



NuScale Standard Plant
Design Certification Application

Chapter Sixteen **Technical Specifications**

PART 2 - TIER 2

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CHAPTER 16 TECHNICAL SPECIFICATIONS

16.1 Technical Specifications

16.1.1 Introduction to Technical Specifications

Technical Specification Content

The NuScale Power, LLC (NuScale) Generic Technical Specifications (GTS) meet the 10 CFR 50.36 and 10 CFR 50.36a requirements and were developed consistent with the Improved Standard Technical Specification (ISTS) format and content typified in NUREG-1431, Revision 4 and NUREG-1432, Revision 4. The content differs from the ISTS as necessary to reflect technical differences between large light water reactor (LWR) designs and the NuScale Power Plant design. For example, Table 1.1 of the NuScale GTS lists five MODES that are distinct from those provided in ISTS for pressurized water reactor or boiling water reactor designs.

The NuScale Power Plant design is a single facility that is comprised of 12 individual NuScale Power Modules (NPMs), each of which constitutes a nuclear steam supply system as described in Section 1.2. Individual NPMs are installed in an operating position during power generation and transferred to a common refueling location when refueled as described in Section 9.1.

The NuScale GTS are constructed to address the NuScale Power Plant design by providing operating limitations for an individual NPM.

The majority of the NuScale GTS address conditions applicable to an individual NPM. However, some systems and parameters are applicable to multiple NPMs. While individually specified, these limits may be applicable to more than one NPM at the same time. Clarifications have been included in the associated bases to address multi-module interactions.

Selection Criteria for Limiting Conditions for Operation

Limiting conditions for operation (LCOs) are included in the NuScale GTS consistent with the screening criteria provided in 10 CFR 50.36(c)(2)(ii). These selection criteria are:

- 1) Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.
- 2) A process variable, design feature, or operating restriction that is an initial condition of a design-basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
- 3) A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

- 4) A structure, system, or component which operating experience or probabilistic safety assessment has shown to be significant to public health and safety.

Information regarding the screening process employed by NuScale is provided in Technical Report TR-1116-52011 (Reference 16.1-1), and the results are incorporated into the bases of each technical specification.

NuScale considered risk-informed technical specification development approaches consistent with Regulatory Guide 1.177, and the guidance in NEI 04-10 and NEI 06-09 (Reference 16.1-2 and Reference 16.1-3). However as a new design with low overall evaluated risk but no applicable operating experience, completion times and surveillance intervals are proposed that are generally consistent with corresponding industry systems or functions as included in the NUREG STS. Reference to the comparable specifications is provided in Technical Report TR-1116-52011 (Reference 16.1-1).

The NuScale Power Plant systems used for MODE reduction differ from those systems in large LWR designs and do not meet the criteria in 10 CFR 50.36. Therefore, LCO requirements for those systems are not specified in the NuScale GTS.

For example, in typical large PWRs safety-related shutdown cooling function is required to operate and reduce primary system temperatures, and to support low-temperature overpressure protection. This shutdown cooling system is cooled by an intermediate closed-loop system to transfer decay heat to another cooling system that transfers the decay heat to the ultimate heat sink. Those safety-related functions are required to be operable and included in the technical specifications by criteria two or three of 10 CFR 50.36(c)(2)(ii).

At NuScale, shutdown cooling is accomplished in the design using passive convection and conduction of decay heat from the flooded portion of the containment through the containment vessel wall directly to the ultimate heat sink. The LTOP function is provided by instrumentation and valves that perform the ECCS function during power operations. These NuScale systems are included in the proposed GTS in accordance with 10 CFR 50.36(c)(2)(ii) however distinct shutdown cooling pumps, valves, LTOP valves, intermediate cooling loops are not credited or provided. Therefore they are not included for the NuScale GTS.

Completion Times and Surveillance Frequencies

When appropriate, the completion times and surveillance frequencies specified in the NuScale GTS are consistent with times and frequencies applied to similar actions and surveillance requirements from NUREG-1431 and NUREG-1432. The bases for completion times and surveillance frequencies for those NuScale GTS for which no large LWR system or function exists, and for those NuScale system design differences which lead to deviations from similar completion times and surveillance frequencies found in the ISTS or other recently-approved technical specifications are described in the associated bases or in the surveillance frequency control program described in technical specification 5.5.11.

Table 16.1-1 provides the initial surveillance test frequencies to be incorporated into the Surveillance Frequency Control Program (SFCP) required by NuScale GTS 5.5.11. The table identifies each GTS surveillance test requirement that references the SFCP, the base testing

frequency for evaluation of future changes to the surveillance test frequency, and the basis for that test frequency. Base test frequencies in Table 16.1-1 include consideration of the rules of applicability for surveillance testing including, when applicable, up to 1.25 times the specified interval as permitted by technical specification SR 3.0.2. For example, a base frequency of 24 months implies consideration of up to 30 months between performance of the surveillance test.

Incorporation of Technical Specification Task Force Change Travelers

Technical Specification Task Force (TSTF) travelers issued since publication of Revision 4 of the ISTS were reviewed in the development of the NuScale GTS. Travelers were incorporated into the NuScale GTS or utilized as a basis for similar NuScale situations as described in the conformance report (Reference 16.1-1). The TSTF travelers considered in development of the NuScale GTS are listed in that report.

The GTS are intended to be used as a guide in the development of the plant-specific technical specifications. Preliminary information has been provided in single brackets []. Combined license applicants referencing the NuScale Power Plant are required to provide the final plant-specific information.

- COL Item 16.1-1: A COL applicant that references the NuScale Power Plant design certification will provide the final plant-specific information identified by [] in the generic Technical Specifications and generic Technical Specification Bases.
- COL Item 16.1-2: A COL applicant that references the NuScale Power Plant design certification will prepare and maintain an owner-controlled requirements manual that includes owner-controlled limits and requirements described in the Bases of the Technical Specifications or as otherwise specified in the FSAR.
- COL Item 16.1-3: A COL applicant that references the NuScale Power Plant design certification, and uses allocations for sensor response times based on records of tests, vendor test data, or vendor engineering specifications as described in the Bases for Surveillance Requirement 3.3.1.3, will do so for selected components provided that the components and methodology for verification have been previously reviewed and approved by the NRC.

16.1.2 References

- 16.1-1 NuScale Power, LLC, "Technical Specifications Regulatory Conformance and Development Technical Report," TR-1116-52011, Rev. 2.
- 16.1-2 Nuclear Energy Institute, "Risk-Informed Technical Specifications Initiative 5b-Risk-Informed Method for Control of Surveillance Frequencies," NEI 04-10, Revision 1, Washington, DC, April 2007.
- 16.1-3 Nuclear Energy Institute, Risk-Informed Technical Specifications Initiative 4b-Risk-Managed Technical Specifications (RMTS) Guidelines," NEI 06-09, Rev. 0-A, Washington, DC, November 2006.

Table 16.1-1: Surveillance Frequency Control Program Base Frequencies

Surveillance Requirement	Base Frequency	Basis
3.1.1.1	24 hours	The Frequency of 24 hours is based on the generally slow change in required boron concentration and the low probability of an accident occurring without the required shutdown margin (SDM). This allows time for the operator to collect the required data, which includes performing a boron concentration analysis, and complete the calculation.
3.1.2.1	31 effective full-power days (EFPDs)	The required subsequent Frequency of 31 EFPDs, following the initial 60 EFPDs after exceeding 5% rated thermal power (RTP), is acceptable based on the slow rate of core changes due to fuel depletion and the presence of other indicators (e.g. axial offset (AO)) monitored by the core monitoring system for prompt indication of an anomaly.
3.1.4.1	12 hours	Verification that individual control rod assembly (CRA) positions are within alignment limits at a 12 hour Frequency provides a history that allows the operator to detect a CRA that is beginning to deviate from its expected position. The specified Frequency takes into account other CRA position information that is continuously available to the operator in the control room, so that during actual rod motion, deviations can immediately be detected.
3.1.4.2	92 days	The 92 day Frequency takes into consideration other information available to the operator in the control room and SR 3.1.4.1, which is performed more frequently and adds to the determination of OPERABILITY of the CRAs.
3.1.5.1	12 hours	Since the shutdown CRAs are not moved during routine operation, except as part of planned Surveillances, verification of shutdown CRA position at a Frequency of 12 hours is adequate to ensure that the shutdown CRAs are within their insertion limits. Also, the Frequency takes into account other information available in the control room for the purpose of monitoring the status of shutdown rods.
3.1.6.1	12 hours	Verification of the regulating group insertion limits at a Frequency of 12 hours is sufficient to detect CRA that may be approaching the insertion limits since, normally, very little rod motion is expected to occur in 12 hours.
3.1.8.1	30 minutes	Verification that the THERMAL POWER is $\leq 5\%$ RTP will ensure that the unit is not operating in a condition that could invalidate the safety analyses. Verification of the THERMAL POWER at a Frequency of 30 minutes during the performance of the PHYSICS TESTS will ensure that the initial conditions of the safety analyses are not violated.
3.1.8.2	24 hours	The Frequency of 24 hours is based on the generally slow change in required boron concentration and on the low probability of an accident occurring without the required SDM.
3.1.9.1	31 days	A 31 day Frequency is considered reasonable in view of other administrative controls that will ensure a misconfiguration of the chemical and volume control system (CVCS) makeup pump demineralized water flow path is unlikely. Also, the Frequency takes into account other information available in the control room for the purpose of monitoring the status of CVCS makeup pump demineralized water flow path configuration.
3.1.9.2	24 months	The 24 month Frequency is based on the potential for unplanned plant transients if the Surveillances were performed with the unit at power. The 24 month Frequency is also acceptable based on consideration of the design reliability of the equipment. The actuation logic is tested as part of Engineered Safety Features Actuation System (ESFAS) Actuation and Logic testing, and valve performance is monitored as part of the Inservice Testing Program.

Table 16.1-1: Surveillance Frequency Control Program Base Frequencies (Continued)

Surveillance Requirement	Base Frequency	Basis
3.1.9.3	31 days	The 31 day Frequency of this SR was developed considering the known stability of stored borated water and the low probability of an undesired source of diluting pure water. The Frequency takes into account administrative controls that will ensure changes to boron concentration are performed in accordance with written procedures. This Frequency also considers the size of the boric acid storage tank and the normally expected demands of boric acid for plant operations.
3.1.9.4	24 months	The 24 month Frequency is based on the potential for unplanned plant transients if the Surveillances were performed with the unit at power. The 24 month Frequency is also acceptable based on consideration of the design reliability of the equipment.
3.2.1.1	31 EFPD	The 31 EFPD Frequency is acceptable because the power distribution changes relatively slowly over this amount of fuel burnup. Accordingly, this Frequency is short enough that the Enthalpy Rise Hot Channel Factor limit cannot be exceeded for any significant period of operation.
3.2.2.1	7 days	The Frequency of 7 days is adequate considering that the AO is monitored by a computer and any deviation from requirements is alarmed.
3.3.1.1	12 hours	The Frequency of 12 hours is based on industry operating experience that demonstrates channel failure is rare. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the LCO required channels.
3.3.1.2	12 hours	The Frequency of every 12 hours is adequate. It is based on industry operating experience, considering industry instrument reliability and operating history data for instrument drift. Together, with engineering judgment, these factors demonstrate that a difference between the calorimetric heat balance calculation and the power range channel output of more than +1% RTP is not expected in any 12 hour period.
3.3.1.3	24 months	As appropriate, each channel's response must be verified every 24 months. This test measures the portion of the response time from the sensor to receipt in the digital module protection system. The digital processing portions of the module protection system are assumed to function in less than 1 second consistent with their design. Equipment actuation is measured through testing required by 3.3.2, 3.3.3, and LCO Surveillance Requirements associated with the actuated components. Response times cannot be determined during unit operation because sensor inputs are required to be varied to measure response times. Industry experience has shown that these components usually pass this Surveillance when performed at the 24 months Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.
3.3.1.4	24 months	The Frequency is based on consideration of the design reliability and performance characteristics of the equipment.
3.3.1.5	24 months	The 24 month Frequency is acceptable based on consideration of the design reliability of the equipment.
3.3.2.1	24 months	The 24 month Frequency is based on the potential for unplanned plant transients if the Surveillances were performed with the unit at power. This Frequency is justified based on the system design, which includes the use of continuous diagnostic test features that will report a failure within the logic and actuation system to the operator promptly. The only part of the actuation logic circuitry that is not continuously self-tested is the actuation and priority logic circuit which consists of simple discrete components that are very reliable.
3.3.2.2	24 months	The Frequency of 24 months is justified based on consideration of the reliability of the equipment and industry operating experience with similar equipment.

Table 16.1-1: Surveillance Frequency Control Program Base Frequencies (Continued)

Surveillance Requirement	Base Frequency	Basis
3.3.2.3	24 months	The 24 month Frequency is based on the potential for unplanned plant transients if the Surveillances were performed with the unit at power. The 24 month Frequency is also acceptable based on consideration of the design reliability of the equipment.
3.3.2.4	24 months	The Frequency of 24 months is based on the known reliability of similar functions in licensed designs and the multidivisional redundancy available, and has been shown to be acceptable through industry operating experience.
3.3.3.1	24 months	This Frequency of 24 months is justified based on the system design which includes the use of continuous diagnostic test features that will report a failure within the logic and actuation system to the operator promptly. The only part of the actuation logic circuitry that is not continuously self-tested is the actuation and priority logic circuit which consists of simple discrete components that are very reliable.
3.3.3.2	24 months	The 24 month Frequency is based on the potential for unplanned plant transients if the Surveillances were performed with the unit at power. The 24 month Frequency is also acceptable based on consideration of the design reliability of the equipment.
3.3.3.3	24 months	The 24 month Frequency is based on the potential for unplanned plant transients if the Surveillances were performed with the unit at power. The 24 month Frequency is also acceptable based on consideration of the design reliability of the equipment.
3.3.3.4	24 months	The Frequency of 24 months is based on the known reliability of similar functions in licensed designs and the multidivisional redundancy available, and has been shown to be acceptable through industry operating experience.
3.3.4.1	24 months	The Frequency of 24 months is based on the known reliability of similar functions in licensed designs and the potential for unplanned plant transients if the Surveillances were performed with the unit at power. The 24 month Frequency is also acceptable based on consideration of the design reliability of the equipment.
3.3.5.1	24 months	The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and the potential for unplanned plant transients if the Surveillances were performed with the unit at power. The 24 month Frequency is also acceptable based on consideration of the design reliability of the equipment.
3.3.5.2	24 months	The Frequency of 24 months is based on the use of the data display capability in the control room as part of the normal unit operation and the availability of multiple video display units at the Remote Shutdown Station. The Frequency of 24 months is based upon industry operating experience and consistency with control room hardware and software.
3.3.5.3	24 months	The 24 month Frequency is based on the known reliability of similar functions in licensed designs and the redundancy available, and has been shown to be acceptable through industry operating experience.
3.4.1.1	12 hours	Since Required Action A.1 allows a Completion Time of 2 hours to restore parameters that are not within limits, the 12 hour Frequency for pressurizer pressure is sufficient to ensure the pressure can be restored to a normal operation, steady state condition following load changes and other expected transient operations. The 12 hour interval has been shown by industry operating practice to be sufficient to regularly assess for potential degradation and to verify operation is within safety analysis assumptions.

Table 16.1-1: Surveillance Frequency Control Program Base Frequencies (Continued)

Surveillance Requirement	Base Frequency	Basis
3.4.1.2	12 hours	Since Required Action A.1 allows a Completion Time of 2 hours to restore parameters that are not within limits, the 12 hour Frequency for reactor coolant system (RCS) cold temperature is sufficient to ensure the temperature can be restored to a normal operation, steady state condition following load changes and other expected transient operations. The 12 hour interval has been shown by industry operating practice to be sufficient to regularly assess for potential degradation and to verify operation is within safety analysis assumptions.
3.4.2.1	12 hours	The SR to verify all RCS temperatures every 12 hours takes into account indications and alarms that are continuously available to the operator in the control room and is consistent with other routine Surveillances which are typically performed once per shift. In addition, operators are trained to be sensitive to RCS temperature during approach to criticality and will ensure that the minimum temperature for criticality is met as criticality is approached.
3.4.3.1	30 minutes	This Frequency of 30 minutes is considered reasonable in view of the control room indication available to monitor RCS status. Also, since temperature rate of change limits are specified in hourly increments, 30 minutes permits assessment and correction for minor deviations within a reasonable time.
3.4.5.1	72 hours	The 72 hour Frequency is a reasonable interval to trend LEAKAGE and recognizes the importance of early leakage detection in the prevention of accidents.
3.4.5.2	72 hours	The Frequency of 72 hours is a reasonable interval to trend primary to secondary LEAKAGE and recognizes the importance of early leakage detection in the prevention of accidents.
3.4.6.1	12 hours	The Frequency of 12 hours is based on the availability and reliability of the automatically monitored pressure alarms to detect a change in accumulator pressure and the similarity of the test to a CHANNEL CHECK as performed throughout existing large plant designs. The test verifies the accumulator pressure and thereby assures the OPERABILITY of the valves, as well as the status of the automatically monitored pressure alarms.
3.4.6.3	24 months	The Frequency of 24 months is based on equipment reliability and the need to perform this Surveillance during periods in which the plant is shutdown for refueling to prevent any upsets of plant operation.
3.4.7.1	12 hours	The Frequency of 12 hours is based on industry operating experience. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the LCO required channels.
3.4.7.2	12 hours	The Frequency of 12 hours is based on industry operating experience that demonstrates channel failure of pressure monitors is rare. The CHANNEL CHECK supplements less formal, but more frequent, checks of channels during normal operational use of the displays associated with the LCO required channels.
3.4.7.3	12 hours	The Frequency of 12 hours is based on instrument reliability and is reasonable for detecting off normal conditions.
3.4.7.4	92 days	The Frequency of 92 days considers instrument reliability, and industry operating experience has shown that it is proper for detecting degradation.
3.4.7.5	92 days	The Frequency of 92 days considers instrument reliability, and industry operating experience has shown that it is proper for detecting degradation.
3.4.7.6	24 months	The Frequency of 24 months considers instrument reliability, and industry operating experience that has proven that this Frequency is acceptable.
3.4.7.7	24 months	The Frequency of 24 months is based on the assumption of a 30 month calibration interval in the determination of the magnitude of equipment drift in the setpoint methodology.
3.4.7.8	24 months	The Frequency of 24 months considers instrument reliability, and industry operating experience that has proven that this Frequency is acceptable.

Table 16.1-1: Surveillance Frequency Control Program Base Frequencies (Continued)

Surveillance Requirement	Base Frequency	Basis
3.4.8.1	14 days	The 14 day Frequency is adequate to trend changes in the noble gas specific activity level and based on the low probability of an accident occurring during this time period.
3.4.8.2	14 days	The 14 day Frequency is adequate to trend changes in the iodine activity level and based on the low probability of an accident occurring during this time period.
3.4.10.1	24 months	The 24 month Frequency is based on equipment reliability and the need to perform these Surveillances under the conditions that apply during a unit outage and the potential for unplanned plant transients if the Surveillances were performed with the reactor at power. The 24 month Frequency is also acceptable based on consideration of the design reliability of the equipment.
3.5.1.1	24 months	The 24 month Frequency is based on equipment reliability and the need to perform these Surveillances under the conditions that apply during a unit outage and the potential for unplanned plant transients if the Surveillances were performed with the reactor at power. The 24 month Frequency is also acceptable based on consideration of the design reliability of the equipment.
3.5.2.1	12 hours	The Frequency of 12 hours is based on the availability and reliability of the automatically monitored pressure alarms to detect a change in accumulator pressure and the similarity of the test to a CHANNEL CHECK as performed throughout existing large plant designs. The test verifies the accumulator pressure and thereby assures the OPERABILITY of the valves, as well as the status of the automatically monitored pressure alarms.
3.5.2.2	24 hours	The 24 hour Frequency is based on equipment reliability and the expected low rate of gas accumulation and the availability of control room indication and alarm of decay heat removal system (DHRS) level in the control room.
3.5.2.3	12 hours	The SR to verify SG level is within limits every 12 hours takes into account indications and alarms that are continuously available to the operator in the control room and is consistent with other routine Surveillances which are typically performed once per shift. In addition, operators are trained to be sensitive to SG level and will ensure that the level is appropriately established and controlled.
3.5.2.4	24 months	The 24 month Frequency is based on equipment reliability and the need to perform these Surveillances under the conditions that apply during a unit outage and the potential for unplanned plant transients if the Surveillances were performed with the reactor at power. The 24 month Frequency is also acceptable based on consideration of the design reliability of the equipment.
3.5.3.1	24 hours	Since the ultimate heat sink (UHS) level is normally maintained at a stable level, and is monitored by main control indication and alarm, a 24 hour Frequency is appropriate. This Frequency also takes into consideration the high ratio of UHS volume change to UHS level change due to the UHS geometry.
3.5.3.2	24 hours	The Frequency of 24 hours is sufficient to identify a temperature change that would approach either the upper or lower limit of UHS bulk average temperature assumed in the safety analyses. Since the UHS bulk average temperature is normally stable, and is monitored by main control indication and alarm, a 24 hour Frequency is appropriate. This Frequency also takes into consideration the large heat capacity of the UHS in comparison to the magnitude of possible heat addition or removal mechanisms.
3.5.3.3	31 days	Since the UHS volume of borated water is large compared to potential dilution sources, the 31 day Frequency is acceptable. In addition, the relatively frequent Surveillance of the UHS water volume provides assurance that the UHS boron concentration is not changed significantly.

Table 16.1-1: Surveillance Frequency Control Program Base Frequencies (Continued)

Surveillance Requirement	Base Frequency	Basis
3.6.2.1	12 hours	The Frequency of 12 hours is based on the availability and reliability of the automatically monitored pressure alarms to detect a change in accumulator pressure and the similarity of the test to a CHANNEL CHECK as performed throughout existing large plant designs. The test verifies the accumulator pressure and thereby assures the OPERABILITY of the valves, as well as the status of the automatically monitored pressure alarms.
3.6.2.2	31 days	Since verification of valve position for containment isolation valves outside containment is relatively easy, the 31 day Frequency is based on engineering judgment and was chosen to provide added assurance of the correct positions.
3.6.2.4	24 months	The 24 month Frequency is based on the need to perform this Surveillance under the conditions that apply during a unit outage and the potential for an unplanned transient if the Surveillance were performed with the reactor at power. Industry operating experience has shown that these components usually pass this Surveillance when performed at the 24 month Frequency. Therefore, the Frequency was concluded to be acceptable from a reliability standpoint.
3.7.1.1	12 hours	The Frequency of 12 hours is based on the availability and reliability of the automatically monitored pressure alarms to detect a change in accumulator pressure and the similarity of the test to a CHANNEL CHECK as performed throughout existing large plant designs. The test verifies the accumulator pressure and thereby assures the OPERABILITY of the valves, as well as the status of the automatically monitored pressure alarms.
3.7.2.1	12 hours	The Frequency of 12 hours is based on the availability and reliability of the automatically monitored pressure alarms to detect a change in accumulator pressure and the similarity of the test to a CHANNEL CHECK as performed throughout existing large plant designs. The test verifies the accumulator pressure and thereby assures the OPERABILITY of the valves, as well as the status of the automatically monitored pressure alarms.
3.7.3.1	72 hours	The 72 hour Frequency is a reasonable interval to trend LEAKAGE and recognizes the importance of early leakage detection in assuring detection of a condition that may be indicative of not meeting the leak-before-break criteria applicable to the in-containment secondary piping.
3.8.1.1	12 hours	The Frequency of 12 hours is based on equipment reliability and is consistent with the CHANNEL CHECK Frequency specified for similar neutron detector instruments in LCO 3.3.1.
3.8.1.2	24 months	Industry operating experience has shown that similar components usually pass this Surveillance when performed at the 24 month Frequency.