probability of turbine missile generation from material and overspeed related failures based on as-built rotor and blade designs and asbuilt material properties (as determined in certified testing and nondestructive examination).<br>b) maximum anticipated speed resulting from a loss of load, assuming normal control system function without trip.<br>c) overspeed basis and overspeed protection trip setpoints.<br>d) discussion of the design and structural integrity of turbine rotors.<br>e) an analysis of potential degradation mechanisms (e.g., stress corrosion cracking, pitting, low-cycle fatigue, corrosion fatigue, erosion and erosioncorrosion), and any specific maintenance or operating requirements necessary for mitigation.<br>f) material properties (e.g., yield strength, stress-rupture properties, fracture toughness, minimum operating temperature of the high-pressure turbine rotor) and the method of determining those properties.<br>g) required preservice test and inspection procedures and acceptance criteria to support calculated turbine missile probability.<br>h) actual maximum tangential and radial stresses and their locations in the turbine rotor.<br>i) rotor and blade design analyses, including loading combinations, assumptions and warmup time, that demonstrate sufficient safety margin to withstand loadings from postulated overspeed events up to 120 percent of rated speed.<br>j) description of the required inservice inspection and testing program for valves essential to overspeed protection and any inservice tests, inspections, and maintenance activities for the turbine and valve assemblies that are required to support the calculated missile probability, including inspection and test frequencies with technical bases, type of inspection, techniques, areas to be inspected, acceptance criteria, disposition of reportable indications, and corrective actions. | 10.2 |
| COL Item 10.3-1: | A COL Applicant that references the NuScale Power Plant design certification will provide a site-specific chemistry control program based on the EPRI PWR Secondary Water Chemistry Guidelines and NEI 97-06. | 10.3 |
| COL Item 10.3-2: | A COL Applicant that references the NuScale Power Plant design certification will provide a description of the flow-accelerated corrosion monitoring program ~~for carbon steel portions of the steam and power conversion systems that contain water or wet steam and are susceptible to erosion and corrosion damage.~~that meets Generic Letter 89-08 and EPRI NSAC-202L-R3 for the turbine generator system (including the turbine bypass system and the turbine gland sealing system), the main steam system (including extraction steam), the condensate and feedwater system (including the condensate polishing system), and the auxiliary boiler system. | 10.3 |
| COL Item 10.4-1: | A COL Applicant that references the NuScale Power Plant design certification will determine the size and number of new and spent resin tanks in the condensate polishing system. | 10.4 |
| COL Item 10.4-2: | A COL Applicant that references the NuScale Power Plant design certification will describe the site-specific auxiliary boiler system, the chemistry requirements, chemistry maintenance program, and how the system meets the design requirements. | 10.4 |

**Table 1.9-2: Conformance with Regulatory Guides (Continued)**

| RG | Division Title | Rev. | Conformance Status | COL Applicability | Comments | Section |
|---|---|---|---|---|---|---|
| 1.28 | Quality Assurance Program Criteria (Design and Construction) | 4 | Conforms | Applicable | The NuScale design is based on NQA12008 and the NQA1a2009 addenda (rather than NQA11994), as endorsed in RG 1.28, Rev. 4. The design for threaded fasteners meet the cleaning criteria in RG 1.28. | 3.13<br>4.5<br>6.1<br>7.2<br>~~10.3~~<br>14.2<br>17.1<br>17.5 |
| 1.29 | Seismic Design Classification for Nuclear Power Plants | 5 | Conforms | Applicable | Endorsed in Section 3.2.1. Each SSC described in Staff Regulatory Guidance C.1 is designated as Seismic Category I. The Seismic Category I dynamic analysis is extended at the interface between Seismic Category I and non-seismic Category I SSC in accordance with Staff Regulatory Guidance C.2. Pertinent Quality Assurance requirements of Appendix B to 10 CFR 50 are applied to all activities affecting the safety-related functions of Seismic Category I SSC in accordance with Staff Regulatory Guidance C.3.<br>The seismic classification from RG 1.29 applicable to a specific component is described throughout the FSAR. | 3.2<br>5.2<br>5.4<br>6.1<br>6.2<br>6.3<br>6.4<br>6.6<br>8.3<br>9.1<br>9.2<br>9.3<br>9.4<br>9.5<br>10.3<br>10.4 |

**Table 1.9-2: Conformance with Regulatory Guides (Continued)**

| RG | Division Title | Rev. | Conformance Status | COL Applicability | Comments | Section |
|---|---|---|---|---|---|---|
| 1.36 | Nonmetallic Thermal Insulation for Austenitic Stainless Steel | - | ~~Conforms~~Not Applicable | Not Applicable | The NuScale design does not use nonmetallic thermal insulation on RCPB or CNV components. ~~If nonmetallic thermal insulation is used on austenitic stainless steel components that are part of the RCPB, CNV or other safety-related or risk-significant systems, the nonmetallic thermal insulation is selected and controlled to ensure the impurity limits contained in RG 1.36 have been met to preclude stress corrosion cracking.~~ | ~~6.1~~<br>~~10.3~~Not Applicable |
| 1.40 | Qualification of Continuous Duty Safety-Related Motors for Nuclear Power Plants | 1 | Not Applicable | Not Applicable | The NuScale design does not use continuous duty Class 1E motors. | Not Applicable |
| 1.41 | Preoperational Testing of Redundant Onsite Electric Power Systems to Verify Proper Load Group Assignments | - | Not Applicable | Not Applicable | This RG is not identified as an applicable RG in DSRS Section 8.1. | Not Applicable |
| 1.43 | Control of Stainless Steel Weld Cladding of Low-Alloy Steel Components | 1 | Conforms | Applicable | None. | 5.2<br>5.3<br>5.4<br>6.1 |
| 1.44 | Control of the Processing and Use of Stainless Steel | 1 | Partially Conforms | Applicable | This RG is applicable except for its specification of applying RG 1.37 for cleaning and flushing of finished surfaces. RG 1.37 has been withdrawn by the NRC. | 4.5<br>5.2<br>5.3<br>5.4<br>6.1<br>~~10.3~~ |

**Table 1.9-2: Conformance with Regulatory Guides (Continued)**

| RG | Division Title | Rev. | Conformance Status | COL Applicability | Comments | Section |
|---|---|---|---|---|---|---|
| 1.45 | Guidance on Monitoring and Responding to Reactor Coolant System Leakage | 1 | Partially Conforms | Applicable | The design satisfies RG 1.45 guidance in that two systems are utilized to detect leakage into the containment; containment pressure monitoring and leakage collection. Both leakage detection methods satisfy Regulatory Positions C.2.1 and C.2.2 in RG 1.45 in that: a) leakage to the primary reactor containment from unidentified sources can be detected, monitored, and quantified for rates = 0.05 gpm; and, b) response time (not including transport delay time) is < 1 hour for a leakage rate greater than 1 gpm. Regulatory Position C.2.4 is satisfied in that the containment pressure method is capable of performing its function following a seismic event that does not require plant shutdown (i.e., vacuum pump remains functional). C.2.5 is satisfied in that both methods permit calibration and testing during plant operation. Finally, radiation detectors in the CES condenser vent line provide an early indication of RCS leakage consistent with Regulatory Position C.2.3. All leakage is treated as unidentified because of the limited capability to identify or quantify RCS leakage. | 5.2<br>6.2<br>9.3<br>11.5 |
| 1.47 | Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems | 1 | Conforms | Applicable | None. | 7.2<br>8.3 |
| 1.50 | Control of Preheat Temperature for Welding of Low-Alloy Steel | 1 | Conforms | Applicable | None. | 5.2<br>5.3<br>5.4<br>6.1<br>~~10.3~~ |

**Table 1.9-2: Conformance with Regulatory Guides (Continued)**

| RG | Division Title | Rev. | Conformance Status | COL Applicability | Comments | Section |
|---|---|---|---|---|---|---|
| 1.68.2 | Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water-Cooled Nuclear Power Plants | 2 | Partially Conforms | Applicable | This guidance is applicable except for site-specific aspects including test performance, test report preparation, and records retention, which are the responsibility of the COL applicant. | |
| 1.68.3 | Preoperational Testing of Instrument and Control Air Systems | 1 | Partially Conforms | Applicable | This guidance is applicable except for site-specific aspects, including test performance and records retention, which are the responsibility of the COL applicant. | 9.3 |
| 1.69 | Concrete Radiation Shields and Generic Shield Testing for Nuclear Power Plants | 1 | Partially Conforms | Applicable | This guidance is applicable to the design of concrete radiation shields. Site-specific aspects of this guidance, including development and implementation of a radiation shield test program, are the responsibility of the COL applicant. | 12.3<br>9.3 |
| 1.70 | Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition) | 3 | Not Applicable | Not Applicable | RG 1.206 and NuScale Design Specific Review Standards (DSRS) are used. | Not Applicable |
| 1.71 | Welder Qualification for Areas of Limited Accessibility | 1 | Partially Conforms | Applicable | This guidance is applicable except for site-specific aspects, including specification of standards for weld fabrication and repair that are performed during construction, installation, and operation of a nuclear facility, which are the responsibility of the COL applicant. | 4.5<br>5.2<br>5.3<br>5.4<br>6.1<br>~~10.3~~ |
| 1.72 | Spray Pond Piping Made from Fiberglass-Reinforced Thermosetting Resin | 2 | Not Applicable | Not Applicable | The design does not involve the use of fiberglass piping in spray pond applications (or for that matter as part of the UHS design). | Not Applicable |
| 1.73 | Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants | 1 | Conforms | Applicable | None. | 3.11 |

**Table 1.9-2: Conformance with Regulatory Guides (Continued)**

| RG | Division Title | Rev. | Conformance Status | COL Applicability | Comments | Section |
|---|---|---|---|---|---|---|
| | | | | | Positions C1.1.3 and C1.1.4 are not applicable because the NuScale design does not rely on operator action to mitigate the consequences of debris accumulation and does not include active devices or systems to prevent debris accumulation.<br>The NuScale design does not comply with regulatory position C.1.2 (alternative water sources for inoperable strainers).<br>NuScale complies with the intent of regulatory position C.1.3 (evaluation of long term recirculation capability as applicable to the design) with the exception of the following:<br>• Position C.1.3.1 (NPSH)<br>• Portions of position C.1.3.2 that are not consistent with the NuScale design<br>The NuScale design does not comply with regulatory positions C1.3.7 (upstream effects) or C.1.3.9 (strainer structural integrity).<br>The NuScale design does not comply with regulatory position C1.3.12 (prototypical head loss testing).<br>The NuScale design does not comply with regulatory position C.2 with the exception that the intent of chemical reaction effects (position 2.2) is met.<br>The NuScale design does not comply with regulatory position C.3. | |
| 1.84 | Design, Fabrication, and Materials Code Case Acceptability, ASME Section III | 36 | Conforms | Applicable | None. | 3.12<br>3.13<br>4.5<br>5.2<br>5.4<br>6.1<br>~~10.3~~ |

### 10.3.5.3 Primary-to-Secondary Leakage

Leakage of primary water into the SG tubes from through-wall tube defects would represent a source of radioactive iodine to the secondary system. The volatility of radioactive iodine is increased by acidic and oxidizing solutions. The secondary side chemicals added (Section 10.3.5.1.2) make the secondary side chemistry both basic and reducing. These conditions suppress the volatility of radioactive iodine species, thus minimizing release through the main condenser evacuation system.

The implications of detecting radioactivity in the secondary side are addressed by the requirements identified in Section 11.5.

### 10.3.5.4 Chemical Addition System

Equipment is provided to inject controlled quantities of treatment chemicals as part of the secondary water chemistry program. These treatment chemicals are injected into the condensate pump discharge header. See details for the feedwater treatment system in Section 10.4.11.

## 10.3.6 Steam and Feedwater System Materials

The portion of the steam and power conversion system discussed under Section 10.3.6 includes the turbine generator system (including the turbine bypass system and the turbine gland sealing system), the MSS (including extraction steam), the CFWS (including the condensate polishing system), and the auxiliary boiler system.

### 10.3.6.1 Fracture Toughness

The ~~MSS and condensate and feedwater system (CFWS)~~portions of the steam and power conversion system noted under Section 10.3.6 above are nonsafety-related and are not relied upon to perform a nuclear safety function. The quality group for the ~~MSS and CFWS~~portions of the steam and power conversion system noted in Section 10.3.6 above is quality group D, thus the piping is non-nuclear safety ASME ~~Code~~ B31.1 piping. ~~All MSS and CFWS component~~The piping materials for the portions of the steam and power conversion system noted in Section 10.3.6 above meet ASME ~~code~~B31.1 requirements.

### 10.3.6.2 Materials Selection and Fabrication

~~Section 3.2 provides the material specification, grade, and classification for piping, valves, fittings, and weld filler material used in the MSS and CFWS.~~Table 10.3-5 provides the piping material specifications and corrosion allowances for the portions of the steam and power conversion system noted in Section 10.3.6 above.

Specifically, material selection and fabrication requirements for the ~~MSS and CFWS~~portions of the steam and power conversion system noted in Section 10.3.6 above conform to ASME ~~Code~~ B31.1 and are consistent with the quality group and seismic design classifications provided in Table 3.2-1.

The design, materials selection, fabrication, and operation of components mitigate susceptibility to intergranular stress corrosion cracking of the stainless steel and nickel-based materials used. See additional stress corrosion cracking information in Section 3.6.3.

### 10.3.6.3 Flow-Accelerated Corrosion

The design of the piping in the ~~MSS and the CFWS~~portions of the steam and power conversion system noted in Section 10.3.6 above incorporates considerations to prevent the occurrence of erosion and corrosion. These considerations include material selection, limits on flow velocity, inspection programs, and limits on water chemistry to reduce FAC, corrosion, and erosion of piping and piping components. The design meets the guidance contained in Generic Letter 89-08 and NSAC-202L-R3 (Reference 10.3-1) governing design considerations to minimize erosion and corrosion (including FAC) and acceptable FAC monitoring programs.

The ~~MSS and CFWS~~ design and layout of the portions of the steam and power conversion system noted in Section 10.3.6 above incorporate appropriate provisions to minimize FAC. These provisions are applied to the high-energy, nonsafety-related portions that could adversely impact safety-related systems susceptible to FAC and other flow-induced degradation mechanisms. These provisions include:

- elimination of high turbulence points wherever possible (e.g., adequate straight pipe length downstream of flow orifice or control valve, etc.)
- use of long radius elbows
- smooth transition at shop or field welds
- selection of pipe diameter to have velocities within industry recommended values
- use of corrosion resistant materials

In addition to the design and layout provisions described above, erosion and corrosion is minimized by the implementation of a secondary water chemistry control program as described in Section 10.3.5.

COL Item 10.3-2: A COL applicant that references the NuScale Power Plant design certification will provide a description of the flow-accelerated corrosion monitoring program ~~for carbon steel portions of the steam and power conversion systems that contain water or wet steam and are susceptible to erosion and corrosion damage.~~that meets Generic Letter 89-08 and EPRI NSAC-202L-R3 for the turbine generator system (including the turbine bypass system and the turbine gland sealing system), the main steam system (including extraction steam), the condensate and feedwater system (including the condensate polishing system), and the auxiliary boiler system.

### 10.3.7 Instrumentation

The main steam temperature, pressure, radiation, and flow instrumentation is designed to permit automatic plant operation, remote control, and continuous indication of system parameters. The remote instrumentation readouts required for monitoring the system are

**Table 10.3-5: Material Specifications and Corrosion Allowances**

| System | Piping segment | Corrosion Allowance mils/yr | Material Specification |
|---|---|---|---|
| Condensate and Feedwater System | Condenser to condensate pumps | 1.0 | SA-335 Grade P11 |
| | Condensate pumps to feedwater pumps | 1.0 | SA-335 Grade P11 |
| | Feedwater pumps to the connection on the module platform | 1.0 | SA-335 Grade P11 |
| Main Steam System | Secondary isolation valve to turbine | 0.4 | SA-335 Grade P11 |
| | Turbine extraction lines to feedwater heaters | 0.4 | SA-335 Grade P11 |
| Turbine Generator, Turbine Gland Sealing, and Turbine Bypass Systems | Auxiliary steam to gland seals | 0.4 | SA-335 Grade P11 |
| | Feedwater to gland steam desuperheater | 1.0 | SA-335 Grade P11 |
| | Turbine bypass to condenser | 0.4 | SA-335 Grade P11 |
| | Feedwater to turbine bypass desuperheater | 1.0 | SA-335 Grade P11 |
| Auxiliary Boiler System | Low pressure boiler to turbine building users | 0.4 | SA-335 Grade P11 |
| | High pressure boiler to module heatup system heat exchangers | 0.4 | SA-335 Grade P11 |
| | Auxiliary boiler to condenser deaerator | 0.4 | SA-335 Grade P11 |