16 TECHNICAL SPECIFICATIONS

This chapter of the safety evaluation report (SER) documents the U.S. Nuclear Regulatory Commission (NRC) staff's (hereinafter referred to as the staff) review of Revision 2 of the NuScale Power, LLC (hereinafter referred to as NuScale or the applicant), Design Certification (DC) Application (DCA), Part 2, "Final Safety Analysis Report (FSAR)," Tier 2, Chapter 16, "Technical Specifications," and the referenced proposed generic technical specifications (GTS) and associated GTS Bases in DCA Part 4. Together these portions of the DCA constitute the information related to technical specifications (TS) in the NuScale DCA.

Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.36(a)(1), requires that each license authorizing operation of a utilization facility (operating license) issued by the Commission contain TS that set forth the safety limits (SLs), limiting safety system settings (LSSSs), limiting conditions for operation (LCOs), and other limitations on facility operation that are necessary for adequate protection of public health and safety. In addition, Section 50.36(a)(1) requires that each application for an operating license include a "summary statement of the bases or reasons for such TS."

Section 50.36(a)(2) requires that each applicant for a DC include in its application proposed GTS in accordance with the requirements of this section [i.e., Section 50.36] for the portion of the plant that is within the scope of the DCA, but does not explicitly require including GTS Bases. Because the staff needs to find that the rationale for each GTS requirement is consistent with the proposed design, as described in DCA Part 2, it is customary for a DC applicant to include a summary statement of the bases or reasons (hereinafter referred to as the Bases) for the proposed GTS in DCA Part 4, using the formatting conventions and applicable contents of the STS Bases.

Section 50.36a(a)(1) requires, among other things, that each applicant for a DC include TS that require that "[o]perating procedures developed pursuant to Section 50.34a(c) for the control of effluents be established and followed and that the radioactive waste system, pursuant to Section 50.34a, be maintained and used."

The regulations in 10 CFR 52.47(a)(11) and 10 CFR 52.79(a)(30), state that a DC applicant and a combined license (COL) applicant, respectively, are to propose TS prepared in accordance with 10 CFR 50.36, "Technical Specifications," and 10 CFR 50.36a, "Technical Specifications on Effluents from Nuclear Power Reactors." COL applicants that reference a certified design are to propose plant-specific TS and Bases, which would include the GTS and Bases approved during the DC review. The COL applicant may propose deviations from the approved GTS or Bases prior to issuance of the COL by requesting an exemption from the associated appendix to 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," that codifies the certified design. A holder of a COL may propose changes to the plant-specific TS in accordance with 10 CFR 50.90, "Application for Amendment of License, Construction Permit, or Early Site Permit."

16.1 <u>Introduction</u>

The staff review of the GTS and Bases is for completeness and correctness in regard to NRC requirements and conformance with applicable guidance, and for consistency with related portions of the NuScale DCA Part 2. In DCA Part 2, Tier 2, Chapter 16, and in DCA Part 4, the applicant proposed GTS and Bases in accordance with 10 CFR 50.36, 10 CFR 50.36a, and

10 CFR 52.47(a)(11). The GTS are derived from the analyses and evaluations in the NuScale DCA Part 2.

16.2 Summary of Application

Part 2 of the DCA contains the Tier 1 and Tier 2 information of the NuScale DCA. In DCA Part 2, Tier 2, Chapter 16 addresses the following topics related to the proposed GTS and Bases. However, the GTS and Bases, which are provided in Part 4 of the DCA, are neither Tier 1 nor Tier 2 information.

GTS content: Most GTS requirements are written to provide operating limitations on an individual NuScale Power Module (NPM), or unit. Operability requirements on some systems (e.g., the reactor pool) and limits on the values of monitored variables (e.g., the reactor pool water level, temperature, and boron concentration) apply to multiple NPMs. The limitations on such systems and variables are applied individually and concurrently to the operation of each applicable NPM. In DCA Part 2, Tier 2, Section 16.1.1, "Introduction to Technical Specifications," the applicant stated the following:

> The [GTS] content differs from the [Standard Technical Specifications (STS)] as necessary to reflect technical differences between large light water reactor (LWR) designs and the NuScale Power Plant design.

The GTS and Bases are formatted consistent with STS, such as NUREG-1431, "Standard Technical Specifications - Westinghouse Plants," Revision 4, issued April 2012 (W-STS), NUREG-1432, "Standard Technical Specifications - Combustion Engineering Plants," Revision 4, issued April 2012 (CE-STS), and NUREG-2194, "STS for Westinghouse Advanced Passive 1000 Plants," Revision 0, issued April 2016 (W-AP1000-STS). They are also written consistent with the pressurized water reactor (PWR) and boiling water reactor (BWR) owner groups' Technical Specification Task Force (TSTF) guidelines in the "Writer's Guide for Plant-Specific Improved Technical Specifications," TSTF-GG-05-01, Revision 1 (writer's guide).

Selection Criteria for LCOs: Technical Report (TR)-1116-52011-NP, "Technical Specifications Regulatory Conformance and Development," Revision 1 (RCDR) (ML18305A964), which the applicant submitted as part of the DCA, documents the application of the LCO selection criteria of 10 CFR 50.36(c)(2)(ii) to the NuScale design and safety analyses of design-basis accidents (DBAs), anticipated operational occurrences (AOOs), and transients. The RCDR provides the basis for including the LCOs chosen for the GTS, and not including LCOs for systems typically addressed by an LCO in STS.

Completion Times and Surveillance Frequencies: The GTS required action completion times are proposed consistent with those completion times provided in STS for similar conditions in which the associated LCO is not met. Likewise, the applicant indicates that GTS surveillance requirement (SR) performance frequencies (test intervals) are proposed consistent with the frequencies of similar SRs in the STS. However, the staff noted that specific frequency values were not provided for GTS SR frequencies included in the proposed "Surveillance Frequency Control Program," GTS Subsection 5.5.11. The DCA did not include program documentation listing surveillance frequencies; such documentation is specified by GTS Subsection 5.5.11.

Consideration of TSTF Traveler Changes to STS: Section 4.2 of the RCDR states that information regarding travelers available to NuScale through June 30, 2018, was considered by NuScale during preparation of the GTS.

DCA Part 2, Tier 1: There are no DCA Part 2, Tier 1 entries for this area of review. The applicant provided proposed GTS and Bases for the NuScale design in DCA Part 2, Tier 2, Chapter 16, and DCA Part 4, summarized here in part, as follows:

The applicant provided the proposed GTS and Bases for the staff's review and approval in accordance with 10 CFR 50.36 and 10 CFR 50.36a. In its DCA, the applicant stated that it had largely developed the GTS and Bases using W-STS, CE-STS, and W-AP1000-STS. In support of DCA Part 2, Tier 2, Chapter 16, the DCA references the RCDR.

DCA Part 2, Tier 2: Although Chapter 16 in DCA Part 2 is Tier 2 information, the referenced GTS and Bases in DCA Part 4 are not.

Inspection, Test, Analysis and Acceptance Criteria (ITAAC): There are no ITAAC for this area of review.

TRs: As noted above, the applicant submitted the RCDR as part of the DCA.

COL Information: DCA Part 2, Tier 2, Chapter 16, lists COL Information Item 16.1-1, which will account for all instances of bracketed site-specific information in the GTS and Bases. It also lists COL Information Item 16.1-2, which will require preparation and maintenance of an owner-controlled requirements manual that includes owner-controlled limits and requirements described in the Bases of the plant-specific TS or as otherwise specified in the FSAR.

16.3 Regulatory Basis

The "Design-Specific Review Standard [DSRS] for the NuScale SMR [Small Modular Reactor] Design," Chapter 16.0, "Technical Specifications" (Agencywide Documents Access and Management System (ADAMS) Accession Number ML15355A312), which was derived from NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (SRP), Chapter 16, "Technical Specifications," Revision 3, issued March 2010, contains the relevant requirements of the NRC's regulations for this area of review, the associated acceptance criteria, and the review interfaces with other DSRS and SRP sections.

Section 182a of the Atomic Energy Act of 1954, as amended, requires that applicants for nuclear power plant operating licenses will state:

> ...such technical specifications, including information of the amount, kind, and source of special nuclear material required, the place of the use, the specific characteristics of the facility, and such other information as the Commission may, by rule or regulation, deem necessary in order to enable it to find that the utilization of special nuclear material will be in accord with the common defense and security and will provide adequate protection to the health and safety of the public. Such technical specifications shall be a part of any license issued.

In 10 CFR 50.36, the NRC established its regulatory requirements related to the content of technical specifications (TS). In doing so, the NRC placed emphasis on those matters related to the prevention of accidents and the mitigation of accident consequences. As recorded in the Statements of Consideration, "Technical Specifications for Facility Licenses; Safety Analysis Reports" (Volume 33 of the *Federal Register* (FR), page 18610, December 17, 1968), the NRC noted that applicants were expected to incorporate into their TS "...those items that are directly related to maintaining the integrity of the physical barriers designed to contain radioactivity." Accordingly, 10 CFR 50.36(c) requires that TS contain (1) SLs and LSSSs, (2) LCOs, (3) SRs, (4) design features, and (5) administrative controls.

In 10 CFR 50.36(c)(2)(ii), the NRC requires that an LCO be established in TS for each item meeting one or more of the following four criteria (referred to as LCO selection criteria):

> (A) *Criterion 1.* Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.
>
> (B) *Criterion 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.
>
> (C) *Criterion 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.
>
> (D) *Criterion 4.* A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.

In accordance with 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants," General Design Criterion (GDC) 17, "Electric power systems," GDC 21, "Protection system reliability and testability," GDC 34, "Residual heat removal," GDC 35, "Emergency core cooling," GDC 38, "Containment heat removal," GDC 41, "Containment atmosphere," and GDC 44, "Cooling water," those structures, systems, and components (SSCs) important to safety need to have sufficient independence, redundancy, and testability to perform their safety functions.

In 10 CFR 50.36a, the NRC requires that TS contain procedures for control of radioactive effluents.

In 10 CFR 52.47(a)(11), the NRC requires that a DC applicant propose TS prepared in accordance with 10 CFR 50.36 and 10 CFR 50.36a.

For the reasons discussed in detail below, the STS documents noted above include the acceptance criteria adequate to meet the above requirements. The STS for PWR designs currently in operation or under construction in the United States appear in four NRC documents: NUREG-1430, "Standard Technical Specifications - Babcock and Wilcox Plants," Revision 4, issued April 2012; NUREG-1431; NUREG-1432; and NUREG-2194. For each document, Volume 1 contains the Specifications, and Volume 2 contains the associated Bases. The STS include Bases for SLs, LSSSs, LCOs, and associated requirements for applicability, actions and surveillances. For the reasons discussed below, guidance documents applicable to the NuScale proposed GTS and Bases mostly include portions of the model STS in NUREG-1431 (W-STS), NUREG-1432 (CE-STS), and NUREG-2194 (W-AP1000-STS).

The STS reflect the detailed effort used to apply the criteria discussed in the Interim Policy Statement on TS Improvements for Nuclear Power Reactors (52 FR 3788, February 6, 1987) to generic system functions, which were published in a "Split Report" and issued to the nuclear steam supply system (NSSS) vendor owners groups in May 1988. In addition, extensive discussions during the development of the STS ensured that the application of the TS criteria and the joint industry and staff plant-specific improved TS writer's guide (which also applies to STS and GTS) would consistently reflect detailed system configurations and operating characteristics for all NSSS designs. As such, Bases documents include an abundance of information regarding the STS model requirements necessary to adequately protect public health and safety.

On July 22, 1993, the NRC issued its Final Policy Statement (58 FR 39132), expressing the view that satisfying the guidance in the policy statement also satisfies Section 182a of the Atomic Energy Act of 1954, as amended, and 10 CFR 50.36. In the final policy statement, the NRC described the safety benefits of the STS and encouraged licensees, to the extent applicable, to use the STS for plant-specific TS amendments and for complete conversions to improved TS. The NRC published major revisions to the STS in 1995 (Revision 1), 2001 (Revision 2), 2004 (Revision 3), and 2012 (Revision 4). The W-AP1000-STS, published in April 2016 (Revision 0), incorporated: (1) selected applicable TSTF travelers approved since issuance of W-STS Revision 2, and (2) improvements to the COL plant-specific TS approved for Vogtle Electric Generating Station, Units 3 and 4, into Revision 19 of the GTS and Bases, which are included in the AP1000 design certification rule, Appendix D, "Design Certification Rule for the AP1000 Design," to 10 CFR Part 52.

The format and content of proposed GTS and Bases prepared for a DCA use applicable provisions of the STS and STS Bases to the extent practicable to realize the safety benefits of standardization, taking into account design-specific characteristics. Before design approval, the staff reviews the DCA in detail to verify that the applicant includes sufficient technical justification for any appropriate deviation from conventions and precedents presented in STS, as well as any deviation in content based on design-specific characteristics.

Generic changes to STS, known as TSTF travelers, which the NRC has approved since issuance of STS Revision 4, are considered needed improvements or corrections to STS. The staff recommends that DC applicants consider such travelers, where applicable, for inclusion, with suitable design-related modifications, in the proposed GTS and Bases, to further realize the safety benefits of standardization. Section 16.4.11 of this SER chapter discusses the disposition of TSTF travelers.

16.4 <u>Technical Evaluation</u>

The staff evaluated the GTS according to the guidance in DSRS Chapter 16 to confirm that they will preserve the validity of the plant design, as described in the NuScale DCA Part 2, by ensuring that the plant will be operated: (1) within the required conditions bounded by the NuScale DCA Part 2 and (2) with operable equipment that is essential to prevent NuScale postulated design-basis events (DBEs) or mitigate their consequences.

The staff also reviewed the GTS Bases to verify that their technical content, level of detail, and format are consistent with the STS Bases, and that they accurately provide the technical basis for each provision in GTS Chapter 2 and Chapter 3, consistent with the DCA Part 2.

The staff's review of the GTS and Bases included the following topics of evaluation:

1. Application of LCO Selection Criteria;
2. Use and Application (Chapter 1), Definitions (Section 1.1), Logical Connectors (Section 1.2), Completion Times (Section 1.3), and Frequency (Section 1.4);
3. SLs (Chapter 2);
4. LCO and SR Use and Applicability (Chapter 3, Section 3.0);
5. LCO Statements (Chapter 3, Sections 3.1 to 3.8);
6. Applicability Statements (Chapter 3, Sections 3.1 to 3.8);
7. Action Requirements (Chapter 3, Sections 3.1 to 3.8);
8. SRs (Chapter 3, Sections 3.1 to 3.8) (The limiting trip setpoints (LTSPs), which are the LSSS and derived from the safety analysis analytical limits, the nominal trip setpoints (NTSPs), which are derived from the LTSPs, and the acceptance criteria for channel calibration SRs, are calculated in accordance with the NRC approved instrumentation setpoint methodology referenced in Subsection 5.5.10, "Setpoint Program (SP)." The SP requires maintaining the current values of these parameters in a document controlled under 10 CFR 50.59, "Changes, Tests and Experiments," and in accordance with the approved setpoint methodology.);
9. Design Features (Chapter 4, Sections 4.1 to 4.3);
10. Administrative Controls (Chapter 5, Sections 5.1 to 5.7); and
11. TSTF Traveler Disposition.

16.4.1 Application of LCO Selection Criteria

The applicant evaluated the NuScale design and safety analyses against the LCO selection criteria in 10 CFR 50.36(c)(2)(ii) and determined the LCOs that must be established for the NuScale design. The Applicable Safety Analyses (ASA) section of each subsection of the GTS Bases states the LCO selection criterion that each of these LCOs satisfies. The applicant also summarized a comparison of the selected LCOs to those LCOs included in W-STS, CE-STS, and W-AP1000-STS in RCDR Table B-1, "Comparison of Standard Technical Specifications with NuScale Generic Technical Specifications."

For each LCO listed under Criterion 2 or 3, this section of the SER states the principal DBA or transient analysis that credits the specified SSC or parameter limit, as described in the associated Bases. The staff compared the Bases for consistency with accident and transient analysis descriptions in DCA Part 2, Tier 2, Chapter 15, "Transient and Accident Analyses."[1] As stated in DCA Part 2, Tier 2, Table 15.0-1, "Design Basis Events," the safety analysis considers DBEs in the following categories classified according to their expected frequency of occurrence: postulated accident (PA), infrequent event (IE), and anticipated operational occurrence (AOO).

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[1] The staff will complete this consistency verification, and its documentation in this SER chapter, during Phase 4 of the GTS and Bases review after resolution of any related open items identified in SER Chapter 15.

The special event of an anticipated transient without scram (ATWS) is also considered. Unless otherwise pointed out, DBEs cited in this SER subsection are designated as AOO, which is the most common category.

16.4.1.1 LCOs Required by Criterion 1 - Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.

- LCO 3.4.7 Reactor Coolant System (RCS) Leakage Detection Instrumentation

This LCO requires two of three operable RCS leakage detection methods and, like STS, it is the only LCO satisfying Criterion 1. For the leakage detection instrumentation to be operable, the nonsafety-related containment evacuation system (CES) must be in operation and must maintain a low pressure in the containment vessel (CNV). Each of the three detection methods has sufficient sensitivity and response time to provide control room operators an early warning of the detection of significant degradation of the reactor coolant pressure boundary (RCPB), which results in reactor coolant leakage into containment. By alerting operators to take effective remedial measures as soon after occurrence as practical, this instrumentation minimizes the potential for propagation to gross failure of the RCPB.

Since no other NuScale system is designed or credited for detection of RCPB leakage within the CNV, and the proposed LCO is consistent with the STS, the staff finds that the GTS satisfy Criterion 1.

16.4.1.2 LCOs Required by Criterion 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.

For each LCO for a process variable, design feature, or operating restriction listed below, the staff compared, for consistency, the Bases ASA section discussion and the DCA Part 2, Tier 2, description of each PA, IE, and AOO[2] for which the process variable, design feature, or operating restriction is an initial condition. The staff finds that the following LCOs satisfy Criterion 2.

- LCO 3.1.1 SHUTDOWN MARGIN (SDM)

The minimum required SDM is assumed as an initial condition process variable for all safety analyses, including analyses of the inadvertent boron dilution (DCA Part 2, Tier 2, Subsection 15.4.6.3.4), uncontrolled control rod assembly (CRA) withdrawal from subcritical or low power condition (DCA Part 2, Tier 2, Subsection 15.4.1.3.2), and CRA ejection (DCA Part 2, Tier 2, Subsection 15.4.8). The LCO on SDM ensures that specified acceptable fuel design limits (SAFDLs) are not exceeded for normal operation and AOOs, with the assumption of the highest worth CRA stuck out of the core on a reactor trip.

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[2] [During Phase 4 of the review of the GTS and Bases, the staff will complete for each LCO a listing of each PA, IE, and AOO for which the LCO protects DBE assumed initial conditions.]

- LCO 3.1.2 Core Reactivity

This LCO establishes the core reactivity[3] behavior prior to exceeding 5-percent Rated Thermal Power (5% RTP) and prior to exceeding a fuel burnup of 60 effective full power days (EFPD) after beginning operation at RTP following initial fuel loading or refueling. The LCO normalizes the predicted change RCS boron concentration to the beginning of the refueling cycle measured steady state RCS critical boron concentration, so that core reactivity relative to predicted values can be continually monitored and evaluated as core conditions change during the refueling cycle. This LCO protects the validity of the accident and transient analysis initial condition assumption that the core is operating within acceptable design limits by comparing predicted and measured steady state RCS critical boron concentrations to ensure the measured reactivity is maintained within 1-percent above or below the predicted reactivity; i.e., to ensure a reactivity balance within ±1%Δk/k of the normalized predicted values is maintained. This LCO must be met in Mode 1.

- LCO 3.1.3 Moderator Temperature Coefficient (MTC)

This LCO ensures that the MTC is maintained within the upper and lower limits specified in the Core Operating Limits Report (COLR). In Mode 1, the upper limit (least negative value) on the MTC must be maintained to ensure that any core overheating accidents will not violate the design assumptions of the accident analysis. The limits must also be maintained to ensure startup and subcritical accidents, such as the uncontrolled CRA withdrawal from zero power, will not violate the assumptions of the accident analysis. The lower MTC limit (most negative value) must be maintained in Modes 1 and 2, and in Mode 3 with any RCS temperature greater than or equal to 200 degrees Fahrenheit (°F) (≥ 200°F) (93.3 degrees Celsius (°C)), to ensure that core overcooling accidents at the end of cycle will not violate the assumptions of the accident analysis.

- LCO 3.1.4 Rod Group Alignment Limits

In Mode 1, complying with the requirements that all shutdown and regulating control rod assemblies (CRAs) be operable and that individual CRA positions be within 6 steps of their shutdown or regulating group position, ensure that the CRA groups maintain the correct core power distribution, and satisfy the SDM requirements of LCO 3.1.1. These CRA alignment limits protect the validity of the initial conditions assumed in the analysis of CRA misalignment accidents.

- LCO 3.1.5 Shutdown Group Insertion Limits

In Mode 1, complying with shutdown group CRA insertion limits protects initial assumptions in all safety analyses that assume shutdown group CRA insertion upon reactor trip. These

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[3] The effective multiplication factor, k_{eff}, equals the neutron production from fission in one neutron population generation divided by the sum of the preceding neutron population generation's absorption by the fuel and leakage from the core. If $k_{eff} = 1.0$, the core is said to be critical and the neutron population from generation to generation stays the same; if $k_{eff} > 1.0$, the core is is said to be supercritical and the neutron population increases; and if $k_{eff} < 1.0$, the core is is said to be subcritical and the neutron population decreases. For power reactors, core reactivity is the deviation of k_{eff} from one, and equals $(k_{eff} – 1)/k_{eff}$; reactivity is expressed as a dimensionless number with units of percent of k_{eff} (%Δk/k).

insertion limits protect assumptions of initial core power distribution, available SDM, ejected shutdown CRA worth, and initial reactivity insertion rate.

- LCO 3.1.6 Regulating Group Insertion Limits

In Mode 1 with $k_{eff} \geq 1.0$, complying with regulating group CRA insertion limits protects initial assumptions in safety analyses of loss of coolant accident (LOCA), loss of flow, ejected CRA, or other accidents that assume regulating group CRA insertion upon reactor trip. These insertion limits protect assumptions of initial core power and fuel burnup distributions, available SDM, ejected regulating CRA worth, and initial reactivity insertion rate.

- LCO 3.1.7 Rod Position Indication

In Mode 1, CRA position indication is required to be operable to determine control rod positions and thereby ensure compliance with the control rod alignment and power-dependent insertion limits. CRA positions must be known with sufficient accuracy in order to verify the core is operating within the group sequence, overlap, design power peaking limits, ejected CRA worth, and within minimum SDM.

- LCO 3.1.9 Boron Dilution Control (chemical and volume control system (CVCS) demineralized water isolation valve operability, boric acid storage tank boron concentration limits, and RCS CVCS makeup flowrate limits)

In Modes 1, 2, and 3, this LCO ensures that the boron addition system (BAS) is not a source of reactor coolant boron dilution and that makeup pump demineralized water flow path flowrate does not exceed the COLR-specified flowrate assumed in the inadvertent decrease in RCS boron concentration AOO analysis (DCA Part 2, Tier 2, Section 15.4.6). The ASA section of Subsection B 3.1.9 states, “The boron concentration in the boric acid storage tank satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).”

DCA Part 2, Tier 2, Section 15.4.6.3.4, “Input Parameters and Initial Conditions,” states, “A minimum makeup temperature of 40 degrees F [4.44°C] is assumed for the analysis of boron dilution of the RCS during Modes 1 through 3.” In a public meeting teleconference with NuScale on September 4, 2018 (ML18275A306, ML18274A071), the applicant pointed out that a makeup flow with water at or near this temperature is very unlikely because of the reactor building location of the demineralized water storage tank. Based on the reasonable expectation of ambient temperatures always exceeding 40°F (4.44°C) in the vicinity of the demineralized water storage tank, the staff agrees with the applicant that including this temperature limit in LCO 3.1.9, because of Criterion 2, is not necessary to preclude RCS injection of makeup water with temperature below 40°F (4.44°C) in Modes 1, 2, and 3.

- LCO 3.2.1 Enthalpy Rise Hot Channel Factor ($F_{\Delta H}$)

DCA Part 2, Tier 2, Section 4.3.2.2.1, “Power Distribution - Definitions,” states:

> The maximum enthalpy rise hot channel factor, $F_{\Delta H}$, is defined as the ratio of the maximum integrated fuel rod power to the average fuel rod power. The limit on $F_{\Delta H}$ is established to ensure that the fuel design criteria are not exceeded and the accident analysis assumptions remain valid. This limit ensures that the design basis value for the [critical heat flux (CHF) ratio (CHFR)] is met for normal operation, anticipated operational occurrences, and infrequent events. The $F_{\Delta H}$ limit is representative of the coolant flow channel with the maximum enthalpy

rise. This channel has the highest power input to the coolant and therefore the highest probability for CHF.

> The NuScale design limit for $F_{\Delta H}$ is 1.50 and is based on the safety analysis.
>
> The heat flux hot channel factor (or total peaking factor), F_Q, is the ratio of maximum local heat flux on the surface of a fuel rod to the average fuel rod heat flux for the entire core. The maximum F_Q value is used to calculate the peak linear heat generation rate (LHGR). The maximum value of F_Q is used to ensure the specified acceptable fuel design limit for fuel centerline melting is not exceeded.

DCA Part 2, Tier 2, Section 4.3.2.2.2, “Power Distribution - Radial Power,” indicates that $F_{\Delta H}$ is an indication of radial flux peaking.

DCA Part 2, Tier 2, Section 4.3.2.2.6, “Power Distribution - Limiting Power Distributions,” in part, states the following:

> The radial power distribution is primarily determined by the cycle design. For each cycle core design, a limit is imposed on the maximum allowed $F_{\Delta H}$. This design limit is then conservatively applied in the subchannel analysis as described in Section 4.4. Except for events in Section 15.4 (Reactor and Power Distribution Anomalies) that do not involve CRA motion, radial power distributions are held constant through the evolution of the transient. Additionally, for Section 15.4 events that do involve CRA motion the radial power shapes account for the possible radial asymmetry of the event and radial power information specific to each event is provided for the subchannel analysis.
>
> The specific assumptions related to power distribution used in the steady state and accident analysis for power distribution are described in more detail in Section 4.4 and Chapter 15. The values of $F_{\Delta H}$ and F_z [Axial Peaking Factor, F_z, is the maximum relative power at any axial point in a fuel rod, divided by the average power of the fuel rod.] are conservatively selected for use in the transient analysis such that they are expected to be bounding for all cycles. If the calculated power distributions for a given cycle are not bounded by the values assumed in the accident analysis, the core design is revised to bring the calculated power distribution within the bounding value or the transient analysis is reperformed.
>
> The limiting power distributions are confirmed during operation by technical specifications that require operation within the [Axial Offset (AO)] window and within the [power dependent insertion limits (PDILs)]. In addition the fixed in-core flux measurements and resulting power distribution that continuously display in the control room provide further assurance that the power distributions both axially and radially are not deviating from those expected and assumed in the analysis.

The limiting value for $F_{\Delta H}$ is specified in the COLR and is an initial condition of all DBE analyses for which limits on the initial core power distribution are assumed. This LCO is applicable in Mode 1 with Thermal Power ≥ 25% RTP.

- LCO 3.2.2 AXIAL OFFSET (AO)

AO is the ratio of the difference in power between the top half of the core and the bottom half of the core to the total core power. This parameter is an indication of axial flux peaking and the limiting values specified in the COLR is an initial condition of all DBE analyses for which limits on the initial core power distribution are assumed. This LCO is applicable in Mode 1 with Thermal Power ≥ 25% RTP.

DCA Part 2, Tier 2, Section 4.3.2.2.9, "Power Distribution - Monitoring," states the following (emphasis added):

> During normal operation, the incore instrumentation system (ICIS) is used to synthesize core-wide three-dimensional power distributions. These power distributions are compared to predicted core power distributions to verify the core is operating as designed. *Axial power distributions are continuously monitored to validate the AO operating window, and actions required by the technical specifications are initiated based on this information.* Also, power distributions from the ICIS are used to calibrate the ex-core neutron flux detectors. When the rod position indication system is not working properly, the ICIS has the capability to determine the relative position of a stuck or misaligned control rod.

DCA Part 2, Tier 2, Section 4.3.2.2.1, "Power Distribution - Definitions," states the following (emphasis added):

> The heat flux hot channel factor (or total peaking factor), F_Q, is the ratio of maximum local heat flux on the surface of a fuel rod to the average fuel rod heat flux for the entire core. The maximum F_Q value is used to calculate the peak linear heat generation rate (LHGR). *The maximum value of F_Q is used to ensure the specified acceptable fuel design limit for fuel centerline melting is not exceeded.*

The staff observed that even though the limit on maximum F_Q is used to ensure that none of the fuel design criteria are exceeded, the currently proposed NuScale GTS Section 3.2 does not include an LCO for F_Q. The staff relies upon such an LCO to establish a finding that each NPM will be operated within the bounds of the safety analyses. Accordingly, in RAI 472-9445 (ML18130A984), Question 16-42, the staff requested that NuScale add an LCO for F_Q in GTS Section 3.2 or add a justification to DCA Part 2, Tier 2, for not including an LCO for F_Q in GTS Section 3.2. In its response (ML18163A417) to RAI 472-9445, Question 16-42, the applicant stated:

> The heat flux hot channel factor (F_Q) is used in the NuScale design to calculate the peak linear heat generation rate to ensure that the specified acceptable fuel design limit for fuel centerline melting is not exceeded. The NuScale design is characterized by a relatively low linear heat rate (kW/ft) compared to the PWR operating fleet and has substantial margin to fuel centerline melting at normal power levels. F_Q is not used as an initial condition for any transient or design basis accident, including loss of coolant accident. As a result, a Limiting Condition for Operation for F_Q is not needed in the NuScale design. FSAR Sections 4.3 and 4.4 are modified to clarify this point.

SER Section 4.3 provides the staff's evaluation of this response and the changes to DCA Part 2, Tier 2, Sections 4.3 and 4.4. Based on that evaluation, the staff concludes that an LCO for F_Q is not needed to ensure that the core SL for peak fuel centerline temperature is not violated in the event of a PA. Therefore, RAI 472-9445, Question 16-42, is resolved. **The staff is tracking changes to DCA Part 2, Tier 2, Sections 4.3 and 4.4, as a confirmatory item associated with RAI 472-9445, Question 16-42.**

- LCO 3.4.1 RCS Pressure, Temperature, and Flow Resistance Critical Heat Flux (CHF) Limits

The limits of this LCO protect initial condition assumptions of the DCA Part 2, Tier 2, Chapter 15 safety analyses. This LCO is applicable in Mode 1.

- LCO 3.4.2 RCS Minimum Temperature for Criticality

This LCO protects the SDM required by LCO 3.1.1. This LCO is applicable in Mode 1.

- LCO 3.4.3 RCS Pressure and Temperature (P/T) Limits

This LCO protects the RCPB, and must be met at all times.

- LCO 3.4.5 RCS Operational LEAKAGE

The leakage limits ensure that RCPB degradation will be detected and corrected before the flaw results in a LOCA. This LCO must be met in Modes 1 and 2, and in Mode 3 with RCS hot temperature at or above 200°F (~93.3°C).

- LCO 3.4.8 RCS Specific Activity

The Dose Equivalent I-131 and the Dose Equivalent XE-133 activity limits are consistent with the design-basis failed-fuel fraction assumed in the design of radiation shielding in spaces with piping and vessels containing reactor coolant that are accessible to plant operators. These activity limits are also consistent with the assumed initial RCS specific activity in the accident radiological dose consequence analyses in DCA Part 2, Tier 2, Chapter 15. These activity limits reflect a specific activity resulting from expected fuel pin cladding defects that are much less severe than typically considered in W-STS. With these much smaller specific activity limits, the contribution of the assumed initial RCS specific activity to dose consequences of DBAs, such as a steam generator tube rupture, is also much smaller.

- LCO 3.4.9 Steam Generator (SG) Tube Integrity

This LCO, in conjunction with the SG Program of Subsection 5.5.4, ensures the SG tubes are maintained such that a SG tube failure PA (double-ended failure of a single tube) is unlikely to occur. The safety analyses of PAs and AOOs other than a SG tube failure assume the maintenance of tube structural integrity. SER Section 16.4.9.3 gives an additional evaluation of the SG tube requirements of GTS Subsections 3.4.9 and 5.5.4.

- LCO 3.5.3 Ultimate Heat Sink (UHS)

In Modes 1, 2, and 3, this LCO protects the UHS bulk average temperature upper limit of 110°F (~43.3°C), which is assumed and credited, directly or indirectly as an initial condition in PAs that require the operation of the decay heat removal system (DHRS) and the emergency core cooling system (ECCS), for both LOCA and non-LOCA DBEs.

In Mode 4, this LCO protects the minimum reactor pool level of 68 feet (ft) (~21 meters), which ensures the buoyancy assumed in the reactor building crane analysis and design to ensure the crane's single-failure-proof capability during movement of an NPM by not loading the crane above its single-failure-proof capacity.

In Mode 5, or during irradiated fuel movement within the spent fuel pool, this LCO ensures the initial condition assumptions of the analysis of a fuel handling PA during irradiated fuel movement are satisfied (DCA Part 2, Tier 2, Section 15.0.3.8.5). The minimum reactor pool water level of 55 ft (~17 meters) (in Condition A) ensures the assumption of 23 ft (~7 meters) of water above the weir wall, which is the most limiting, most shallow location of a dropped fuel assembly.

DCA Part 2, Tier 2, Section 15.4.6.3.4, "Input Parameters and Initial Conditions," for the inadvertent decrease in reactor pool boron concentration AOO analysis (DCA Part 2, Tier 2, Section 15.4.6) states "The minimum possible reactor pool volume is used to provide a limiting time to loss of shutdown margin for Mode 5."

- LCO 3.7.3 In-Containment Secondary Piping Leakage

In a supplemental response (ML18354B172) to RAI 375-9201 (ML18059B016), Question 5.2.5-7, the applicant proposed Subsection 3.7.3 to place a TS limit on secondary piping leakage inside the CNV, as requested by the staff. This limit would serve as a leak-before-break (LBB) criterion to ensure that when such leakage above the specified limit is discovered, operators can take appropriate action before the integrity of an affected main steam or feedwater line is impaired. In the Background section of proposed Subsection B 3.7.3, the applicant states the following:

> LBB is an argument which allows elimination of design for dynamic load effects of postulated pipe breaks. The fundamental premise of LBB is that the materials used in nuclear plant piping are strong enough that even a large through wall crack leaking well in excess of rates detectable by present leak detection systems would remain stable, and would not result in a double-ended guillotine break under maximum loading conditions. The benefit of LBB is the elimination of pipe whip restraints, jet impingement effects, and internal system blowdown loads.

The staff agrees with this description of the LBB issue. However, in the Applicable Safety Analyses (ASA) section of proposed Subsection B 3.7.3, the applicant states the following conclusion that the in-containment secondary system piping leakage limit of LCO 3.7.3 meets none of the LCO selection criteria:

> Although the in-containment secondary system piping leakage limit is not required by the 10 CFR 50.36(c)(2)(ii) criteria, this specification has been included in Technical Specifications due to the potential for adverse interaction between in-containment secondary system piping and other safety related equipment located inside the containment if a postulated failure occurred.

Since, in Question 5.2.5-7, the staff presented a clear rationale for concluding that a LBB limit on in-containment secondary system piping leakage satisfies 10 CFR 50.36(c)(2)(ii)(B), Criterion 2, the staff disagrees with the applicant's determination that this LBB limit meets none of the LCO selection criteria. See SER Section 5.2.5 for further discussion of the response to

Question 5.2.5-7 and the LBB limit on in-containment secondary system piping leakage. **The staff is tracking this disagreement and Subsections 3.7.3 and B 3.7.3 as an open item under RAI 375-9201, Question 5.2.5-7**.

- LCO 3.8.2 Decay Time

In Mode 5, this LCO ensures irradiated fuel movement within the reactor vessel does not occur until 48 hours after reactor shutdown as assumed by the fuel handling PA analysis.

Pending resolution of the open item on whether the in-containment secondary system piping leakage limit satisfies Criterion 2, the staff's evaluation of whether the proposed GTS satisfy Criterion 2 is not complete.

16.4.1.3 LCOs Required by Criterion 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.

For each LCO subsystem and instrumentation function listed below, the staff compared for consistency the Bases ASA section discussion and the DCA Part 2, Tier 2, description of each PA, IE, and AOO that credits the subsystem or function. [During Phase 4 of the review of the GTS and Bases, the staff will complete, for each LCO, a listing of each PA, IE, and AOO for which the LCO protects the primary success path for prevention or mitigation.] The staff finds that the following LCOs satisfy Criterion 3.

- LCO 3.1.9 Boron Dilution Control (CVCS DWSI valve operability, boric acid storage tank boron concentration limits, and CVCS makeup pump flow path flowrate limit)

This LCO requires two CVCS demineralized water isolation valves to be operable to ensure that there will be redundant means available to automatically terminate an inadvertent boron dilution event in Modes 1, 2, and 3. This LCO also ensures that the BAS is not a source of reactor coolant boron dilution and that makeup pump flow does not exceed the COLR-specified flowrate assumed in the inadvertent decrease in RCS boron concentration AOO (boron dilution event) analysis (DCA Part 2, Tier 2, Section 15.4.6). Subsection B 3.1.9, ASA section states, "CVCS demineralized water isolation valves satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii)."

- LCO 3.3.1 Module Protection System (MPS) Instrumentation

Each MPS instrumentation Function with its Modes of Applicability for each supported RTS or ESFAS logic and actuation Function is listed in Table 16.4.1-1. For each supported Function, the events crediting the MPS Function are also listed, including a reference to the Section of DCA Part 2, Tier 2, describing each event.

Table 16.4.1-1
MPS (Reactor Trip System (RTS) and
Engineered Safety Feature Actuation System (ESFAS))
Instrumentation Functions

MPS INSTRUMENTATION FUNCTION AND SUPPORTED RTS AND ESFAS LOGIC AND ACTUATION FUNCTION(S)	APPLICABLE MODES		
1. *High Power Range Linear Power*			
a. Reactor Trip System (RTS)	1	2(a)	3(a)
• Loss of feedwater heating (15.1.1, 10.4.7.2)			
• Decrease in feedwater temperature AOO (15.1.1.2) (5% RTP penalty added)			
• Increase in feedwater flow AOO (15.1.2.2) (5% RTP penalty added)			
• Increase in steam flow AOO (non limiting CHFR 125% steam flow case) (15.1.3.2) (5% RTP penalty added)			
• Steam piping failures inside & outside CNV (15.1.5.2) (5% RTP penalty added)			
• Uncontrolled CRA withdrawal from a subcritical or low power or startup condition (at 25% RTP for startup conditions) (15.4.1.2)			
• Uncontrolled CRA withdrawal at power (15.4.2.2)			
• Control rod misoperation (system malfunction or operator error) (15.4.3.2)			
• Spectrum of rod ejection accidents (15.4.8.2.4)			
b. DWSI	1	2(a)	3(a)
• Inadvertent decrease in RCS boron concentration (15.4.6.2); DWSI occurs on any RTS reactor trip signal.			
(a) When capable of CRA withdrawal.			
2. *High Power Range Positive and Negative Rate*			
a. RTS	1(b)	-	-
• Decrease in feedwater temperature AOO *(not credited)* (15.1.1.2)			
• Increase in feedwater flow AOO *(not credited)* (15.1.2.2)			
• Increase in steam flow AOO *(not credited)* (15.1.3.2)			
• Steam piping failures inside & outside CNV (*not credited*) (15.1.5.2)			
• Uncontrolled CRA withdrawal at power (15.4.2.2)			
• Spectrum of rod ejection accidents (15.4.8.2.4)			
b. DWSI	1(b)	-	-
• DWSI occurs on any RTS reactor trip signal.			
(b) With power above the N-2H Interlock.			
3. *High Intermediate Range Log Power Rate*			
a. RTS	1(c)	2(a)	3(a)

MPS INSTRUMENTATION FUNCTION AND SUPPORTED RTS AND ESFAS LOGIC AND ACTUATION FUNCTION(S)	APPLICABLE MODES		
• Uncontrolled CRA withdrawal from a subcritical or low power or startup condition (15.4.1.2)			
b. DWSI	1(c)	2(a)	3(a)
• DWSI occurs on any RTS reactor trip signal.			
(a) When capable of CRA withdrawal.			
(c) *With power b*elow the N-2L Interlock.			
4. High Source Range Count Rate			
a. RTS	1(d)	2(a)	3(a)
• Uncontrolled CRA withdrawal from a subcritical or low power or startup condition (15.4.1.2)			
b. DWSI	1(d)	2(a)	3(a)
• DWSI occurs on any RTS reactor trip signal.			
(a) When capable of CRA withdrawal.			
(d) When Intermediate Range Log Power less than N-1 interlock.			
5. High Source Range Log Power Rate			
a. RTS	1(d)	2(a)	3(a)
• [to be determined]			
b. DWSI	1(d)	2(a)	3(a)
• DWSI occurs on any RTS reactor trip signal.			
(a) When capable of CRA withdrawal.			
(d) When Intermediate Range Log Power less than N-1 interlock.			
6. High Subcritical Multiplication			
a. DWSI	1(d)	2(a)	3(a)
• Inadvertent decrease in RCS boron concentration (15.4.6.2)			
(a) When capable of CRA withdrawal.			
(d) When Intermediate Range Log Power less than N-1 interlock.			
7. High Pressurizer Pressure			
a. RTS	1	2(a)	3(a)
• Rod ejection accident—maximum RCS pressure case, (15.4.8, Table 15.4-21) • Inadvertent DHRS actuation (15.2.9, 10.4.7.2) • Loss of feedwater flow (15.2.7, 10.4.7.2) • Increase in steam flow AOO (15.1.3.2) • Loss of external load AOO (15.2.1.2) • Turbine trip AOO (15.2.2.1) • Loss of condenser vacuum AOO (15.2.3.1) • Closure of MSIV(s) AOO (15.2.4.2) • Loss of non-emergency AC power to the station auxiliaries (15.2.6.2, Table 15.2-15, RCS Overpressurization, Table 15.2-16, SG Peak Pressure) • Loss of normal feedwater flow AOO (15.2.7.2) • Feedwater system pipe breaks inside and outside of containment (15.2.8.1) • Uncontrolled CRA withdrawal at power (15.4.2.2)			

MPS INSTRUMENTATION FUNCTION AND SUPPORTED RTS AND ESFAS LOGIC AND ACTUATION FUNCTION(S)	APPLICABLE MODES		
• Control rod misoperation (15.4.3.2) • Spectrum of rod ejection accidents (15.4.8.2.4) • CVCS malfunction AOO (15.5.1.2) • Failure of small lines carrying primary coolant outside containment (CVCS makeup line break + loss of normal AC) IE (15.6.2.3.3, CVCS letdown line break + loss of normal AC, Table 15.6-3 maximum RPV pressure) • LOCAs resulting from a spectrum of postulated piping breaks within the RCPB PA (15.6.5.3.3)			
b. Decay Heat Removal System (DHRS) [4]	1	2	3(e)
• Increase in steam flow AOO (15.1.3.2) • Loss of feedwater flow (15.2.7, 10.4.7.2) • Loss of external load AOO (15.2.1.2) • Turbine trip AOO (15.2.2.1) • Loss of Condenser Vacuum AOO (15.2.3.1) • Closure of MSIV(s) AOO (15.2.4.2) • Loss of non-emergency AC power to the station auxiliaries (15.2.6.2, Table 15.2-15, RCS Overpressurization, Table 15.2-16, SG Peak Pressure) • Loss of Normal Feedwater Flow AOO (15.2.7.2) • Uncontrolled CRA withdrawal from a subcritical or low power or startup condition (15.4.1.2) • Feedwater System pipe breaks inside and outside of containment (15.2.8.1) • Uncontrolled CRA withdrawal at Power (15.4.2.2) • Control rod misoperation (15.4.3.2) • Failure of small lines carrying primary coolant outside containment (CVCS makeup line break + loss of normal AC IE, 15.6.2.3.3, Table 15.6-3 maximum RPV pressure) • LOCAs resulting from a spectrum of postulated piping breaks within the RCPB PA (15.6.5.3.3)			
c. Pressurizer Heater Trip (PHT)	1	2(f)	3(f)
• Failure of small lines carrying primary coolant outside containment IE (15.6.2.3.3, Table 15.6-3 maximum RPV pressure)			
d. DWSI	1	2(a)	3(a)
• DWSI occurs on any RTS reactor trip signal.			
(a) When capable of CRA withdrawal. (e) When not PASSIVELY COOLED. (f) With pressurizer heater trip breakers closed.			

[4] DHRS actuation includes isolation of each feedwater line using the feedwater isolation valve (FWIV) and the feedwater regulating valve (FWRV, and each main steam line using the main steam isolation valves (MSIVs) and the main steam isolation bypass valves (MSIBVs).

MPS INSTRUMENTATION FUNCTION AND SUPPORTED RTS AND ESFAS LOGIC AND ACTUATION FUNCTION(S)	APPLICABLE MODES		
8. Low Pressurizer Pressure			
a. RTS • Decrease in feedwater temperature AOO (15.1.1.2) • Steam line break outside containment (15.1.5, 10.4.7.2) • Increase in steam flow AOO (15.1.3.2) • Steam piping failures inside & outside CNV (15.1.5.2) • Failure of small lines carrying primary coolant outside containment IE (15.6.2.3.2/3) • Steam generator tube failure (SGTF) PA (15.6.3.3.2,10.4.7.2) • LOCAs resulting from a spectrum of postulated piping breaks within the RCPB PA (15.6.5.3.3)	1(g)	-	-
b. DHRS • Decrease in feedwater temperature AOO (15.1.1.2) • Increase in steam flow AOO (15.1.3.2) • Control rod misoperation (15.4.3.2) • Steam generator tube failure (SGTF) PA (15.6.3.3.2,10.4.7.2, Table 15.6-6 limiting mass release and iodine spiking time)	1(g)	-	-
c. Chemical and Volume Control System Isolation (CVCSI) • Increase in steam flow AOO (Table 15.1-5, Sequence of Events) • Failure of small lines carrying primary coolant outside containment IE (15.6.2.3.2/3)	1(g)	-	-
d. PHT • [to be determined]	1(g)	-	-
e. DWSI • DWSI occurs on any RTS reactor trip signal.	1(g)	-	-
(g) With narrow range RCS hot temperature above the T-4 interlock.			
9. Low Low Pressurizer Pressure			
a. RTS • [to be determined]	1	2(a)	-
b. DHRS • [to be determined]	1	2	-
c. CVCSI • [to be determined]	1	2	-
d. PHT • [to be determined]	1	2	-
e. DWSI • DWSI occurs on any RTS reactor trip signal.	1	2(a)	-
(a) When capable of CRA withdrawal.			

MPS INSTRUMENTATION FUNCTION AND SUPPORTED RTS AND ESFAS LOGIC AND ACTUATION FUNCTION(S)	APPLICABLE MODES		
10. High Pressurizer Level			
a. RTS • Inadvertent DHRS actuation AOO (15.2.9, 10.4.7.2) • Loss of feedwater flow AOO (15.2.7, 10.4.7.2) • CVCS malfunction AOO (15.5.1.2)	1	2(a)	3(a)
b. CVCSI • [to be determined]	1	2	3
c. DWSI • DWSI occurs on any RTS reactor trip signal.	1	2(a)	3(a)
(a) When capable of CRA withdrawal.			
11. Low Pressurizer Level			
a. RTS • Decrease in feedwater temperature AOO (15.1.1.2) • Steam piping failures inside & outside containment (15.1.5.2, 10.4.7.2) • Failure of small lines carrying primary coolant outside containment IE (15.6.2.3.2) • SGTF (15.6.3,10.4.7.2), Table 15.6-6 limiting mass release and iodine spiking time, Table 15.6-8 limiting SG pressure • LOCAs resulting from a spectrum of postulated piping breaks within the RCPB PA (15.6.5.3.3)	1	2(a)	3(a)
b. PHT • SGTF (15.6.3,10.4.7.2, Table 15.6-6 limiting mass release and iodine spiking time, Table 15.6-7 limiting RPV pressure, Table 15.6-8 limiting SG pressure)	1	2(f)	3(f)
c. DWSI • DWSI occurs on any RTS reactor trip signal.	1	2(a)	3(a)
(a) When capable of CRA withdrawal. (f) With pressurizer heater trip breakers closed.			
12. Low Low Pressurizer Level			
a. DHRS • Decrease in feedwater temperature AOO	1	2	3(h)
b. Containment Isolation System (CIS) • Decrease in feedwater temperature AOO (15.1.1.2, Table 15.1-1) • SGTF (15.6.3,10.4.7.2) • LOCAs resulting from a spectrum of postulated piping breaks within the RCPB PA (15.6.5.3.3)	1	2	3(h)
c. CVCSI • Decrease in feedwater temperature AOO (15.1.1.2, Table 15.1-1) • Failure of small lines carrying primary coolant outside containment IE (15.6.2.3.2)	1	2	3(h)

MPS INSTRUMENTATION FUNCTION AND SUPPORTED RTS AND ESFAS LOGIC AND ACTUATION FUNCTION(S)	APPLICABLE MODES		
d. PHT	1	2(f)	3(f)
• [to be determined]			
(f) With pressurizer heater trip breakers closed.			
(h) With RCS temperature above the T-2 interlock and containment water level below the L-1 interlock.			
13. High Narrow Range RCS Hot Temperature			
a. RTS	1	-	-
• Increase in steam flow AOO - limiting CHFR 114% steam flow case (15.1.3.2)			
• Decrease in feedwater temperature AOO (15.1.1.2)			
• Increase in steam flow AOO *(*15.1.3.2)			
• Loss of normal feedwater flow AOO (15.2.7.2)			
• Inadvertent operation of DHRS AOO (15.2.9.2, Table 15.2-31)			
• Uncontrolled CRA withdrawal at power (15.4.2.2)			
• Control rod misoperation (15.4.3.2)			
b. DHRS	1	2	3(e)
• Decrease in feedwater temperature AOO (15.1.1.2)			
• Increase in steam flow (15.1.3.2)			
• Increase in steam flow AOO *(*15.1.3.2)			
• Loss of normal feedwater flow AOO (15.2.7.2)			
• Inadvertent operation of DHRS AOO (15.2.9.2)			
• Uncontrolled CRA withdrawal at power (15.4.2.2)			
• Control rod misoperation (15.4.3.2)			
c. PHT	1	2	3(f)
• [to be determined]			
d. DWSI	1	-	-
• DWSI occurs on any RTS reactor trip signal.			
(e) When not PASSIVELY COOLED.			
(f) With pressurizer heater trip breakers closed.			
14. Low RCS Flow			
a. DWSI	1	2	3
• Inadvertent decrease in RCS boron concentration (15.4.6.2)			
15. Low Low RCS Flow			
a. RTS	1	2(a)	3(a)
• [to be determined]			
b. CVCSI	1	2	3
• [to be determined]			
c. DWSI	1	2(a)	3(a)
• [to be determined]			
(a) When capable of CRA withdrawal.			

MPS INSTRUMENTATION FUNCTION AND SUPPORTED RTS AND ESFAS LOGIC AND ACTUATION FUNCTION(S)	APPLICABLE MODES		
16. Low Reactor Pressure Vessel (RPV) Riser Level			
a. Emergency Core Cooling System (ECCS)[5]	1	2	3
• Inadvertent operation of ECCS (RVV opening bounds RSV opening) AOO (15.6.6.3.2)			
17. High Main Steam Pressure			
a. RTS	1	2(a)	-
• Loss of external load AOO (15.2.1.2; limiting minimum CHFR (MCHFR))			
• Turbine trip AOO (15.2.2.1)			
• Loss of condenser vacuum AOO (15.2.3.1)			
• Closure of MSIV(s) AOO (15.2.4.2)			
• Increase in feedwater flow AOO (15.1.2.2, 10.4.7.2) *(5% RTP penalty added)*			
• Inadvertent DHRS actuation (one valve opens, turbine load controller ineffective; turbine bypass not credited) (15.2.9.2, 10.4.7.2)			
• SGTF (15.6.3, 10.4.7.2)			
• Loss of Non-Emergency AC Power to the Station Auxiliaries (15.2.6 - Table 15.2-17, Limiting MCHFR)			
• Failure of small lines carrying primary coolant outside containment IE (15.6.2.3.2) (CVCS letdown line break + loss of normal AC, Table 15.6-1, Maximum Mass Release)			
b. DHRS	1	2	3(e)
• Decrease in feedwater temperature AOO (15.1.1.2)			
• Increase in feedwater flow AOO (15.1.2.2)			
• Loss of external load AOO (15.2.1.2; limiting MCHFR)			
• Turbine trip AOO (15.2.2.1)			
• Loss of condenser vacuum AOO (15.2.3.1)			
• Closure of MSIV(s) AOO (15.2.4.2)			
• Loss of Non-Emergency AC Power to the Station Auxiliaries (15.2.6, Table 15.2-17, Limiting MCHFR)			
• Failure of small lines carrying primary coolant outside containment IE (15.6.2.3.2)			
c. PHT	1	2(f)	3(f)
• [to be determined]			
d. DWSI	1	2(a)	-
• DWSI occurs on any RTS reactor trip signal.			
(a) When capable of CRA withdrawal.			
(e) When not PASSIVELY COOLED.			
(f) With pressurizer heater trip breakers closed.			

5 As of December 2018, the applicant has communicated its intention to remove this MPS function from the design. The staff will evaluate associated changes to GTS and Bases during Phase 4 of the DCA review.

MPS INSTRUMENTATION FUNCTION AND SUPPORTED RTS AND ESFAS LOGIC AND ACTUATION FUNCTION(S)	APPLICABLE MODES		
18. Low Main Steam Pressure			
a. RTS • Increase in steam flow AOO (15.1.3.2) • Steam piping failures inside and outside containment (5.1.5.2) • Inadvertent DHRS actuation AOO (15.2.9.2, 10.4.7.2) • Steam line break outside containment (15.1.5, 10.4.7.2)	1(b)	-	-
b. DHRS • Increase in steam flow AOO (15.1.3.2) • Feedwater system pipe breaks inside and outside of containment (15.2.8.1)	1(b)	-	-
c. Pressurizer Heater Trip • [to be determined]	1(b)	-	-
d. DWSI • DWSI occurs on any RTS reactor trip signal.	1(b)	-	-
(b) With power above the N-2H Interlock.			
19. Low Low Main Steam Pressure			
a. RTS • [to be determined]	1	2(a)	-
b. DHRS • [to be determined]	1	2	-
c. Pressurizer Heater Trip • [to be determined]	1	2(f)	-
d. DWSI • [to be determined]	1	2(a)	-
(a) When capable of CRA withdrawal. (f) With pressurizer heater trip breakers closed.			
20. High Steam Superheat			
a. RTS • Decrease in feedwater temperature AOO (15.1.1.2) • Increase in feedwater flow AOO *(not* credited*)* (15.1.2.2) • Increase in steam flow AOO *(not credited)* (15.1.3.2) • Steam piping failures inside and outside containment (5.1.5.2) • Feedwater system pipe breaks inside and outside of containment (15.2.8.1) • Inadvertent DHRS actuation (one valve opens, turbine load controller ineffective; turbine bypass not credited) (15.2.9.2) • Spectrum of rod ejection accidents (15.4.8.2.4)	1	-	-
b. DHRS • Decrease in feedwater temperature AOO (15.1.1.2) • Feedwater system pipe breaks inside and outside of containment (15.2.8.1)	1	-	-
c. PHT • [to be determined]	1	-	-

MPS INSTRUMENTATION FUNCTION AND SUPPORTED RTS AND ESFAS LOGIC AND ACTUATION FUNCTION(S)	APPLICABLE MODES		
d. DWSI • DWSI occurs on any RTS reactor trip signal.	1	-	-
21. Low Steam Superheat			
a. RTS • Steam piping failures inside and outside containment (5.1.5.2)	1	-	-
b. DHRS • Increase in feedwater flow AOO (15.1.2.2)	1	-	-
c. PHT • [to be determined]	1	-	-
d. DWSI • DWSI occurs on any RTS reactor trip signal.	1	-	-
22. High Narrow Range Containment Pressure			
a. RTS • Main steam line break (SLB) inside containment PA (6.2.1.4.4, 15.1.5.1) • Feedwater line break (FWLB) PA (6.2.1.4.4, 15.1.5.1) • Feedwater system pipe breaks inside and outside of containment (15.2.8.1) • Steam piping failures inside and outside containment (15.1.5.2) • Loss of CNV vacuum, or CNV flooding (15.1.6.2) • LOCAs resulting from a spectrum of postulated piping breaks within the RCPB PA (15.6.5.3.3) • Inadvertent operation of ECCS (RVV opening bounds RSV opening) AOO (15.6.6.3.2/3)	1	2(a)	3(a)
b. DHRS • Main SLB inside containment PA (6.2.1.4.4, 15.1.5.1) • FWLB PA (6.2.1.4.4, 15.1.5.1) • Feedwater system pipe breaks inside and outside of containment (15.2.8.1) • Inadvertent operation of ECCS (RVV opening bounds RSV opening) AOO (15.6.6.3.2/3)	1	2	3(e)
c. CIS • Main SLB inside containment PA (15.1.5.1) • Feedwater system pipe breaks inside and outside of containment (15.2.8.1) • Inadvertent operation of ECCS (RVV opening bounds RSV opening) AOO (15.6.6.3.2)	1	2	3(i)
d. CVCSI • [to be determined]	1	2	3(i)
e. PHT • [to be determined]	1	2(f)	3(f)
f. DWSI • DWSI occurs on any RTS reactor trip signal.	1	2(a)	3(a)
(a) When capable of CRA withdrawal. (e) When not PASSIVELY COOLED. (f) With pressurizer heater trip breakers closed. (i) With RCS temperature above the T-3 interlock.			

MPS INSTRUMENTATION FUNCTION AND SUPPORTED RTS AND ESFAS LOGIC AND ACTUATION FUNCTION(S)	APPLICABLE MODES		
23. High Containment Water Level			
a. ECCS • LOCAs resulting from a spectrum of postulated piping breaks within the RCPB PA (15.6.5.3.3) • Inadvertent operation of ECCS (RVV opening bounds RSV opening) AOO (15.6.6.3.2)	1	2	3(e)
24. High RCS Pressure – Low Temperature Overpressure Protection (LTOP)			
a. LTOP • [to be determined]	-	-	3(k)
(k) With wide range RCS cold temperature below the LTOP enable temperature specified in the PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR) (T-1 interlock) and more than one reactor vent valve closed.			
25. Low AC Voltage to Low Voltage AC Electrical Distribution System (ELVS) Battery Chargers			
a. RTS • SGTF PA (with loss of highly reliable DC power & normal AC power (15.6.3.3.2)	1	2(a)	3(a)
b. DHRS • SGTF PA (with loss of highly reliable DC power & normal AC power (15.6.3.3.2)	1	2	3(e)
c. CIS • SGTF PA (with loss of highly reliable DC power & normal AC power (15.6.3.3.2)	1	2	3
d. DWSI • DWSI occurs on any RTS reactor trip signal.	1	2(a)	3(a)
e. PHT • [to be determined]	1	2(f)	-
(a) When capable of CRA withdrawal. (e) When not PASSIVELY COOLED. (f) With pressurizer heater trip breakers closed.			
26. High Under-the-Bioshield Temperature			
a. RTS • [to be determined]	1	2(a)	3(a)
b. DHRS • [to be determined]	1	2	3
c. CIS • [to be determined]	1	2	3
d. DWSI • [to be determined]	1	2(a)	3(a)
e. PHT • [to be determined]	1	2(f)	3(f)
(a) When capable of CRA withdrawal. (f) With pressurizer heater trip breakers closed.			

- LCO 3.3.2 Reactor Trip System (RTS) Logic and Actuation

The following MPS instrumentation functions initiate an RTS actuation:

Table 16.4.1-2
RTS Logic and Actuation Function

RTS LOGIC AND ACTUATION FUNCTION *ASSOCIATED MPS INSTRUMENTATION FUNCTIONS*	APPLICABLE MODES		
LCO 3.3.2 **Reactor Trip System** (a) When capable of CRA withdrawal.	1	2(a)	3(a)
1.a. High Power Range Linear Power	*1*	*2(a)*	*3(a)*
2.a. High Power Range Positive and Negative Rate	*1(b)*	-	-
3.a. High Intermediate Range Log Power Rate	*1(c)*	*2(a)*	*3(a)*
4.a. High Source Range Count Rate	*1(d)*	*2(a)*	*3(a)*
5.a. High Source Range Log Power Rate	*1(d)*	*2(a)*	*3(a)*
7.a. High Pressurizer Pressure	*1*	*2(a)*	*3(a)*
8.a. Low Pressurizer Pressure	*1(g)*	-	-
9.a. Low Low Pressurizer Pressure	*1*	*2(a)*	-
10.a. High Pressurizer Level	*1*	*2(a)*	*3(a)*
11.a. Low Pressurizer Level	*1*	*2(a)*	*3(a)*
13.a. High Narrow Range RCS Hot Temperature	*1*	-	-
15.a. Low Low RCS Flow	*1*	*2(a)*	*3(a)*
17.a. High Main Steam Pressure	*1*	*2(a)*	-
18.a. Low Main Steam Pressure	*1(b)*	-	-
19.a. Low Low Main Steam Pressure	*1*	*2(a)*	-
20.a. High Steam Superheat	*1*	-	-
21.a. Low Steam Superheat	*1*	-	-
22.a. High Narrow Range Containment Pressure	*1*	*2(a)*	*3(a)*
25.a. Low AC Voltage to ELVS Battery Chargers	*1*	*2(a)*	*3(a)*
26.a. High Under-the-Bioshield Temperature	*1*	*2(a)*	*3(a)*

(a) When capable of CRA withdrawal.

(b) With power above the N-2H Interlock.

The power range linear power interlock N-2H automatically bypasses (enables) MPS RTS Functions 2.a and 18.a below (above) 15% RTP (bypass requires 3 of 4 channels < 15% RTP).

(c) With power below the N-2L Interlock.

The power range linear power interlock N-2L automatically bypasses (enables) MPS RTS Function 3.a above (below) 15% RTP (bypass requires 3 of 4 channels > 15% RTP).

The power range linear power permissive N-2L allows manual bypass of (automatically enables) MPS RTS Function 1.a, High-1 above (below) 15% RTP (permissive requires 3 of 4 channels > 15% RTP).

(d) When Intermediate Range Log Power less than N-1 interlock.

The intermediate range log power permissive N-1 allows manual bypass of (automatically enables) MPS RTS Functions 4.a and 5.a above (below) 1E5 cps (one decade above channel lower range limit).

RTS LOGIC AND ACTUATION FUNCTION *ASSOCIATED MPS INSTRUMENTATION FUNCTIONS*	APPLICABLE MODES
(g) With narrow range RCS hot temperature above the T-4 interlock. The narrow range RCS hot temperature interlock T-4 automatically enables (bypasses) MPS RTS Function 8.a above (below) 600°F.	

- LCO 3.3.3 Engineered Safety Features Actuation System (ESFAS) Logic and Actuation

The following listed MPS instrumentation functions initiate the indicated ESFAS logic and actuation functions:

Table 16.4.1-3
ESFAS Logic and Actuation Functions

ESFAS LOGIC AND ACTUATION FUNCTION *ASSOCIATED MPS INSTRUMENTATION FUNCTION(S)*		APPLICABLE MODES		
1.	**Emergency Core Cooling System** (ECCS)	1	2	3(a)
	(a) Not PASSIVELY COOLED.			
16.a.	*Low RPV Riser Level*[6]	*1*	*2*	*3*
23.a.	*High Containment Water Level*	*1*	*2*	*3(e)*
	(e) When not PASSIVELY *COOLED.*			
2.	**Decay Heat Removal System** (DHRS)[7]	1	2	3(a)
	(a) Not PASSIVELY COOLED			
7.b.	*High Pressurizer Pressure*	*1*	*2*	*3(e)*
8.b.	*Low Pressurizer Pressure*	*1(g)*	-	-
9.b.	*Low Low Pressurizer Pressure*	*1*	*2*	-
12.a.	*Low Low Pressurizer Level*	*1*	*2*	*3(h)*
13.b.	*High Narrow Range RCS Hot Temperature*	*1*	*2*	*3(e)*
17.b.	*High Main Steam Pressure*	*1*	*2*	*3(e)*
18.b.	*Low Main Steam Pressure*	*1(b)*	-	-
19.b.	*Low Low Main Steam Pressure*	*1*	*2*	
20.b.	*High Steam Superheat*	*1*	-	-
21.b.	*Low Steam Superheat*	*1*	-	-
22.b.	*High Narrow Range Containment Pressure*	*1*	*2*	*3(e)*
25.b.	*Low AC Voltage to ELVS Battery Chargers*	*1*	*2*	*3(e)*
26.b.	*High Under-the-Bioshield Temperature*	*1*	*2*	*3*

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[6] As of December 2018, the applicant has communicated its intention to remove this Function from the design. Evaluation of changes to generic TS and Bases may be done during Phase 4 of the review.
[7] As of December 2018, the applicant communicated it intends to modify the actuation logic for DHRS to facilitate unit startup. Evaluation of this modification and changes to generic TS and Bases will occur during Phase 4 of the DCA review.

ESFAS LOGIC AND ACTUATION FUNCTION *ASSOCIATED MPS INSTRUMENTATION FUNCTION(S)*	APPLICABLE MODES

(b) With power above the N-2H interlock.

The power range linear power interlock N-2H automatically bypasses (enables) MPS ESFAS Function 18.b below (above) 15% RTP (bypass requires 3 of 4 channels < 15% RTP).

(e) When not PASSIVELY COOLED.

(g) With narrow range RCS hot temperature above the T-4 interlock.

The narrow range RCS hot temperature interlock T-4 automatically enables (bypasses) MPS ESFAS Function 8.b above (below) 600 degrees F.

(h) With [wide range] RCS [hot] temperature above the T-2 interlock and containment water level below the L-1 interlock.

- Provided containment water level is at or less than 45 ft (containment water level interlock L-1 not active)

  and

  Provided both divisional reactor trip breakers are open (reactor tripped permissive RT-1 active)

  then

  The wide range RCS hot temperature interlock T-2 automatically bypasses (enables) MPS ESFAS Function 12.a below (above) 200°F (bypass requires 3 of 4 channels < 200°F).
- With L-1 interlock active, or RT-1 permissive not active, the T-2 interlock automatically enables MPS ESFAS Function 12.a, even with 3 of 4 channels of wide range RCS hot temperature < 200°F.

3. **Containment Isolation System** (CIS)	1	2	3(b)

(b) With narrow range [NR] RCS hot temperature above the T-4 interlock.

12.b. Low Low Pressurizer Level	*1*	*2*	*3(h)*
22.c. High Narrow Range Containment Pressure	*1*	*2*	*3(i)*
25.c. Low AC Voltage to ELVS Battery Chargers	*1*	*2*	*3*
26.c. High Under-the-Bioshield Temperature	*1*	*2*	*3*

(h) With [wide range] RCS [hot] temperature above the T-2 interlock and containment water level below the L-1 interlock.

- With L-1 interlock not active, and RT-1 permissive active, the wide range RCS hot temperature interlock T-2 automatically bypasses (enables) MPS ESFAS Function 12.b below (above) 200°F (bypass requires 3 of 4 channels < 200°F).
- With L-1 interlock active, or RT-1 permissive not active, the T-2 interlock automatically enables MPS ESFAS Function 12.b, even with 3 of 4 channels of wide range RCS hot temperature < 200°F.

(i) With RCS temperature above the T-3 interlock.

T-3 interlock *is active when 3 of 4 channels of wide range RCS hot temperature < 350°F.*

ESFAS LOGIC AND ACTUATION FUNCTION *ASSOCIATED MPS INSTRUMENTATION FUNCTION(S)*	APPLICABLE MODES		
4. **Demineralized Water Supply Isolation** (DWSI)	1	2	3
1.b. High Power Range Linear Power	*1*	*2(a)*	*3(a)*
2.b. High Power Range Positive and Negative Rate	*1(b)*	*-*	*-*
3.b. High Intermediate Range Log Power Rate	*1(c)*	*2(a)*	*3(a)*
4.b. High Source Range Count Rate	*1(d)*	*2(a)*	*3(a)*
5.b. High Source Range Log Power Rate	*1(d)*	*2(a)*	*3(a)*
6.a. High Subcritical Multiplication	*1(d)*	*2(a)*	*3(a)*
7.d. High Pressurizer Pressure	*1*	*2(a)*	*3(a)*
8.e. Low Pressurizer Pressure	*1(g)*	*-*	*-*
9.e. Low Low Pressurizer Pressure	*1*	*2(a)*	
10.c. High Pressurizer Level	*1*	*2(a)*	*3(a)*
11.c. Low Pressurizer Level	*1*	*2(a)*	*3(a)*
13.d. High Narrow Range RCS Hot Temperature	*1*	*-*	*-*
14.a. Low RCS Flow	*1*	*2*	*3*
15.c. Low Low RCS Flow	*1*	*2(a)*	*3(a)*
17.d. High Main Steam Pressure	*1*	*2(a)*	*-*
18.d. Low Main Steam Pressure	*1(b)*	*-*	*-*
20.d. High Steam Superheat	*1*	*-*	*-*
21.d. Low Steam Superheat	*1*	*-*	*-*
22.f. High Narrow Range Containment Pressure	*1*	*2(a)*	*3(a)*
25.c. Low AC Voltage to ELVS Battery Chargers	*1*	*2(a)*	*3(a)*
26.c. High Under-the-Bioshield Temperature	*1*	*2(a)*	*3(a)*

(a) *When capable of CRA withdrawal.*

(b) *With power above the N-2H interlock.*

The power range linear power interlock N-2H automatically bypasses (enables) MPS ESFAS Functions 2.b and 18.d below (above) 15% RTP (bypass requires 3 of 4 channels < 15% RTP).

(c) *With power below the N-2L Interlock.*

The power range linear power interlock N-2L automatically bypasses (enables) MPS ESFAS Function 3.b above (below) 15% RTP (bypass requires 3 of 4 channels > 15% RTP).

The power range linear power permissive N-2L allows manual bypass of (automatically enables) MPS ESFAS Function 1.b, High-1 above (below) 15% RTP (permissive requires 3 of 4 channels > 15% RTP).

(d) *When Intermediate Range Log Power less than N-1 interlock.*

The intermediate range log power permissive N-1 allows manual bypass of (automatically enables) MPS ESFAS Functions 4.b and 5.b above (below) 1E5 cps (one decade above channel lower range limit) (permissive requires 3 of 4 channels > 1E5 cps).

The intermediate range log power interlock N-1 automatically bypasses (enables) MPS ESFAS Function 6.a above (below) 1E5 cps (bypass requires 3 of 4 channels > 1E5 cps).

(g) *With narrow range RCS hot temperature above the T-4 interlock.*

The narrow range RCS hot temperature interlock T-4 automatically enables (bypasses) MPS ESFAS Function 8.e above (below) 600°F.

ESFAS LOGIC AND ACTUATION FUNCTION *ASSOCIATED MPS INSTRUMENTATION FUNCTION(S)*	APPLICABLE MODES		
5. **CVCS Isolation** (CVCSI)	1	2	3
8.c. Low Pressurizer Pressure	*1(g)*	-	-
9.c. Low Low Pressurizer Pressure	*1*	*2*	-
10.b. High Pressurizer Level	*1*	*2*	*3*
12.c. Low Low Pressurizer Level	*1*	*2*	*3(h)*
15.b Low Low RCS Flow (Modes 1, 2, and 3)	*1*	*2*	*3*
22.d High Narrow Range Containment Pressure	*1*	*2*	*3(i)*

(g) With narrow range RCS hot temperature above the T-4 interlock.

The narrow range RCS hot temperature interlock T-4 automatically enables (bypasses) MPS ESFAS Function 8.c above (below) 600°F.

(h) With [wide range] RCS [hot] temperature above the T-2 interlock and containment water level below the L-1 interlock.

- With L-1 interlock not active, and RT-1 permissive active, the wide range RCS hot temperature interlock T-2 automatically bypasses (enables) MPS ESFAS Function 12.c below (above) 200°F (bypass requires 3 of 4 channels < 200°F).
- With L-1 interlock active, or RT-1 permissive not active, the T-2 interlock automatically enables MPS ESFAS Function 12.c, even with 3 of 4 channels of wide range RCS hot temperature < 200°F.

(i) With RCS temperature above the T-3 interlock.

6. **Pressurizer Heater Trip**	1	2(c)	3(c)

(c) Not required when Pressurizer Heater trip breakers are open and deactivated.

7.c. High Pressurizer Pressure	*1*	*2(f)*	*3(f)*
8.d. Low Pressurizer Pressure	*1(g)*	-	-
9.d. Low Low Pressurizer Pressure	*1*	*2*	-
11.b. Low Pressurizer Level	*1*	*2(f)*	*3(f)*
12.d. Low Low Pressurizer Level	*1*	*2(f)*	*3(f)*
13.c. High Narrow Range RCS Hot Temperature	*1*	*2(f)*	*3(f)*
17.c. High Main Steam Pressure	*1*	*2(f)*	*3(f)*
18.c. Low Main Steam Pressure	*1(b)*	-	-
19.c. Low Low Main Steam Pressure	*1*	*2(f)*	-
20.c High Steam Superheat	*1*	-	-
21.c. Low Steam Superheat	*1*	-	-
22.e. High Narrow Range Containment Pressure	*1*	*2(f)*	*3(f)*
25.e. Low AC Voltage to ELVS Battery Chargers	*1*	*2(f)*	-
26.e. High Under-the-Bioshield Temperature	*1*	*2(f)*	*3(f)*

(b) With power above the N-2H interlock.
(f) With pressurizer heater trip breakers closed.
(g) With narrow range RCS hot temperature above the T-4 interlock.

ESFAS LOGIC AND ACTUATION FUNCTION *ASSOCIATED MPS INSTRUMENTATION FUNCTION(S)*	APPLICABLE MODES		
7. **Low Temperature Overpressure Protection** (LTOP)	-	-	3(d)
(d) With wide range RCS cold temperature below the LTOP enable temperature specified in the PTLR (T-1 interlock) and more than one reactor vent valve closed.			
24.a High RCS Pressure – Low Temperature Overpressure Protection	-	-	*3(k)*
(k) With wide range RCS cold temperature below the LTOP enable temperature specified in the PTLR (T-1 interlock) and more than one reactor vent valve closed.			
With at least 3 of 4 wide range RCS cold temperature channels above the T-1 interlock setpoint (the nil ductility transition (NDT) temperature) 325°F, T-1 is active and the LTOP actuation Function is automatically bypassed. Below T-1, the LTOP actuation Function is automatically enabled. The LTOP actuation Function opens the closed reactor vent valves on 2 of 4 MPS high wide range RCS pressure channels with indication above the LTOP setpoint, which is calculated for each channel as a function of wide range RCS cold temperature, as indicated by DCA Part 2, Tier 2, Figure 5.2-4 "Variable LTOP Setpoint"; and Table 5.2-10, "LTOP Pressure Setpoint as Function of Cold Temperature."			

- LCO 3.4.4 Reactor Safety Valves (RSVs)

The two RSVs must be operable to provide RCS overpressure protection in Modes 1 and 2, and in Mode 3 above the T-1 interlock setpoint, which is specified in the PTLR of Subsection 5.6.4.

The ASA section of Subsection B 3.4.4 lists the DCA Part 2, Tier 2, Chapter 15 analyses that credit the functioning of the two RSVs for overpressure protection not only of the RCS but also the Steam Generator System (SGS). One RSV, in conjunction with the MPS, can prevent RCS pressure from exceeding the RCS pressure SL of 2285 psia. The RSV minimum relief capacity is based on a postulated overpressure transient of a turbine trip without turbine bypass capability.

- LCO 3.4.6 Chemical and Volume Control System (CVCS) Isolation Valves

This LCO addresses the CVCS isolation function of the eight containment isolation valves in the CVCS. During normal conditions with the NPM in MODE 1, 2, or 3, the two valves in each of the three flow paths of RCS injection, RCS discharge, and pressurizer spray, are normally open, and the two valves in the reactor pressure vessel high point degasification line are normally closed. All of the valves receive an ESFAS signal to close (CVCSI) on two of four channels of any of the following MPS Functions of LCO 3.3.1 generating trip signals to the two ESF Logic and Actuation divisions:

8.c Low Pressurizer Pressure (Mode 1 with narrow range RCS hot temperature above the T-4 interlock)

9.c Low Low Pressurizer Pressure (Modes 1 and 2)

10.b High Pressurizer Level (Modes 1, 2, and 3)

12.c Low Low Pressurizer Level (Modes 1 and 2, and Mode 3 with RCS temperature above the T-2 interlock and containment water level below the L-1 interlock.)

15.b Low Low RCS Flow (Modes 1, 2, and 3)

22.d High Narrow Range Containment Pressure (Modes 1 and 2, and Mode 3 with RCS temperature above the T-3 interlock.)

The CVCSI Function's actuated devices, the eight CVCS containment isolation valves, are required to be operable in Modes 1, 2, and 3 to provide mitigation of pressurizer overfill event, steam generator tube failure accident, CVCS postulated break outside containment event, and reverse RCS flow event, which are considered possible in these Modes, and the automatic closure of these valves is assumed in the safety analyses of these events.

- LCO 3.4.10 Low Temperature Overpressure Protection (LTOP) Valves

This LCO was added with the submission of Revision 1 of the DCA in order to capture the LTOP function of the three ECCS reactor vent valves (RVVs). SER Section 16.4.5 gives the staff's evaluation of Subsection 3.4.10 and the applicant's response to RAI 506-9614, Question 16-53, Subquestion B.

- LCO 3.5.1 Emergency Core Cooling System (ECCS) – Operating

This LCO ensures the normally closed RVVs and RRVs will automatically open to mitigate the postulated LOCAs and a steam generator tube failure when the unit is initially in Mode 1, Mode 2, or in Mode 3 and not Passively Cooled. The ECCS in combination with the required water level in the containment vessel, can also be used to conduct Passive Cooling in Mode 3 maintaining a safe shutdown condition.

- LCO 3.5.2 Decay Heat Removal System (DHRS)

This LCO ensures the normally closed DHRS parallel actuation valves for each steam generator will automatically open, and that the normally open MSIVs and FWIVs will automatically close to establish a natural circulation flow of DHRS water through the SG tubes, which transfers energy from the reactor coolant to the DHRS water water flowing in the SG tubes, through the main steam header plenum to the inlets of the DHRS heat exchangers in the reactor building pool, which rejects the energy to the ultimate heat sink, then to the outlet of the DHRS heat exchangers back to the feedwater SG inlet plenum, and again through the SG tubes. The DHRS passively removes core decay heat during non-LOCA events, and cools down the RCS to the safe shutdown condition of Mode 3 with Passive Cooling in operation, assuming the secondary heat sink is unavailable because of a concurrent loss of AC power to the condensate and feedwater system, and circulating water system. The DHRS is relied upon to provide a passive means of decay heat removal in Modes 1 and 2, and must remain operable in Mode 3 until Passive Cooling is placed in operation, which can be done by placing the DHRS in operation.

- LCO 3.5.3 Ultimate Heat Sink

In Modes 1, 2, and 3, the minimum reactor pool water level of 55 ft (in Condition A) provides margin above the minimum level required to support DHRS and ECCS operation in response to LOCA and non-LOCA design basis events.

- LCO 3.6.1 Containment

The containment vessel functions to limit the release of fission products to the outside environment in the event of a postulated design basis accident involving fuel damage. In the NuScale design it is also an integral component of the ECCS system and is used in two methods of Passive Cooling.

- LCO 3.6.2 Containment Isolation Valves (CIVs)

The CIVs automatically close in response to a CIS actuation signal and provide mitigation of the main steam line break (SLB) inside containment design basis accident (DCA Part 2, Tier 2, Section 15.1.5.1).

- LCO 3.7.1 Main Steam Isolation Valves (MSIVs) [safety related]

The MSIVs automatically close in response to a CIS actuation signal and a DHRS actuation signal to mitigate the main steam line break (SLB) outside containment design basis accident (DCA Part 2, Tier 2, Section 15.1.5.1). A small SLB is more limiting on CHFR and RCS pressure than a double-ended rupture of the main steam line.

- LCO 3.7.2 Feedwater Isolation – Feedwater Isolation Valves (FWIVs) [safety related]

The FWIVs automatically close in response to a CIS actuation signal and a DHRS actuation signal to mitigate a feedwater system pipe break design basis accident, both inside and outside containment. (DCA Part 2, Tier 2, Section 15.2.8)

- LCO 3.8.1 Nuclear Instrumentation (refueling neutron flux [monitoring] channels)

In Mode 5, two of the three refueling neutron flux channels to be must be operable to ensure that redundant monitoring capability is available to detect changes in core reactivity during removal of the upper reactor vessel assembly and during movement of an irradiated fuel assembly in the reactor vessel. Each channel must provide visual indication in the control room. In addition, at least one of the two required channels must provide an operable audible count rate function to alert the operators to the initiation of a boron dilution event.

Based on its evaluation of the DCA rationale for identifying the operability of SSCs specified by the above listed LCOs as meeting Criterion 3, the staff finds that the GTS satisfy 10 CFR 50.36(c)(2)(ii)(C).

16.4.1.4 LCOs required by Criterion 4 - A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.

The following LCOs require operability of SSCs that provide backup to other LCO-required SSCs, and their inclusion in the GTS enhances the safe operation of the NPM. Therefore, the staff finds that these LCOs satisfy Criterion 4.

- LCO 3.3.4 [RTS and ESF System] Manual Actuation Functions
- LCO 3.3.5 Remote Shutdown Station (RSS) [Monitoring Instrumentation]
- LCO 3.7.1 Main Steam Isolation Valves (MSIVs) [non-safety related]

- LCO 3.7.2 Feedwater Isolation – Feedwater Regulating Valves (FWRVs) [non-safety related]

The staff concludes that designating the operability of the SSCs specified by the above listed LCOs as meeting Criterion 4 is beneficial to safety. Therefore, the staff finds that the GTS satisfy 10 CFR 50.36(c)(2)(ii)(D).

16.4.1.5 LCOs required by none of the Criteria

The following LCO specifies which LCO requirements may be suspended while conducting testing of the reactor, because physics testing requires exceeding the excepted LCO restrictions. This LCO also specifies other restrictions to ensure plant safety during physics testing. LCO 3.0.7 addresses physics testing by providing rules for entering and exiting the physics testing LCO and by providing an exception to LCO 3.0.1.

- LCO 3.1.8 PHYSICS TESTS Exceptions

Because this LCO and the associated LCO 3.0.7 are consistent with W-STS, and the NuScale physics testing, the staff finds that including LCO 3.0.7 and LCO 3.1.8 in the GTS is acceptable.

16.4.1.6 Non-LCO-required SSCs, functions, and process variables typically addressed by LCOs in W-STS, CE-STS, or W-AP1000-STS

The staff reviewed the NuScale design as described in DCA Part 2 to confirm that omission of certain SSCs and parameter limits typically included in TS is justified.

- *LCO not* required *because parameter is implicitly ensured to be within limits by another LCO*

<u>Containment vessel atmosphere temperature and pressure</u>

STS Section 3.6 usually includes LCOs on containment temperature and pressure. The staff notes that in the NuScale design a very low containment vessel internal pressure is required for leakage detection instrumentation operability. Therefore, the accident analysis assumed initial value of containment vessel pressure in MODES 1 and 2, and in MODE 3 above 200°F (~93.3°C), is ensured by meeting LCO 3.4.7. Accordingly, an explicit LCO to ensure the safety analysis assumed initial value of containment vessel pressure, in accordance with Criterion 2, is unnecessary. In addition, accident analysis conclusions are insensitive to the initial mass and energy content and temperature of the containment vessel atmosphere because of the near vacuum initial pressure of the containment vessel. Therefore, an LCO to ensure the validity of the initial value assumption for the containment vessel atmosphere temperature is also unnecessary. For these reasons, the staff finds that omitting explicit LCOs for initial containment pressure and temperature is acceptable.

- *LCO not required because system is classified as nonsafety-related in NuScale design*

<u>Electrical Power</u> (Includes Offsite (Preferred) AC Electrical Power Sources; Onsite alternating current (ac) (Standby) Electrical Power Sources; Onsite direct current (dc) Electrical Power Sources (Batteries); Battery Chargers; dc-to-ac Inverters; Battery Parameters; ac and dc Electrical Power Distribution Systems)

SER Chapter 8, “Electric Power,” provides the staff’s evaluation of electrical power systems in the NuScale design.

Control Room Habitability (Includes Bottled Air System; Radioactivity Filtration System; Control Room Envelope Passive Cooling System; Control Room Normal HVAC System, Control Room Envelope Air Temperature and Humidity Limits; Control Room Envelope Boundary Unfiltered Inleakage Limit; Automatic Initiation of Control Room Isolation Mode and Bottled Air System on Detection of High Radiation in Outside Air Intake and on Detection of Toxic Gas)

SER Chapters 6, “Engineered Safety Features” and 9, “Auxiliary Systems,” provide the staff’s evaluation of standby and normal HVAC systems, respectively.

- *LCO not required because system or component is not part of the NuScale Design*

RCS Loops (external to the reactor pressure vessel)
Pressurizer Power Operated Relief Valves
Containment Purge Supply and Exhaust Ventilation System and Isolation Dampers

- *LCO not required because the 1988 split report’s rationale for including an optional system is not satisfied*

Post-Accident Monitoring Instrumentation

DCA Part 2, Tier 2, Section 7.1.1.2.2, “Post-Accident Monitoring,” states in part:

> The post-accident monitoring (PAM) is a nonsafety-related function. The PAM instrumentation includes the required functions, range and accuracy for each variable monitored. The selection of each type of variable follows the guidance provided in [Institute of Electrical and Electronics Engineers] IEEE Std 497-2002, “IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations” (Reference 7.1-11), as modified by [Regulatory Guide] RG 1.97, Revision 4.
>
> [PAM Type B and C variables] and their type classification are based on their accident management function as identified in abnormal operating procedures, emergency operating procedures, and emergency procedure guidelines. Since the abnormal and emergency operating procedures and guidelines have not been developed, NuScale developed an approach to identify PAM variables as described below. [SER Chapter 7 gives the staff’s evaluation of the alternate approach for selecting PAM variables.] ...
>
> ... The NuScale reactor design has no Type A variables because there are no operator actions credited in any Chapter 15 anticipated operational occurrence, infrequent event, or [postulated] accident, nor the station blackout or anticipated transient without scram analysis.

The RCDR in Table B-1, “Comparison of standard technical specifications with NuScale generic technical specifications,” indicates that no Type A PAM variables were identified. In DCA Part 2, Tier 2, Section 7.1.5.1.14, “Guideline 14 - Manual Operator Action,” begins by stating the following:

> The critical safety functions are accomplishing or maintaining containment integrity, fuel assembly heat removal, and reactivity control; however, there are no Type A accident monitoring variables. Type A variables provide information essential for the direct accomplishment of critical safety functions that require manual action.

The ASA section of the Bases for Subsection 3.8.1, states the following:

> The audible count rate from the refueling neutron flux channels provides prompt and definite indication of any change in reactivity. The count rate increase is proportional to subcritical multiplication and allows operators to promptly recognize any change in reactivity. Prompt recognition of unintended reactivity changes is consistent with the assumptions of the safety analysis and is necessary to assure sufficient time is available to initiate action before SHUTDOWN MARGIN is lost (Ref. 1). The refueling neutron flux channels satisfy Criterion 3 of 10 CFR 50.36(c)(2)(ii).

Since PAM instrumentation does not address postulated events during refueling operations, proposed LCO 3.8.1 is adequate to ensure sufficient time is available for control room operators to initiate action to terminate a reactivity transient in MODE 5 before SDM is lost.

The DCA Part 2, Tier 2, Section 7.1 identifies Type B and Type C PAM variables; however, the DCA does not address the option of not including an LCO for equivalent (non-Type A, but Type B and C Category 1) variables described in the 1988 split report.[8] That report states the following, in part:

> During the NRC Staff's review, several issues were raised concerning the proper interpretation or application of the criteria in the Commission's Interim Policy Statement. The NRC Staff has considered these issues and concluded the following:
>
> ...
>
> (5) Post-Accident Monitoring Instrumentation that satisfies the definition of Type A variables in Regulatory Guide 1.9, "Instrumentation for Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident," meets Criterion 3 and should be retained in Technical Specifications. Type A variables provide primary information (i.e., information that is essential for the direct accomplishment of the specified manual actions (including long-term recovery actions) for which no automatic control is provided and that are required for safety systems to accomplish their safety functions for DBAs or transients). Type A variables do not include those variables associated with contingency actions that may also be identified in written procedures to compensate for failures of primary equipment. Because only Type A variables meet Criterion 3, the STS should contain a narrative statement

[8] Thomas E. Murley, Director, Office of Nuclear Reactor Regulation, to Walter S. Wilgus, Chairman, The B&W Owners Group, "NRC Staff Review of Nuclear Steam Supply Vendors Owners Groups' Application of The Commission's Interim Policy Statement Criteria to Standard Technical Specifications," May 9, 1988, ADAMS Accession No. ML11264A057.

that indicates that individual plant Technical Specifications should contain a list of Post-Accident Instrumentation that includes Type A variables. Other Post-Accident Instrumentation (i.e., non-Type A Category I) is discussed on page 6.

...

The staff reviewed the methodology and results provided by each Owners Group to verify that none of the requirements proposed for relocation contains constraints of prime importance in limiting the likelihood or severity of accident sequences that are commonly found to dominate risk. For the purpose of this application of the guidance in the Commission [Interim] Policy Statement, the staff agrees with the Owners Groups' conclusions except in two areas. First, the staff finds that the Remote Shutdown Instrumentation meets the Policy Statement criteria for inclusion in Technical Specifications based on risk; and second, the staff is unable to confirm the Owners Groups' conclusion that Category 1 Post-Accident Monitoring Instrumentation is not of prime importance in limiting risk. Recent PRAs have shown the risk significance of operator recovery actions which would require a knowledge of Category 1 variables. Furthermore, recent severe accident studies have shown significant potential for risk reduction from accident management. The Owners Groups should develop further risk-based justification in support of relocating any or all Category 1 variables from the Standard Technical Specifications.

In RAI 196-9050 (ML17237C007), Question 16-22, the staff requested that the applicant add an LCO for Type B and C PAM variables, because the DCA did not include a risk analysis to justify its omission. In its response (ML17291A482) to RAI 196-9050, Question 16-22, the applicant addressed the above guidance from the split report and presented a risk-based justification for omitting an LCO for Type B and C PAM variables. SER Chapter 19 provides the staff finding that the NuScale PRA is acceptable, and based on this, the staff concludes the risk-based analysis of the Type B and C PAM variables is acceptable. The response also pointed out that the PAM variables are displayed using the safety display and information system (SDIS), which is subject to what NuScale calls "augmented quality assurance," which is addressed in DCA Part 2, Tier 2, Table 3.2-1, "Classification of Structures, Systems, and Components." This table states that all components of the SDIS have an "SSC classification" of B2 (nonsafety-related, nonrisk-significant), "Quality Assurance Program applicability" of AQ-S, and "Augmented Design Requirements" of: (1) IEEE Std 497-2002, "IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations," with "Corrigendum 1: Incorporation of User Feedback through 2005" (CORR 1), (2) electromagnetic and radio frequency interference protection, (3) power from vital instrument bus, and (4) Seismic Classification I. AQ-S "indicates that the pertinent requirements of 10 CFR 50 Appendix B are applicable to nonsafety-related SSC classified as Seismic Category I or Seismic Category II in accordance with the quality assurance program."

The highly reliable direct current power system - common (EDSS-C) powers the PAM instrumentation and the SDIS. The source of electrical supply to the EDSS-C battery chargers is the 480-volt ac low voltage alternating current electrical distribution system (ELVS), through the backup diesel generator (BDG)-backed ELVS motor control centers. There are a total of four 125-volt dc batteries and four battery chargers (two batteries and chargers in Division I and two batteries and chargers in Division II) in the EDSS-C subsystem. Upon a loss of power to all battery chargers, both the Division I and Division II EDSS-C batteries are capable of supplying their connected plant loads for 72 hours. The primary function of the BDGs is to provide backup electrical power to certain loads in the post-72-hour period following a station blackout event.

Based on the applicant response's justification of low risk significance, and the above design information, the staff concludes that there is reasonable assurance that the control room indication of PAM Type B and C variables will be available for 72 hours after a PA, IE, or AOO. The staff finds that omitting an LCO for PAM Type B and C variables is therefore acceptable, and that the NuScale design has no PAM Type A variables. Therefore, RAI 196-9050, Question 16-22, is resolved and closed.

16.4.1.7 Support system with operability requirement implied by surveillance requirement

The Class 1E isolation devices serve to isolate the Class 1E MPS, RTS Logic and Actuation, and ESFAS Logic and Actuation electrical circuits from non-Class 1E electrical power circuits. The Channel Calibration test of SR 3.3.1.5, SR 3.3.2.3, and SR 3.3.3.3, respectively, verifies the operability of these isolation devices each refueling cycle. Meeting these SRs is necessary to meet LCO 3.3.1 for MPS instrumentation Functions 1 through 26; the LCO 3.3.2 for the RTS Logic and Actuation Function; and LCO 3.3.3 for ESFAS Logic and Actuation Functions 1 through 7. Revision 2 of DCA Part 4, LCO 3.3.4, RTS and ESFAS Manual Actuation, does not explicitly specify a Channel Calibration of Class 1E isolation devices for LCO 3.3.4 manual actuation Functions 1 through 8. SER Section 16.4.8.5, "Proposed exceptions to meeting certain surveillances for isolation valves and circuit breakers," further addresses this observation, which the **staff is tracking as an open item under RAI 197-9051 (ML17237C008), Question 16-28.**

Similarly, meeting SR 3.3.2.4 ("Verify each RTB actuates to the open position on an actual or simulated actuation signal.") is necessary for meeting LCO 3.3.2; and meeting SR 3.3.3.4 ("Verify each pressurizer heater trip (PHT) breaker actuates to the open position on an actual or simulated actuation signal.") is necessary for meeting LCO 3.3.3, Function 6, PHT Logic and Actuation.

The staff finds that implicitly requiring these components to be operable by specifying Surveillances for them in the LCO subsections of the systems they support is acceptable because it is sufficient to ensure the operability of these components when the supported systems are required to be operable. In addition, this approach is consistent with the W-AP1000-STS implicit support system operability requirements in Surveillances of W-AP1000-STS LCO 3.3.15 for pressurizer heater circuit breakers, reactor coolant pump (RCP) breakers, CVS letdown isolation valves, feedwater pump breakers, and auxiliary spray and purification line isolation valves; and LCO 3.3.16 for RCP breakers, CVS letdown isolation valves, and Spent Fuel Pool Cooling System containment isolation valves. None of these components have explicit LCO operability requirements, but each supports operability of a specified ESF actuation function in the AP1000 design.

16.4.1.8 Conclusion

Based on its review of Revision 1 of the RCDR, and Revision 2 of DCA Part 2, Chapters 4, 5, 6, 7, 8, 9, 11, 12, 15, 16, and 19; and Revision 2 of DCA Part 4, the staff finds that the NuScale GTS include all of the LCOs required by the LCO selection criteria. Therefore, the staff concludes that the GTS satisfy 10 CFR 50.36(c)(2)(ii).

16.4.2 Use and Application (Chapter 1), Definitions (Section 1.1), Logical Connectors (Section 1.2), Completion Times (Section 1.3), and Frequency (Section 1.4)

The GTS and Bases follow the STS in presenting defined terms in capitalized type. This SER section follows this convention in discussions of defined terms and their definitions.

16.4.2.1 Included W-STS or W-AP1000-STS definitions with no changes

The GTS include the following W-STS or W-AP1000-STS definitions without change:

ACTIONS

The proposed definition matches the W-STS definition and the W-AP1000-STS definition, and is therefore acceptable.

DOSE EQUIVALENT I-131

The proposed definition matches the W-AP1000-STS definition, and is therefore acceptable.

DOSE EQUIVALENT XE-133

The proposed definition matches the W-AP1000-STS definition, and is therefore acceptable.

INSERVICE TESTING PROGRAM

This defined term and definition ("The INSERVICE TESTING PROGRAM is the licensee program that fulfills the requirements of 10 CFR 50.55a(f)."), match the change made to W-STS, Revision 4, by approved STS change traveler TSTF-545-A, Revision 3; therefore this defined term and definition are acceptable.

PHYSICS TESTS

The proposed definition matches W-AP1000-STS definition, and is therefore acceptable.

RATED THERMAL POWER (RTP)

The proposed definition matches W-AP1000-STS definition, and is therefore acceptable.

THERMAL POWER

The proposed definition matches W-AP1000-STS definition, and is therefore acceptable.

16.4.2.2 Included W-STS or W-AP1000-STS definitions with proposed changes

ACTUATION LOGIC TEST

SER Section 16.4.8.3 gives the staff's evaluation of the specified SRs for the ACTUATION LOGIC TEST and associated Bases. The definition departs from the definition of the ACTUATION LOGIC TEST in the W-AP1000-STS, as shown in the following markup of the W-AP1000-STS definition (The last phrase is highlighted by shading for a separate discussion below):

ACTUATION LOGIC TEST An ACTUATION LOGIC TEST shall be ~~the~~ :

a. The use of diagnostic programs, or application of ~~various~~ simulated or actual input combinations, to test digital computer hardware; and ~~in conjunction with *each possible interlock logic state required for OPERABILITY of a logic circuit* and the verification~~

b. Verification of the required logic output.

An ACTUATION LOGIC TEST shall include *each possible interlock logic state required for OPERABILITY of a logic circuit*. The ACTUATION LOGIC TEST shall verify the OPERABILITY of each manual logic input device required for channel OPERABILITY. The ACTUATION LOGIC TEST shall be conducted such that it provides component overlap with the actuated device. The ACTUATION LOGIC TEST may be performed by means of any series of sequential, overlapping, or total steps, and each step must be performed within the Frequency in the Surveillance Frequency Control Program for the devices included in the step.

The staff discussed potential updates to DCA Part 2, Tier 2, and GTS related to the description of the MPS self-testing features, as described in DCA Revision 1, in a public teleconference on June 25, 2018 (ML18193B084). The applicant subsequently proposed changes to DCA Part 2, Tier 2, Section 7.2, "System Features," GTS Section 1.1, "Definitions," and Section B 3.3, "Instrumentation," in a letter dated July 13, 2018 (ML18194A648), to clarify language related to self-testing features, such as using "self-testing and diagnostics" instead of "self-checking and self-diagnostics." Specifically, the applicant revised the definition of ACTUATION LOGIC TEST as indicated in the following markup of the GTS Revision 1 definition:

ACTUATION LOGIC TEST An ACTUATION LOGIC TEST shall be:

a. The use of ~~diagnostic programs~~ self-testing features, or application of simulated or actual input combinations as appropriate, to test digital computer hardware; and

b. Verification of the required logic output.

An ACTUATION LOGIC TEST shall include each possible interlock logic state required for OPERABILITY of a logic circuit. The ACTUATION LOGIC TEST shall verify the OPERABILITY of each manual logic input device required for channel OPERABILITY. The ACTUATION LOGIC TEST shall be conducted such that it provides component overlap with the actuated device. The ACTUATION LOGIC TEST may be performed by means of any series of sequential, overlapping, or total steps, and each step must be performed within the Frequency in the Surveillance

Frequency Control Program for the devices included in the step.

In addition, the applicant revised the Background section of Subsection B 3.3.1, the last two paragraphs on page B 3.3.1-6, as indicated:

> The MPS incorporates continuous system self-testing ~~self-checking~~ features from the sensor input to the output switching logic, with the exception of the actuation and priority logic (APL). The self-testing ~~self-checking~~ features evaluate whether the MPS is functioning correctly. Surveillance testing verifies OPERABILITY of the APL. Self-testing ~~-checking~~ features include on-line diagnostics for the MPS hardware and communications tests. These self-tests ~~self-checking tests~~ do not interfere with normal system operation.
>
> In addition to the self-testing ~~-checking~~ features, the system includes functional testing features. ...

The applicant also revised the ASA section of Subsection B 3.3.1, first paragraph, next to last sentence on page B 3.3.1-11:

> ...The permissives and interlocks associated with each MPS Instrumentation Function channel, each Reactor Trip System (RTS) Logic and Actuation Function division, and each Engineered Safety Features Actuation System (ESFAS) Logic and Actuation Function division, respectively, must be OPERABLE for the associated Function channel or Function division to be OPERABLE. The combination of the continuous self-testing ~~self-checking~~ features of the MPS and the CHANNEL CALIBRATION specified by SR 3.3.1.4 verify the OPERABILITY of the interlocks and permissives. ...

The applicant revised the SRs section of Subsection B 3.3.2, page B 3.3.2-4, second, third, and fourth paragraphs of Bases for SR 3.3.2.1:

> MPS testing from the input sensors to the SVMs is addressed by surveillance requirements specified in LCO 3.3.1, “Module Protection System (MPS) Instrumentation.” The RTS logic and actuation circuitry functional testing is accomplished with continuous system self-testing ~~self checking~~ features on the SVMs and EIMs and the communication between them. The self-testing ~~self-checking~~ features are designed to perform complete functional testing of all circuits on the SVM and EIM, with the exception of the actuation and priority logic (APL) circuitry. The ~~self checking~~ self-testing includes testing of the voting and interlock/permissive logic functions. The built-in self-testing ~~self checking~~ will report a failure to the operator and place the SVM or EIM in a fail-safe state.

The only portion of the RTS logic and actuation circuitry that is not ~~self checked~~ self-tested is the APL. The manual actuation switches, enable nonsafety control switches, and operating bypass switches do not include ~~self checking~~ self-testing features ~~and their OPERABILITY is verified by required surveillance testing~~. The manual actuation switches are addressed by surveillance requirements specified in LCO 3.3.4, "Manual Actuation Functions."

This ACTUATION LOGIC TEST includes testing of the APL on all RTS EIMs, the enable nonsafety control switches, and the operating bypass switches. The ACTUATION LOGIC TEST includes a review of any alarms or failures reported by the self-testing ~~self checking~~ features.

Finally, the applicant revised the SRs section of Subsection B 3.3.3, page B 3.3.3-9, second, third, and fourth paragraphs of Bases for SR 3.3.3.1:

MPS testing from the input sensors to the SVMs is addressed by surveillance requirements specified in LCO 3.3.1, “Module Protection System (MPS) Instrumentation.” The ESFAS logic and actuation circuitry functional testing is accomplished with continuous system self-testing ~~self checking~~ features on the SVMs and EIMs and the communication between them. The self-testing ~~self-checking~~ features are designed to perform complete functional testing of all circuits on the SVM and EIM, with the exception of the actuation and priority logic (APL) circuitry. The ~~self checking~~ self-testing includes testing of the voting and interlock/permissive logic functions. The built-in self-testing ~~self checking~~ will report a failure to the operator and place the SVM or EIM in a fail-safe state.

The only portion of the ESFAS logic and actuation circuitry that is not ~~self checked~~ self-tested is the APL. The manual actuation switches, enable nonsafety control switches, main control room isolation switches, override switches, and operating bypass switches do not include ~~self checking~~ self-testing features ~~and their OPERABILITY is verified by required surveillance testing~~. The manual actuation switches are addressed by surveillance requirements specified in LCO 3.3.4, "Manual Actuation Functions."

This ACTUATION LOGIC TEST includes testing of the APL on all ESFAS EIMs, the enable nonsafety control switches, the main control room isolation switches, the override switches, and the operating bypass switches. The ACTUATION LOGIC TEST includes a review of any alarms or failures reported by the self-testing ~~self checking~~ features.

Because the above changes result in consistent use of the terms “self-test” and “self-testing,” the descriptions of the MPS self-testing features in DCA Part 2, and DCA Part 4, GTS, and Bases are clear, as is the scope of the part of the ACTUATION LOGIC TEST that uses the self-testing features. Therefore, these changes are acceptable.

During the June 25, 2018, teleconference (ML18193B084), participants also discussed the first sentence and the last two sentences of the ACTUATION LOGIC TEST definition. The staff observed that the phrase “diagnostic programs” is ambiguous, and suggested it be replaced by an equivalent phrase, which is well defined in the highly integrated protective system (HIPS) topical report. The revised first sentence, (“...The use of ~~diagnostic programs~~ self-testing features, or application of simulated or actual input combinations as appropriate, to test digital computer hardware...”) resolved the noted ambiguity, and is therefore acceptable.

The next-to-last sentence states, “The ACTUATION LOGIC TEST shall be conducted such that it provides component overlap with the actuated device.” Because the W-AP1000-STS definition includes this sentence, the staff concludes that including it in the NuScale ACTUATION LOGIC TEST definition is acceptable.

The first part of the last sentence states, “The ACTUATION LOGIC TEST may be performed by means of any series of sequential, overlapping, or total steps”; the staff noted that this part of the sentence is included in the W-AP1000-STS definitions of CHANNEL CALIBRATION and CHANNEL OPERATIONAL TEST, but not ACTUATION LOGIC TEST. Based on the NuScale MPS design, the staff concludes that this sentence is appropriate and acceptable for the ACTUATION LOGIC TEST definition.

The second part of the last sentence (shaded in the above markup) states, “…and each step must be performed within the Frequency in the Surveillance Frequency Control Program for the devices included in the step.” The staff requested NuScale to explain why this sentence was added to the W-AP1000-STS definition of ACTUATION LOGIC TEST. Presumably, the test interval associated with using “self-testing” will be different from a test interval based on application of simulated or actual input signal combinations. As described below in the discussion of the CHANNEL OPERATIONAL TEST definition, this phrase is acceptable based on the recently approved STS change traveler TSTF-563, Revision 0, on adoption of a Surveillance Frequency Control Program (SFCP); therefore, it is acceptable for inclusion in the NuScale ACTUATION LOGIC TEST definition (as well as for the definitions of CHANNEL OPERATIONAL TEST and CHANNEL CALIBRATION).

In RAI 156-9031 (ML17220A038), Question 16-2, Subquestion a, the staff requested that the applicant explain why the ACTUATION LOGIC TEST definition includes the new phrase “to test digital computer hardware” but does not include the phrase “to test digital computer software.” In its response (ML17269A210) to Question 16-2, Subquestion a, the applicant stated:

> The definition specifies testing of digital hardware only because there is no operating software in the installed system which performs a safety related function. A software development process is used to develop the logic which is implemented in the digital hardware (FPGAs). The requirements for software development quality assurance are described in [DCA Part 2,] Tier 2, Section 7.2.1.

The staff finds this explanation is acceptable because field programmable gate array (FPGA) digital hardware implements the logic of the scheduling and bypass modules (SBMs), safety voter modules (SVMs), and equipment interface modules (EIMs) without use of software, as described in Section 7.2.15, “Capability for Test and Calibration,” and Revision 2 of TR-1015-18653-P-A, “Design of the Highly Integrated Protection System Platform Topical Report.” Therefore, RAI 156-9031, Question 16-2, Subquestion a, is resolved and closed.

Based on the above discussions, the staff concludes that the ACTUATION LOGIC TEST definition is acceptable.

CHANNEL CALIBRATION

The proposed definition of CHANNEL CALIBRATION matches the W-STS definition, except that the last sentence includes an additional phrase (“...and each step must be performed within the Frequency in the Surveillance Frequency Control Program for the devices included in the step.”), which was added by the response to RAI 156-9031, Question 16-2, Subquestion c, which is resolved and closed as described below in the discussion of the CHANNEL OPERATIONAL TEST definition. Because the proposed CHANNEL CALIBRATION definition includes this change by recently approved STS change traveler TSTF-563, Revision 0, the staff concludes that the CHANNEL CALIBRATION definition is acceptable.

CHANNEL CHECK

The applicant proposed changes to the W-STS definition of CHANNEL CHECK, as indicated in the following markup of the STS definition:

CHANNEL CHECK	A CHANNEL CHECK shall be the ~~qualitative assessment, by observation, of~~ <u>verification through the absence of alarms from the automatic analog and binary process signal monitoring features used to monitor</u> channel behavior during operation<u>. Deviation beyond the established acceptance criteria is alarmed to allow appropriate action to be taken.</u> This determination shall include, where possible, comparison of ~~the~~ channel indication and status to other indications or status derived from independent instrument channels measuring the same parameter.<u> This determination can be made using computer software or be performed manually.</u>

The changes are consistent with the design features of the MPS and how the applicant intends this Surveillance to be performed; the CHANNEL CHECK is the principal means of monitoring channel performance and status between CHANNEL CALIBRATIONS. Therefore, the staff concludes that this definition is acceptable. SER Section 16.4.8.3 describes the capabilities of the digital platform and the self-testing features of the MPS.

CHANNEL OPERATIONAL TEST (COT)

The applicant proposed specifying a COT only for LCO-required instrumentation functions implemented by the Module Control System (MCS). These are the RCS leakage detection instrumentation of the CES condensate monitor (two channels) and CES gaseous radioactivity monitor (one channel), which are required to be operable by LCO 3.4.7 in Modes 1 and 2, and in Mode 3 with RCS hot temperature at or greater than 200°F (~93.3°C). The proposed COT definition is consistent with the COT definition in Revision 4 of the W-STS, with one exception. The applicant proposed a change to this definition in its response (ML17269A210) to RAI 156-9031, Question 16-2, Subquestion c. The applicant proposed to include a change consistent with the recently approved STS change traveler TSTF-563, Revision 0. This traveler adds a phrase to the last sentence of the COT definition (as well as the definitions of ACTUATION LOGIC TEST and CHANNEL CALIBRATION), as indicated:

> The COT may be performed by means of any series of sequential, overlapping, or total channel steps, and each step must be performed within the Frequency in the Surveillance Frequency Control Program for the devices included in the step.

Since the proposed COT definition includes this change by approved traveler TSTF-563, the staff concludes that the COT definition is acceptable. Therefore, RAI 156-9031, Question 16-2, Subquestion c, is resolved and closed.

CORE OPERATING LIMITS REPORT (COLR)

The proposed definition matches the W-STS definition of the COLR, except that instead of the phrase “Plant operation within these parameter limits...”, the GTS uses “Module operation within these parameter limits....” Because “module operation” is equivalent to the intended meaning of “plant operation” and both include operation of the reactor core, the staff concludes that using “module” is only an administrative difference and is therefore acceptable.

LEAKAGE

The applicant proposed to depart from the W-STS definitions of “identified LEAKAGE” and “unidentified LEAKAGE” by omitting references to leakage “such as that from pump seals or valve packing (except RCP seal water injection or leakoff), that is captured and conducted to collection systems or a sump or collecting tank”; this departure is appropriate because the leakage sources and associated leakage collection systems do not apply to the NPM design. Accordingly, this departure omits paragraph a.1 and revises paragraph a.2 of the W-STS definition of “identified LEAKAGE,” as indicated in the markup provided below in the discussion of “pressure boundary LEAKAGE.” The W-STS definition’s paragraph a.2 reference to LEAKAGE “into the containment atmosphere” is also omitted from the GTS “identified LEAKAGE” definition’s paragraph a.1. This is appropriate because only RCS LEAKAGE into containment, which is not pressure boundary LEAKAGE, can be collected and measured by RCS leakage detection instrumentation, such as the CES condensate monitor channels.

The applicant further proposed to depart from the W-STS definition of pressure boundary LEAKAGE (paragraph c) by reducing the scope of what the definition considers to be RCPB LEAKAGE. This is accomplished by adding a sentence that excludes leakage that can be isolated using a valve such that when the valve is in the closed position, the leakage is no greater than 0.5 gpm per nominal inch of valve size up to a maximum of 5 gpm. This change had previously been proposed for the W-STS, Revision 4, definition of LEAKAGE by STS change traveler TSTF-534, "Clarify Application of Pressure Boundary Leakage Definition" Revision 0, which was withdrawn by the TSTF in 2012, in the same letter that included the TSTF’s response to staff comments.

In RAI 156-9031 (ML17220A038), Question 16-2, Subquestion f, the staff requested that the applicant justify including the sentence added to paragraph c of the LEAKAGE definition, as shown in the following markup of the W-STS LEAKAGE definition:

LEAKAGE LEAKAGE shall be:

a. Identified LEAKAGE

~~1. LEAKAGE, such as that from pump seals or valve packing (except reactor coolant pump (RCP) seal water injection or leakoff), that is captured and conducted to collection systems or a sump or collecting tank,~~

~~2~~1. LEAKAGE ~~into the containment atmosphere~~ from sources that are both specifically located and known either not to interfere with the operation of leakage detection systems or not to be pressure boundary LEAKAGE, or

~~3~~2. Reactor Coolant System (RCS) LEAKAGE through a steam generator (SG) to the Secondary System (primary to secondary LEAKAGE),

b. Unidentified LEAKAGE

All LEAKAGE ~~(except RCP seal water injection or leakoff)~~ that is not identified LEAKAGE, and

c. Pressure Boundary LEAKAGE

LEAKAGE (except ~~primary to secondary~~ SG LEAKAGE) through a nonisolable fault in an RCS component body, pipe wall, or vessel wall. A fault in an RCS component body, pipe wall, or vessel wall is isolated if LEAKAGE through the isolation device is ≤ 0.5 gpm per nominal inch of valve size up to a maximum limit of 5 gpm.

In its response (ML17269A210) to RAI 156-9031, Question 16-2, Subquestion f, the applicant indicated that the traveler is not the basis for the proposed sentence. Rather, it is based on "significant differences" of the NuScale design compared to previous PWR designs currently in operation. Notwithstanding such design differences, the staff questions the need for departing from the LEAKAGE definition of W-STS. During a public meeting teleconference with NuScale on April 4, 2018, the staff pointed out that the TSTF may soon submit a revision to TSTF-534 for the staff's consideration. The applicant indicated it will re-examine implementation of this traveler. Pending a decision by the applicant to supplement its response to clarify the RCPB leak locations for which the proposed sentence would provide relief (by avoiding a unit shutdown to Mode 3 below 200°F (~93.3°C) in 48 hours per Required Action B.2 of GTS Subsection 3.4.5); or to remove the sentence, the staff is unable to complete its review of Section 1.1. Accordingly, the staff is tracking RAI 156-9031, Question 16-2, Subquestion f, as an open item. In a November 6, 2018, public meeting teleconference (ML18337A019), NuScale said it will provide a supplemental response to RAI 156-9031, Question 16-2, Subquestion f.

In addition, again in definition paragraph c, the applicant replaced the W-STS phrase "(except primary to secondary LEAKAGE)" with the phrase "(except SG LEAKAGE)." Because definition paragraph a.2 indicates that primary to secondary LEAKAGE is "Reactor Coolant System (RCS) LEAKAGE through a steam generator to the Secondary System," and "SG LEAKAGE" is not so narrowly defined, the GTS definition should use the W-STS phrase. Pending incorporation of this change to the definition of LEAKAGE to conform to the W-STS definition, **the staff is tracking this departure as part of the open item associated with RAI 156-9031, Question 16-2, Subquestion f.**

OPERABLE – OPERABILITY

The NuScale design does not use the word "emergency" to describe the onsite electrical power system (sources and distribution), and does not use "seal water," and in addition to the word "channel" uses the equivalent term "separation group" to describe a redundant MPS instrumentation loop. In RAI 156-9031, Question 16-2, Subquestion f, the staff requested the applicant to revise the definition to account for these items. In its response (ML17269A210) to RAI 156-9031, Question 16-2, Subquestion f, the applicant revised the definition of OPERABILITY (as proposed in DCA Part 4, Revision 0) by incorporating the changes indicated by underlining and lineout in the below markup of the W-STS OPERABILITY definition. After reviewing this response, the staff identified additional clarifications for consistency and completeness, which are indicated by shading:

OPERABLE – OPERABILITY	A system, subsystem, separation group, channel, division, train, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified safety function(s) and when all necessary attendant instrumentation, controls, ~~normal or emergency~~ electrical power, cooling ~~and seal~~ water, lubrication, and other auxiliary equipment that are required for the system, subsystem, separation group, channel, division, train, component, or device to perform its specified safety function(s) are also capable of performing their related support function(s).

The addition of the NuScale term "separation group" is logical since Revision 2 of DCA Part 4, GTS Bases Subsection B 3.3.1 uses it (e.g., the Background section discussion of measurement channels contains the following paragraphs):

> Four identical measurement channels (also designated separation group-A through D) with electrical and physical separation are provided for each variable used in the generation of trip and actuation signals.
>
> MPS sensor processing consists of four separation groups of sensors. Each of the four groups is composed of safety function modules (SFMs) that condition input signals and provide channel trip and actuation determination....

However, the staff notes that no provision of Revision 2 of the NuScale GTS uses the term "separation group"; the GTS, as well as the Bases, do use the terms "channel" and "division." Accordingly, the staff suggests including these terms in the OPERABILITY definition, especially as Subsection 3.3.1 uses the term "channel" and Subsections B 3.3.1, 3.3.2 and B 3.3.2, 3.3.3 and B 3.3.3, and 3.3.4 and B 3.3.4 use the term "division"; in addition, Specification 5.5.8.a.1

uses “division” instead of “train” in the phrase “cross division checks.” The Section 1.1 definition of PASSIVELY COOLED - PASSIVE COOLING, Section 1.3, and Subsection 3.5.2 use the term “train” as the only examples of the use of “train” in the GTS (other than in the OPERABILITY definition); in the Bases, Subsection B 3.0 for SR 3.0.4, SR 3.0.5, SR 3.0.6, and SR 3.0.8; Subsection B 3.1.7; Subsection B 3.5.1; Subsection B 3.5.2; and Subsection B 3.7.1 all use the term “train.”

Pending consideration by the applicant of the above suggestions, the staff is tracking the definition of OPERABILITY as part of the open item related to the pending supplemental response to RAI 156-9031 (ML17220A038), Question 16-2, Subquestion f. The staff verified that the OPERABLE-OPERABILITY definition in Revision 2 of DCA Part 4, reflects the markup of Revision 1 of DCA Part 4, Section 1.1, in the applicant’s response (ML17269A210) to RAI 156-9031, Question 16-2, Subquestion f.

PRESSURE AND TEMPERATURE LIMITS REPORT

The proposed PTLR definition matches the W-STS definition except that it omits the W-STS definition’s phrase, “and the low temperature overpressure protection arming temperature,” which is also not included in the W-AP1000-STS PTLR definition; the AP1000 design uses the relief valves in the normal residual heat removal system suction line for LTOP and has no valve operator to “arm” at a particular RCS temperature. So the applicant concluded that this phrase is not applicable. However, the NuScale LTOP functionality of the three reactor vent valves (RVVs) is automatically enabled by the wide range RCS cold temperature interlock T-1 (2 of 4 channels ≤ LTOP enable temperature specified in the PTLR, approximately 325°F (~163°C)). The T-1 interlock LTOP enabling temperature appears analogous to an “LTOP arming temperature” as used in the W-STS, which is based on a typical LTOP system design, such as the design implemented at Vogtle Electric Generating Station, Units 1 and 2. Therefore, the staff questions omission of an equivalent phrase, such as “and the low temperature overpressure protection enable temperature,” from the NuScale GTS PTLR definition. The staff issued RAI 506-9614 (ML18289A751), Question 16-51, requesting the applicant to consider including an equivalent phrase in the PTLR definition.

In its response (ML18347A619) to Question 16-51, the applicant declined to incorporate the suggested changes into the PTLR definition, stating that “the LTOP arming temperature is established and maintained as specified in [generic] TS 5.5.10, Setpoint Program, and described in the Bases for LCO 3.3.1, Module Protection System.” Taking the applicant’s response into account, the staff finds that its suggested changes, though intended to promote consistency with the PTLR definition in other STS, are not necessary to ensure that the NuScale T-1 interlock LTOP enabling temperature will be correctly set and maintained to support operability of the RVV LTOP Function, in accordance with SR 3.3.1.4, CHANNEL CALIBRATION. Therefore, RAI 506-9614, Question 16-51, is resolved and closed.

SHUTDOWN MARGIN (SDM)

The proposed definition of SDM departs from the W-STS definition as indicated by the following markup of the W-STS definition:

SHUTDOWN MARGIN (SDM)	SDM shall be the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming:
	a. Moderator temperature is 420°F; and

b. All ~~rod cluster control assemblies (RCCAs)~~ CRAs are fully inserted except for the single ~~RCCA~~ assembly of highest reactivity worth, which is assumed to be fully withdrawn. However, with all ~~RCCAs~~ CRAs verified fully inserted by two independent means, it is not necessary to account for a stuck ~~RCCA~~ CRA in the SDM calculation. With any ~~RCCA~~ CRA~~(s)~~ not capable of being fully inserted, the reactivity worth of ~~the RCCA~~ the affected CRA must be accounted for in the determination of SDM~~, and~~

~~b.~~ ~~In MODES 1 and 2, the fuel and moderator temperatures are changed to the [nominal zero power design level]~~.

The change in the order of parts a and b, and the use of CRA instead of RCCA, are editorial administrative changes to reflect NuScale nomenclature and the applicant's preferred presentation. Since the acronym "CRA" is previously defined in the definition of "MODE," not defining it upon its first use in this definition is acceptable. However, the staff suggests defining the acronym again for clarity. Regardless, subsequent use of the word "assembly" and "assemblies" should be changed to "CRA" and "CRAs" to conform to the improved TS writer's guide convention concerning acronyms. The W-STS definition does not appear to consider more than one RCCA to be incapable of being fully inserted; however, the W-AP1000-STS SDM definition does consider more than one uninsertable RCCA. Revision 1 of the DCA contains no justification of why NuScale needs to consider more than one CRA that cannot be fully inserted. Finally, the DCA does not justify using the minimum temperature for criticality, 420°F, in place of the statement, "In MODE 1, the fuel and moderator temperatures are changed to the [nominal zero power design level]." (Note that NuScale MODE 1 corresponds to W-STS MODES 1 and 2; and NuScale MODE 2 corresponds to W-STS MODE 3 with RCS average temperature ≥ 420°F.) The applicant can resolve these issues by providing the noted missing justifications, which are acceptable to the staff, and editing the SDM definition to state:

> SDM shall be the instantaneous amount of reactivity by which the reactor is subcritical or would be subcritical from its present condition assuming:
>
> a. Moderator temperature is 420°F; and
>
> b. All control rod assemblies (CRAs) are fully inserted except for the single CRA of highest reactivity worth, which is assumed to be fully withdrawn. However, with all CRAs verified fully inserted by two independent means, it is not necessary to account for a stuck CRA in the SDM calculation. With any CRA not capable of being fully inserted, the reactivity worth of the affected CRA must be accounted for in the determination of SDM.

In RAI 512-9634 (ML18333A021), Question 16-60, Subquestion 9, the staff requested that the applicant address the above editorial issues, by adopting the above suggested definition of SDM. In a November 6, 2018, public meeting teleconference (ML18337A019) with NuScale, the applicant stated it will respond to RAI 512-9634, Question 16-60, Subquestion 9, as a part of its supplemental response to RAI 228-9034, Question 16-30, Subquestion a1. SER Section 16.4.8.6 describes the resolution of RAI 512-9634, Question 16-60, Subquestion 9, regarding the SDM definition.

16.4.2.3 Included NuScale-specific definitions

The following defined terms and definitions are unique to NuScale because of design differences from large light water pressurized water reactors. These differences are highlighted for some terms by providing a markup of the STS definition. The staff concludes that these definitions are acceptable because they accurately reflect the NuScale design.

AXIAL OFFSET (AO)

This defined term and definition (AO = (power in top half of core minus power in bottom half of core) divided by (power in top half plus power in bottom half)) is similar to the W-STS defined term and definition of AXIAL FLUX DIFFERENCE (AFD) except that the AFD is based on core power derived from excore power range neutron detectors. The AO is based on core power derived from the neutron detectors of the Incore Instrumentation System (ICIS).

MODE – MODES

The operational MODE definition differs from the W-AP1000-STS definition as shown in the following markup of the STS definition:

> MODE – MODES   A MODE shall correspond to any one inclusive combination of ~~core reactivity condition~~ reactivity condition, ~~power level, average reactor coolant temperature~~ reactor coolant temperature, control rod assembly (CRA) withdrawal capability, Chemical and Volume Control System (CVCS) and Containment Flood and Drain System (CFDS) configuration, reactor vent valve electrical isolation, and reactor vessel ~~head closure~~ flange bolt tensioning specified in Table 1.1-1 with fuel in the reactor vessel.

In RAI 512-9634 (ML18333A021), Question 16-60, Subquestion 5, the staff requested the applicant to revise the definition of the defined term MODE to be fully consistent with Table 1.1-1, "MODES." In its initial partial response (ML19010A409) to RAI 512-9634, Question 16-60, concerning Subquestion 5, the applicant made the requested change, so that the definition of MODE reads as follows:

> MODE – MODES   A MODE shall correspond to any one inclusive combination of reactivity condition, reactor coolant temperature, control rod assembly (CRA) withdrawal capability, Chemical and Volume Control System (CVCS) and Containment Flood and Drain System (CFDS) configuration, reactor vent valve electrical isolation, and reactor vessel flange bolt tensioning specified in Table 1.1-1 with fuel in the reactor vessel.

The staff verified that this definition and associated Table 1.1-1, "MODES," are appropriate for delineating practical ranges of the NPM operational states. Therefore, **the staff is tracking**

RAI 512-9634, Question 16-60, Subquestion 5, which is resolved, as a confirmatory item. SER Section 16.4.6, "Applicability Statements," gives the staff's evaluation of Table 1.1-1.

PASSIVELY COOLED – PASSIVE COOLING

This definition applies during MODES 2 and 3 when the secondary heat sink is not available for removal of core decay heat from the reactor coolant. Although there are three stated methods for achieving PASSIVE COOLING, they all transfer core decay heat to the reactor building pool, the UHS.

16.4.2.4 Omitted W-STS definitions

The following W-STS defined terms and definitions are not included in GTS because of NuScale design differences from large light water pressurized water reactors, differences that include the use of digital instrumentation and control platforms. These differences are highlighted for terms that had been proposed in the initial version of the DCA, but were subsequently removed from the GTS and Bases, by providing a markup of the W-STS definition. The staff concludes that omission of these definitions is acceptable.

AXIAL FLUX DIFFERENCE (AFD)

Since the AFD is based on core power derived from excore power range neutron detectors, it is not applicable to the NuScale design, which uses a similar defined term and definition, AXIAL OFFSET. Therefore, omission of the AFD defined term and definition is acceptable.

DOSE EQUIVALENT I-131

Section 1.1 includes the W-AP1000-STS definition of DOSE EQUIVALENT I-131, which is an improvement over the W-STS definition of DOSE EQUIVALENT I-131 and is therefore acceptable to staff.

$\bar{E}$ – AVERAGE DISINTEGRATION ENERGY

Approved STS change traveler TSTF-490-A, Revision 1, removed the AVERAGE DISINTEGRATION ENERGY definition in W-STS, Revision 4, Section 1.1. Consistent with this traveler, GTS Section 1.1 omits the defined term and definition of $\bar{E}$ – AVERAGE DISINTEGRATION ENERGY, replaces the W-STS definition of the term DOSE EQUIVALENT I-131 with the W-AP1000-STS definition of this term, and includes the W-AP1000-STS defined term and definition of DOSE EQUIVALENT XE-133. GTS Subsection 3.4.8, "RCS Specific Activity," and associated Bases, use these two defined terms.

The proposed RCS specific activity limits in Subsection 3.4.8 are consistent with the fuel defect level of 0.066 percent as assumed by the NuScale design basis source term in the analyses of DBA radiological consequences, which is described in DCA Part 2, Tier 2, Section 15.0.3 and the applicant's supplemental response (ML18080A162) to RAI 11-8759, Question 12.2-1. This response included markups of Subsection 3.4.8 and Subsection B 3.4.8 that indicate the following changes:

- decrease the steady state upper limit on DOSE EQUIVALENT I-131 from 0.2 μCi/gm to 0.037 μCi/gm, which is stated in Actions Condition A and SR 3.4.8.2;

- decrease the steady state upper limit on DOSE EQUIVALENT XE-133 from 60 µCi/gm to 10 µCi/gm, which is stated in Actions Condition B and SR 3.4.8.1; and

- decrease the short term (48 hours) upper limit on DOSE EQUIVALENT I-131 from 12 µCi/gm to 2.2 µCi/gm, which is stated in Required Action A.1 and in Actions Condition C.

SER Section 12.2.4 gives the staff's evaluation of this response, and the staff's finding that the limits in Subsection 3.4.8 and Subsection B 3.4.8 are acceptable.

ENGINEERED SAFETY FEATURE (ESF) RESPONSE TIME

In Revision 1 of DCA Part 4, GTS Section 1.1, "Definitions," included the W-STS definition of ESF RESPONSE TIME with changes related to the NuScale design's lack of ESF pumps and Class 1E diesel generators, as indicated in the following markup of the W-STS definition:

> The ESF RESPONSE TIME shall be that time interval from when the monitored parameter exceeds its actuation setpoint at the channel sensor until the ESF equipment is capable of performing its safety function (i.e., the valves travel to their required positions~~, pump discharge pressures reach their required values, etc.~~). ~~Times shall include diesel generator starting and sequence loading delays, where applicable.~~ The response time may be measured by means of any series of sequential, overlapping, or total steps so that the entire response time is measured. In lieu of measurement, response time may be verified for selected components provided that the components and methodology for verification have been previously reviewed and approved by the NRC.

Because these changes resulted in an ESF RESPONSE TIME definition appropriate for the NuScale design, the staff considered the changes acceptable. However, in Revision 1 of DCA Part 4, Section 3.3, "Instrumentation," did not use the ESF RESPONSE TIME defined term, but did use the RTS RESPONSE TIME defined term, even though Section 1.1 did not include its definition. Section 3.3 stated the response time Surveillances as follows:

- SR 3.3.1.3 Verify channel RESPONSE TIME is within limits. | 24 months

- SR 3.3.2.2 Verify RTS RESPONSE TIME is within limits. | 24 months

- SR 3.3.3.2 Verify required RESPONSE TIME is within limits. | 24 months

In Revision 2 of DCA Part 4, the applicant revised Section 1.1 by omitting the RTS and ESF response time definitions and defined terms; the applicant also revised the Section 3.3 response time Surveillances and associated Bases, which are quoted below. In these quotations, underlined and lined-through text indicate staff recommended additional editorial corrections to the Surveillance statements and associated Bases. Following the quoted material for each SR, the staff has provided its observations about shaded text; in RAI 9642 , Question 16-65, the staff requested the applicant to address these observations:

- SR 3.3.1.3 Verify channel ~~required~~ response time is within limits. | 24 months

  The Bases for SR 3.3.1.3 state the following:

This SR ~~3.3.1.3~~ verifies that the individual channel ~~actuation~~ response times are less than or equal to the maximum values assumed in the accident analysis. The channel ~~actuation~~ response time is the time from when the process variable exceeds its setpoint until the output from the channel analog logic reaches the input of the MPS digital logic. Response time testing criteria are included in FSAR Chapter 7.

Channel response time may be verified by any series of sequential, overlapping or total channel measurements, including allocated sensor response time, such that the channel response time is verified. Allocations for sensor response times may be obtained from records of test results, vendor test data, or vendor engineering specifications. ...

Observations:

- o The word “required” is unnecessary in the Surveillance statement.

- o In the Bases phrase, “channel actuation response time,” the word “actuation” is unnecessary and inconsistent with SR 3.3.1.3, which uses the phrase “channel response time.”

- o The phrase “accident analysis” is used in the Bases for SR 3.3.1.3, but the phrase “safety analysis” is used in the corresponding similar sentences in the Bases for SR 3.3.2.2 and SR 3.3.3.2. This appears to be inconsistent.

- o In the Bases, consider modifying the reference “FSAR Chapter 7” to say “FSAR Section 7.2 (Ref. 1).”

- o The “channel response time” verified by SR 3.3.1.3 appears to span the channel’s process sensor to the channel’s output from the analog to digital converter, and excludes the comparison of the digital signal with the channel trip setpoint in the SFM. SER Section 7.2 gives the staff’s evaluation of the “digital response time” verification testing.

- o When “channel response time” is meant, the Bases should use the full phrase for clarity, not just “response time,” which is more general. Consider discussing the overlapping component response times in an MPS instrument channel (e.g., “sensor response time” is already called out).

- o Regarding allocated MPS instrument channel component response times, the last sentence of the definitions of the W-AP1000-STS defined terms RTS Response Time and ESF Response Time states:

> In lieu of measurement, response time may be verified for selected components provided that the components and methodology for verification have been previously reviewed and approved by the NRC.

Unless the staff has previously reviewed and approved the components and methodology for response time verification [by allocation] as a part of the NuScale DCA review, as documented in SER Chapter 7, the above quoted SR 3.3.1.3 Bases statement, “Allocations for sensor response times may be obtained from records of test results, vendor test data, or vendor engineering specifications." may need to be designated as a COL action item.

- SR 3.3.2.2 Verify ~~required~~ response time is within limits. | 24 months

The Bases for SR 3.3.2.2 state the following:

> This SR ensures that the response times of the two RTS divisions are verified to be less than or equal to the maximum values assumed in the safety analysis. Individual component response times are not modeled in the analyses. The analyses model the overall or total elapsed time, from the point at which the process variable exceeds the trip setpoint value at the sensor to the time at which the [reactor trip breakers (RTBs)] open. Total response time may be verified by any series of sequential, overlapping, or total channel measurements.
>
> ... The maximum digital time response is described in the FSAR. This SR encompasses the response time of the RTS division from the output of the equipment interface modules until the RTBs are open. ...

Observations:

- The word "required" is unnecessary in the Surveillance statement.
- The phrase "accident analysis" is used in the Bases for SR 3.3.1.3, but the phrase "safety analysis" is used in the corresponding similar sentences in the Bases for SR 3.3.2.2 and SR 3.3.3.2. This appears to be inconsistent.
- In the Bases, consider modifying the reference to "FSAR" to say "FSAR Section 7.2 (Ref. 1)."
- Consider whether it would be more accurate to say "total division measurements" in place of "total channel measurements."
- The "RTS division response time" verified by SR 3.3.2.2, appears to span the analog output of the RTS EIM to the division's two RTBs, and excludes verification of the "digital time response," which appears to span the components from receipt of the digital process signal, to the setpoint comparison in the SFM, through the SVM, and through the priority logic of the RTS EIM. SER Section 7.2 gives the staff's evaluation of the "digital response time" verification testing.
- Consider discussing in the Bases the overlapping digital component response times in an RTS division and how "maximum digital time response" is verified.

- SR 3.3.3.2 Verify ~~required~~ pressurizer heater breaker response time is within limits. | 24 months

The Bases for SR 3.3.3.2 state the following:

> This SR ensures that the pressurizer heater breaker opening response times are verified to be less than or equal to the maximum values

assumed in the safety analysis. Individual component response times are not modeled in the analyses. The analyses model the overall or total elapsed time, from the point at which the process variable exceeds the trip setpoint value at the sensor to the time at which the ESF component actuates. Total response time may be verified by any series of sequential, overlapping, or total channel measurements.

Response times of the sensors are tested in accordance with LCO 3.3.1, "MPS Instrumentation." The maximum digital time response is described in the FSAR. This SR encompasses the response time of the ESFAS from the output of the equipment interface modules to the loss of voltage at the output of the pressurizer heater breaker. The response time of valves actuated by the ESFAS are verified in accordance with the IST program, and LCO 3.4.6, "Chemical and Volume Control System Isolation Valves," LCO 3.4.10, "LTOP Valves," LCO 3.5.1, "ECCS," LCO 3.5.2, "DHRS," LCO 3.6.2, "Containment Isolation Valves," LCO 3.7.1, "MSIVs," and LCO 3.7.2, "Feedwater Isolation."

Observations:

- The word "required" is unnecessary in the Surveillance statement.
- The phrase "accident analysis" is used in the Bases for SR 3.3.1.3, but the phrase "safety analysis" is used in the corresponding similar sentences in the Bases for SR 3.3.2.2 and SR 3.3.3.2. This appears to be inconsistent.
- In the Bases, consider modifying the reference to "FSAR" to say "FSAR Section 7.2 (Ref. 1)."
- Consider whether it would be more accurate to say "total division measurements" in place of "total channel measurements."
- The "ESFAS division response time" verified by SR 3.3.3.2, appears to span the analog output of the pressurizer heater breaker EIM to the division's two pressurizer heater breakers, and excludes verification of the "digital time response," which appears to span the components from receipt of the digital process signal, to the setpoint comparison in the SFM, through the SVM, and through the priority logic of the pressurizer heater breaker EIM. Also excluded is the digital portion of the ESFAS division for the other ESF Logic and Actuation functions. See SER Section 7.2 for the staff's evaluation of the "digital response time" verification testing.
- Consider discussing in the Bases the overlapping digital component response times in an ESFAS division and how "maximum digital time response" is verified.
- Consider including the phrase "response time" in the SRs for Inservice Testing Program ESFAS valve actuations (The Frequency of "In accordance with the Inservice Testing Program" is taken to mean 24 months for these SRs.):

SR 3.4.6.2	Verify the ~~required~~ isolation response time of each automatic power operated CVCS valve is within limits.

SR 3.4.10.2 Verify the open actuation response time of each RVV is within limits.

SR 3.5.1.2 Verify the open actuation response time of each RVV and RRV is within limits.

SR 3.5.2.4 Verify the open actuation response time of each DHRS actuation valve is within limits.

SR 3.6.2.3 Verify the isolation response time of each automatic containment isolation valve is within limits except for valves that are open under administrative controls.

Note that the staff is tracking the exception to SR 3.6.2.3 as an open item under RAI 197-9051 (ML17237C008), Question 16-28, which is described in SER Section 16.4.8.5, "Proposed exceptions to meeting certain surveillances for isolation valves and circuit breakers."

SR 3.7.1.2 Verify isolation response time of each MSIV and MSIV bypass valve is within limits on an actual or simulated actuation signal.

SR 3.7.2.2 Verify the closure response time of each FWIV and FWRV is within limits on an actual or simulated actuation signal.

In RAI 506-9614 (ML18289A751), Question 16-50, the staff requested that the applicant provide justification for not including response time defined terms and their definitions in GTS Section 1.1, and in response time SRs in Section 3.3. In its response (ML18347A619) to RAI 506-9614, Question 16-50, the applicant explained in detail the reasons the STS response time definitions are not suitable for the NuScale instrumentation design, and how the response time for the digital signal processing is "verified during factory acceptance testing of the MPS as described in associated inspections, tests, analyses, and acceptance criteria listed in [Revision 2 of DCA Part 2,] Tier 1, Table 2.5-7 of the FSAR." The response also stated:

> The self-testing features of the design will notify operators of failures that could impact system function, however degradation of the system response time cannot occur. An OPERABLE MPS has a defined digital response time that does not change and does not require further verification.

Pending completion of its review of the applicant's response **the staff is tracking the omission of the response time definitions and the adequacy of the proposed response time verification Surveillances as an open item under RAI 506-9614, Question 16-50. The staff is tracking the disposition of the above observations as an open item under RAI -9642, Question 16-65.**

MASTER RELAY TEST

This W-STS defined term is not applicable to the NuScale MPS because the NuScale MPS has no master relay.

QUADRANT POWER TILT RATIO (QPTR)

This W-STS defined term is not used to define limits on asymmetry of the reactor core radial power distribution in the NuScale design. Table B-1, "Comparison of standard technical specifications with NuScale generic technical specifications," of the RCDR (Revision 1) (ML18305A964) states that W-STS LCO 3.2.4, "QPTR," is "not applicable to NuScale analysis methodology and design." The staff agrees with this statement. Therefore, the staff finds that omitting the QPTR defined term and its definition in GTS Section 1.1 is acceptable.

REACTOR TRIP SYSTEM (RTS) RESPONSE TIME

In Revision 1 of DCA Part 4, Section 1.1 did not include the W-STS definition of RTS RESPONSE TIME, even though SR 3.3.2.2 used the defined term of RTS RESPONSE TIME ("Verify RTS RESPONSE TIME is within limits. | 24 months"). The Section 1.1 RTS and ESF response time definitions were removed in Revision 2 of the DCA, as described above in the discussion of ESF RESPONSE TIME. **The staff is tracking the omission of these definitions and the adequacy of the proposed response time verification Surveillances as an open item under RAI 506-9614 (ML18289A751), Question 16-50**.

STAGGERED TEST BASIS

The GTS do not use this defined term to modify any Surveillance Frequency because staggered testing of redundant subsystems, trains, or instrumentation channels provides no safety benefit in the NuScale design. The staff therefore finds that omitting it and its definition in GTS Section 1.1 is acceptable.

TRIP ACTUATING DEVICE OPERATIONAL TEST (TADOT)

The scope of testing applicable to the TADOT definition exceeds the testing needed by the NuScale design. The GTS do specify an equivalent test, which only applies to manual actuation functions; SR 3.3.4.1 requires performing an "actuation device operational test" for the eight manual functions for initiating RTS, ECCS, DHRS, CIS, DWSI, CVCSI, PHT, and LTOP. Also, if a TADOT with a paired down definition appropriate for this SR if included in the GTS, this SR would be the sole use of this defined term. The Bases for SR 3.3.4.1 provide an adequate description of the specified actuating device operational test. The staff therefore finds that omitting the W-STS TADOT defined term and its definition in GTS Section 1.1 is acceptable.

16.4.2.5 Conclusion for Section 1.1

The staff has not completed its review of Section 1.1 due to the pending resolution of the above identified open items.

16.4.2.6 Logical connectors, completion times, and frequency

The W-AP1000-STS Sections 1.2, 1.3, and 1.4 provide examples depicting the use and application rules, which are specified in these sections, for logical connectors, required action completion times, and surveillance requirement frequencies (test intervals), respectively. These examples reflect the AP1000 passive design features. Each example includes a discussion of the particular provision being illustrated. Because the NuScale design also relies on passive design features, the examples in the GTS for these sections are similar to and consistent with the examples in the W-AP1000-STS. The staff therefore concludes that GTS Sections 1.2, 1.3, and 1.4 are acceptable.

16.4.2.7 Conclusion for Chapter 1

The staff has not completed its review of Chapter 1 due to the pending completion of the Section 1.1 review.

16.4.3 Safety Limits (Chapter 2)

In its letter to the staff (ML17342B343), the applicant updated Revision 0 of DCA Part 2, Tier 2, Chapters 1, 2, and 15, and DCA Part 4, Technical Specifications (TS) and Bases, with conforming changes to reflect Revision 1 of Licensing Topical Report, NuScale Power Critical Heat Flux Correlations TR-0116-21012, which adopts a new critical heat flux (CHF) correlation, NSP4. The letter stated the following, in part:

> Note that the Technical Specification Safety Limits affected by the implementation of the NSP4 correlation were also modified to relocate the critical heat flux correlation values from the Safety Limit to the Core Operating Limits Report (COLR). The requirement for and contents of the COLR are described in Technical Specification 5.6.3. This relocation is consistent with similar approved Technical Specification changes implemented at the Farley nuclear plant (ML013400451).

The staff reviewed the safety evaluation for Amendment No. 151 to Facility Operating License No. NPF-2 and Amendment No. 143 to Facility Operating License No. NPF-8, for the Joseph M. Farley Nuclear Plant, Units 1 and 2 (Farley), respectively, which were issued on December 4, 2001. The amendments included a change to plant-specific TS Subsection 2.1.1, “Reactor Core SLs,” that moved the curves depicting departure from nucleate boiling (DNB) criterion correlation limits to the COLR, a report cited and governed by plant-specific TS Subsection 5.6.5, “COLR.” This relocation was based on Generic Letter (GL) 88-16, “Removal of Cycle-Specific Parameter Limits from TS,” dated October 4, 1988 (ML031200485). The Farley amendments were also based on a topical report, WCAP-14483-A, “Generic Methodology for Expanded Core Operating Limits Report,” approved January 19, 1999 (ML020430092). The topical report addressed implementing GL 88-16 for Westinghouse plants, including the relocation of curves depicting DNB limits. However, this report did not propose, and the enclosed staff safety evaluation did not approve, relocating the numerical value for the core SL from the TS to the COLR.

Based on its review of the safety evaluation and examination of GL 88-16, the staff concluded that its scope does not include relocating reactor core SL values because 10 CFR 50.36(c)(1) requires TS to include SLs. Apparently, the removal of curves depicting DNB limits from the Farley plant-specific TS was consistent with GL 88-16. However, because of an apparent oversight, the license amendments incorporating GL 88-16 did not include specifying a DNB criterion correlation value for reactor core SL 2.1.1.1, because this value is not expected to change each fuel cycle. Including this SL value is also a condition for approving a COLR in the staff’s safety evaluation of topical report WCAP-14483-A.

Accordingly, the staff cannot accept the proposed omission of reactor core SL CHF correlation numerical values from GTS SL 2.1.1.1. In RAI 472-9445 (ML18130A984), Question 16-44, the staff requested that the applicant restore these SL values to SL 2.1.1.1 and make conforming changes to the associated Bases in Subsection B 2.1.1 and the list of specifications, which reference the COLR, in Subsection 5.6.3, paragraph a. In its response (ML18163A417) to RAI 472-9445, Question 16-44, the applicant restored reactor core SL CHF correlation numerical values to GTS SL 2.1.1.1, so that Section 2.1.1.1 states the following:

2.1.1 Reactor Core SLs

2.1.1.1 In MODE 1 the critical heat flux ratio shall be maintained at or above the following correlation safety limits:

Correlation	Safety Limit
NSP2	[1.17]
Hench-Levy	[1.06]
NSP4	[1.21]

The staff had expected to see four CHF correlations and their SL values listed, based on Revision 2 of DCA Part 2, Tier 2, Section 4.3. In addition, the applicant may need to revise the DCA Part 2, Tier 2, description of COL action items for Chapter 16, and the Bases for SL 2.1.1, "Reactor Core SLs." SER Section 16.5 describes COL information.

The applicant's response (ML18163A417) to RAI 472-9445, Question 16-44, does not include the Griffith-Zuber CHF correlation; also, the 1.06 value for Hench-Levy is not consistent with information provided in DCA Part 2, Tier 2, Section 15.6.6 or the LOCA topical report. As part of the review for TR-0516-49422, "Loss-of-Coolant Accident Evaluation Model," the staff issued RAI 9536 (ML18167A016), Question 15.6.6-2, requesting that the applicant (1) submit a methodology, for NRC staff review, that describes the experimental data supporting the development of the CHFR limits for the Griffith-Zuber and Hench-Levy correlations, and that demonstrates the CHF models have sufficient validation as demonstrated through appropriate quantification of error, and (2) update the appropriate licensing documentation to consistently reflect the final CHFR limits. The staff reviewed the response (ML18264A338) to Question 15.6.6-2 and decided to change its status to unresolved closed, and pursue the issue of including a CHFR value for the Griffith-Zuber CHFR correlation in SL 2.1.1.1 under RAI 472-9445, Question 16-44. In a November 6, 2018, public meeting teleconference (ML18337A019), the applicant said it would provide a supplemental response to Question 16-44 to further address this issue.

In its supplemental response (ML19016A462) to RAI 472-9445, Question 16-44, the applicant stated in part *(emphasis added)*:

> Consistent with the standard technical specifications of existing plants, the safety limit[s] in specification 2.1.1, Reactor Core SLs, are applicable in MODE 1 when the reactor is, or may be critical. The three correlation safety limits provided in the technical specifications are the safety limits that must be set to satisfy the requirements of 10 CFR 50.36 for safety limits.
>
> In addition to the evaluation of postulated events during critical operations, the NuScale design safety analyses evaluate the effects of other, post-reactor trip transients on reactor cladding to ensure the integrity of the barrier to radioactivity release is maintained. As described in the response to RAI 15.06.06-2, the Griffith-Zuber correlation is used to evaluate CHFR in low core flow conditions that typically exist during postulated events post-reactor trip. *This limit is not included in the technical specifications because it is not a process variable that is controlled by plant conditions during operations.* CHF is one of many acceptance criteria applied in analyses to demonstrate that the design adequately limits the release of radioactive material after a postulated event.

In summary, the CHFR limits in specification 2.1.1.1 are met through a combination of operating limits and design criteria. The Griffith-Zuber CHFR limitation is used as an accident analysis design criteria that is not directly dependent on operating conditions or controllable by the reactor operators.

Based on this justification, the Griffith-Zuber correlation limit is not included in the technical specifications, but is used in the design and accident analyses of the plant.

Because **the staff has not completed evaluating the supplemental response to Question 16-44, it is tracking SL 2.1.1.1 as an open item under RAI 472-9445, Question 16-44**.

Also, in its initial response to Question 16-44, the applicant removed the reference to SL 2.1.1 from Subsection 5.6.3, "COLR," paragraph a, which is acceptable because SL 2.1.1 does not reference the COLR.

Conclusion for Chapter 2

Pending resolution of the identified open item, the review of Chapter 2 is not complete.

16.4.4 LCO and SR Use and Applicability (Chapter 3, Section 3.0)

The staff reviewed the general LCO and SR usage rules of Section 3.0 for consistency with W-STS Section 3.0 except for departures needed to account for NuScale unique design and operational features.

16.4.4.1 LCO Use and Applicability

The staff found that LCO 3.0.1, LCO 3.0.2, LCO 3.0.3, LCO 3.0.5, LCO 3.0.6, LCO 3.0.7, and LCO 3.0.8 are consistent with the W-STS and the NuScale design. The following describes the resolution of LCO-related issues for selected LCOs, which were brought to the attention of the applicant by the staff in RAI questions.

LCO 3.0.1

This Specification defines the logical connection between an LCO statement and the associated Applicability statement. It states that "LCOs shall be met during the MODES or other specified conditions in the Applicability, except as provided in LCO 3.0.2, [and] LCO 3.0.7[, and LCO 3.0.8]." The list of LCOs containing exceptions to LCO 3.0.1 is appropriate for the NuScale GTS, and includes brackets to reflect the status of bracketed LCO 3.0.8 as a COL action item. Since this Specification matches the W-STS, LCO 3.0.1 is acceptable.

LCO 3.0.2

This Specification defines the logical connection between the LCO and Applicability statements and the associated Action statements; it also specifies that LCO 3.0.5 and LCO 3.0.6 provide exceptions to LCO 3.0.2, consistent with the W-STS.

In RAI 157-9033 (ML17220A108), Question 16-9, the staff requested the applicant to change Section B 3.0 for LCO 3.0.2, to more closely conform to changes made to Revision 4 of W-STS Section B 3.0 for LCO 3.0.2 by STS change traveler TSTF-529-A, "Clarify Use and Application Rules," Revision 4, dated February 29, 2016 (ML16060A455). In its response (ML17257A450) to RAI 157-9033, Question 16-9, the applicant made the requested changes, but also included changes proposed by unapproved traveler TSTF-565, which was under the staff's review at the time. The staff discussed these changes to Section B 3.0 for LCO 3.0.2 with NuScale during a public meeting teleconference on April 4, 2018. The purpose of TSTF-565 is to clarify the STS Section B 3.0 discussions (in the Bases for LCO 3.0.2 and LCO 3.0.3) about intentional entry into Conditions in an LCO Actions table, especially the admonition against doing so just for "operational convenience." The industry TSTF submitted Revision 1 of TSTF-565 on March 30, 2018, for the staff's review. The staff accepted the STS Bases changes proposed in the traveler revision in a letter to the TSTF dated November 30, 2018. The staff compared the proposed changes in the revised traveler with Revision 2 of DCA Part 4, Bases for LCO 3.0.2 and LCO 3.0.3, and finds that the GTS Bases for these LCOs match the traveler. Therefore, the Bases for LCO 3.0.2 and LCO 3.0.3 are acceptable, and RAI 157-9033, Question 16-9, is resolved and closed.

LCO 3.0.3

This Specification is consistent with W-STS Section 3.0, LCO 3.0.3, with differences stemming from NuScale unit operational mode definitions. The staff noted that this Specification allowed times to place the unit in Mode 2 and in various specified conditions in Mode 3, that appeared to be inconsistent with the allowed times in most other LCO subsections with shutdown action requirements. In RAI 157-9033 (ML17220A108), Question 16-7, the staff requested that the applicant provide additional justification for the shutdown sequence Completion Times of LCO 3.0.3. These Completion Times are 7 hours to be in Mode 2, and 37 hours to be in Mode 3 and Passively Cooled.

The Bases for LCO 3.0.3 are also consistent with the Bases for LCO 3.0.3 in W-STS Section B 3.0, with differences stemming from NuScale unit operational mode definitions. As previously noted, the staff accepted the STS Bases changes proposed in STS change traveler TSTF-565. The staff verified that Revision 2 of DCA Part 4 includes these accepted changes in the Bases for LCO 3.0.3, as well as for LCO 3.0.2.

In its response (ML17257A450) to RAI 157-9033, Question 16-7, the applicant modified the Bases for LCO 3.0.3 by adding a paragraph (subsequently modified in DCA Revision 2, as shown in the below markup) describing the reasons why the shutdown sequence Completion Times of LCO 3.0.3 are appropriate, as follows:

> The Completion Times are established considering the limited likelihood of a design basis event during the 37 hours allowed to ~~reach~~ enter MODE 3 and be PASSIVELY COOLED. They also provide adequate time to permit evaluation of conditions and restoration of OPERABILITY without ~~unnecessarily~~ challenging plant systems during a shutdown. Analysis shows that 37 hours from entry into [LCO] 3.0.3 is a reasonable time to reach MODE 3 and be PASSIVELY COOLED using normal plant systems and procedures.

This additional Bases explanation clarifies the rationale for the shutdown sequence Completion Times, which seem reasonable because they are consistent with the allowed time intervals to reach safe shutdown conditions in W-AP1000-STS LCO 3.0.3, which is 37 hours to establish normal shutdown cooling (normal residual heat removal system) in Mode 5, and is equivalent to the GTS LCO 3.0.3 allowance of 37 hours to establish Passive Cooling in Mode 3 using the DHRS. Based on its assessment of this part of the applicant's response, the staff concludes that GTS LCO 3.0.3 and Bases are acceptable. This includes the LCO 3.0.3 Bases passages related to TSTF-565 changes, as described in the above discussion of the resolution of RAI 157-9033, Question 16-9.

SER Section 16.4.7.6 describes the resolution of the part of RAI 157-9033, Question 16-7 concerning the apparent inconsistency between LCO 3.0.3 and the less restrictive allowed Completion Times for shutdown action requirements specified in the Actions of other LCOs. Based on the resolution of that part of RAI 157-9033, Question 16-7, incorporation of the proposed changes to the Bases for LCO 3.0.3 in Revision 2 of DCA Part 4, and the above determination of the acceptability of the LCO 3.0.3 shutdown action Completion Times, the staff concludes that RAI 157-9033, Question 16-7, is resolved and closed.

LCO 3.0.4

This Specification defines the conditions that must be met to allow for entry into a Mode or other specified condition in the Applicability of an LCO when the LCO is not met. The GTS LCO 3.0.4 is consistent with Revision 4 of W-STS LCO 3.0.4, which is based on traveler TSTF-359-A, "Increase Flexibility in Mode Restraints," Revision 9.

Revision 2 of DCA Part 4, has no LCO Subsections with LCO 3.0.4 exception Notes. Consistent with W-STS, Subsection 3.4.8, "RCS Specific Activity," Actions A and B include the Note "LCO 3.0.4.c is applicable." LCO 3.0.4.c states: "When an LCO is not met, entry into a MODE or other specified condition in the Applicability shall only be made: c. When an allowance is stated in the individual value, parameter, or other Specification."

Because LCO 3.0.4 matches the W-STS, LCO 3.0.4 is acceptable.

The staff identified an apparent oversight in the Bases for LCO 3.0.4 on page B 3.0-7 in Subsection B 3.0 of Revision 2 of DCA Part 4. In RAI 9642, Question 16-63 the staff requested that the applicant consider the following NuScale design-specific paragraph change:

> The provisions of LCO 3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with ACTIONS. In addition, the provisions of LCO 3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that result from any unit shutdown. In this context, a unit shutdown is defined as a change in MODE or other specified condition in the Applicability associated with transitioning from MODE 1 to MODE 2, ~~and~~ MODE 2 to MODE 3 and not PASSIVELY COOLED, and not PASSIVELY COOLED to PASSIVELY COOLED.

Pending resolution of this suggested clarification, **the staff is tracking the Subsection B 3.0 Bases for LCO 3.0.4 as part of the open item under RAI 9642, Question 16-63**.

LCO 3.0.5

This Specification defines an exception to LCO 3.0.2: "Equipment removed from service or declared inoperable to comply with ACTIONS may be returned to service under administrative control solely to perform testing required to demonstrate its OPERABILITY or the OPERABILITY of other equipment." Because this Specification matches the W-STS, LCO 3.0.5 is acceptable.

As a part of adopting TSTF-529, the third paragraph of the Bases for LCO 3.0.5, was modified to reflect the NuScale design, which lacks RCS pressure isolation valves (PIVs). In its supplemental response (ML18079B134) to RAI 157-9033, Question 16-12, the applicant stated there are eight CVCS isolation valves, which are specified to be operable by LCO 3.4.6:

CVC-ISV-0323	Pressurizer Spray Line Outboard Isolation Valve
CVC-ISV-0325	Pressurizer Spray Line Inboard Isolation Valve
CVC-ISV-0329	CVCS Injection Outboard Isolation Valve
CVC-ISV-0331	CVCS Injection Inboard Isolation Valve
CVC-ISV-0334	CVCS Discharge Inboard Isolation Valve
CVC-ISV-0336	CVCS Discharge Outboard Isolation Valve
CVC-ISV-0401	RPV Vent Inboard Isolation Valve
CVC-ISV-0403	RPV Vent Outboard Isolation Valve

The containment isolation function of these valves is also required to be operable by LCO 3.6.2. The problem with the LCO 3.0.5 Bases referencing RCPB leakage isolation is that no LCO 3.4.5 Action explicitly requires isolation of leakage by closing a valve. Although LCO 3.4.6 does not address RCPB leakage, it does address CIV leakage for systems connected to the RCS, such as the four CVCS flowpath lines listed above. Therefore, the LCO 3.0.5 Bases discussion ought to reference a CVCS isolation valve (also a CIV) inoperability requiring isolation, possibly because of valve leakage. Following is a suggested modification of the subject LCO 3.0.5 Bases paragraph:

> An example of demonstrating equipment is OPERABLE with the Required Actions not met is opening a manual valve that was closed to comply with Required Actions to isolate a <u>CVCS</u> flowpath with ~~excessive Reactor Coolant System (RCS) pressure boundary leakage~~ an inoperable CVCS isolation valve in order to perform testing to demonstrate that ~~RCS pressure boundary leakage~~ <u>the isolation valve</u> is now operable~~within limit~~.

In a November 6, 2018, public meeting teleconference (ML18337A019), **NuScale said it will provide a supplemental response to RAI 157-9033, Question 16-12. The staff is tracking this as an open item pending Bases changes for consistency with the NuScale design.**

<u>LCO 3.0.6</u>

This Specification defines the Actions required to be taken when a supported system LCO is not met solely because a support system LCO is not being met. Only the support system LCO Actions are required to be entered, unless a specific exception is specified. The Actions required to be taken include an evaluation that shall be performed in accordance with Specification 5.5.8, “Safety Function Determination Program (SFDP).” Because this Specification matches the W-STS, LCO 3.0.6 is acceptable.

<u>LCO 3.0.7</u>

This Specification defines the rules for applying the allowances of Subsection 3.1.8, “PHYSICS TESTS Exceptions.” Because this Specification matches the W-STS, LCO 3.0.7 is acceptable.

<u>LCO 3.0.8</u>

The GTS Section 3.0 and Section B 3.0 include LCO 3.0.8, which is based on approved traveler TSTF-427-A, “Allowance for Non Technical Specification Barrier Degradation on Supported

System OPERABILITY," Revision 2. In RAI 157-9033 (ML17220A108), Question 16-8, the staff requested the applicant to provide a bounding risk assessment for the NuScale design that is consistent with the bounding generic risk assessment provided in TSTF-427-A. In its response (ML17257A450) to RAI 157-9033, Question 16-8, the applicant inserted a bracketed reviewer's note before LCO 3.0.8, which is also bracketed, to designate both as a COL action item, as follows:

> [--------------------------------REVIEWER'S NOTE--------------------------------
> A COL applicant who wants to adopt LCO 3.0.8 must perform or reference a risk assessment for the NuScale design that has been submitted to and accepted by the NRC, and that was prepared consistent with the bounding generic risk assessment provided in TSTF-427-A, "Allowance for Non-Technical Specification Barrier Degradation on Supported System OPERABILITY," Revision 2.
> ---]

[LCO 3.0.8 When one or more required barriers are unable to perform their related support function(s), any supported system LCO(s) are not required to be declared not met solely for this reason for up to 30 days provided that at least one train or subsystem of the supported system is OPERABLE and supported by barriers capable of providing their related support function(s), and risk is assessed and managed. This Specification may be concurrently applied to more than one train or subsystem of a multiple train or subsystem supported system provided at least one train or subsystem of the supported system is OPERABLE and the barriers supporting each of these trains or subsystems provide their related support function(s) for different categories of initiating events.

If the required OPERABLE train or subsystem becomes inoperable while this Specification is in use, it must be restored to OPERABLE status within 24 hours or the provisions of this Specification cannot be applied to the trains or subsystems supported by the barriers that cannot perform their related support function(s).

At the end of the specified period, the required barriers must be able to perform their related support function(s) or the supported system LCO(s) shall be declared not met.]

This bracketed reviewer's note was also inserted before the bracketed Bases for LCO 3.0.8. Designating LCO 3.0.8 as a COL action item is acceptable because it minimizes the administrative burden on the NRC staff and a COL applicant if the applicant elects to omit LCO 3.0.8 from the plant-specific TS. Deferring the submission or referencing of an associated risk assessment to a COL application referencing the NuScale design certification is acceptable because it will still ensure that the inclusion of LCO 3.0.8 in the plant-specific TS is technically justified and not adverse to safe operation of the unit. The staff verified that Revision 2 of DCA Part 4 included LCO 3.0.8 and the reviewer's note as stated above, and that the Bases for LCO 3.0.8 are bracketed and also include the above reviewer's note. Therefore, RAI 157-9033, Question 16-8 is resolved and closed.

In RAI 157-9033 (ML17220A108), Question 16-13, the staff requested the applicant to justify the apparent omission of two reviewer's notes from LCO 3.0.8 and its Bases. One note states a licensee commitment to the guidance in Section 11 of NUMARC 93-01, "Industry Guideline for

Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," the other, a licensee commitment to the guidance of NEI 04–08, "Allowance for Non Technical Specification Barrier Degradation on Supported System OPERABILITY (TSTF-427) Industry Implementation Guidance," issued March 2006. The staff also requested the applicant to designate LCO 3.0.8, its Bases, and the reviewer's notes as a COL action item using square brackets, as previously stated. In its response (ML17257A450) to RAI 157-9033, Question 16-13, the applicant adequately justified the presentation of the traveler's reviewer's notes in Section B 3.0 for LCO 3.0.8. The applicant also placed square brackets around LCO 3.0.8 and its Bases, as well as around each reviewer's note for LCO 3.0.8, to indicate that they are part of a COL action item. The staff concludes that LCO 3.0.8 and its Bases, and the reviewer's notes, which are all enclosed in brackets, are acceptable because they are consistent with TSTF-427-A. Therefore RAI 157-9033, Question 16-13, is resolved and closed.

The staff verified that Revision 2 of DCA Part 4 includes the added reviewer's notes and brackets. Therefore, as stated above, RAI 157-9033, Questions 16-8 and 16-13 are resolved and closed. Based on its review and resolution of the two RAI questions, the staff concludes that LCO 3.0.8 is acceptable.

16.4.4.2 SR Use and Applicability

The staff found that SR 3.0.1, SR 3.0.2, SR 3.0.3, and SR 3.0.4 are consistent with the W-STS and the NuScale design. The following describes the resolution of SR-related issues for selected SRs, which were brought to the attention of the applicant by the staff in RAI questions.

<u>SR 3.0.1</u>

This Specification defines the logical connection that meeting the LCO and Applicability statements requires meeting the acceptance criteria and performance intervals of the associated Surveillance Requirements (SRs). Because this Specification matches the W-STS, SR 3.0.1 is acceptable.

<u>SR 3.0.2</u>

This Specification provides a 25-percent extension of the specified Surveillance performance interval (Frequency) "as measured from the previous performance or as measured from the time a specified condition of the Frequency is met." It also defines specific exceptions to this allowance for Frequencies specified as "once," and for the initial performance of a Completion Time that requires periodic performance of a Required Action on a "once per..." basis. Because this Specification matches the W-STS, SR 3.0.2 is acceptable.

<u>SR 3.0.3</u>

This Specification defines the actions required to be taken if it is discovered that a Surveillance was not performed within its specified Frequency, and provides an exception to SR 3.0.1. Because this Specification matches the W-STS, as revised by NRC-approved traveler TSTF-529-A, SR 3.0.3 is acceptable.

The staff issued RAI 157-9033 (ML17220A108) Question 16-15, requesting the applicant to revise SR 3.0.3 and associated Bases by removing phrasing based on changes proposed by unapproved traveler TSTF-530, which the staff had declined to review in 2012. In its response (ML17257A450) to RAI 157-9033, Question 16-15, the applicant restored the affected passages to match W-STS SR 3.0.3 and associated Bases. However, this had the unintended effect of removing acceptable phrasing changes based on approved traveler TSTF-529-A, which NuScale intends incorporating in the GTS and Bases. The applicant and the staff discussed this issue in a public meeting teleconference on February 21, 2018. The applicant subsequently restored the approved phrasing based on TSTF-529-A as a part of Revision 1 of DCA Part 4, with one exception in the second and third paragraphs of the Bases for SR 3.0.3. The staff verified that Revision 2 of DCA Part 4, Subsection B 3.0, Bases for LCO 3.0.3, includes this correction. Therefore RAI 157-9033, Question 16-15, is resolved and closed.

SR 3.0.4

The GTS SR 3.0.4 is consistent with Revision 4 of W-STS SR 3.0.4, which is based on traveler TSTF-359-A, "Increase Flexibility in Mode Restraints," Revision 9. Revision 2 of DCA Part 4 has no LCO Subsections with SR 3.0.4 exception Notes. Because this Specification matches the W-STS, SR 3.0.4 is acceptable.

The staff identified an apparent oversight in the Bases for SR 3.0.4 on page B 3.0-21 in Subsection B 3.0 of Revision 2 of DCA Part 4. In RAI 9642, Question 16-63 the staff requested that the applicant consider the following NuScale design-specific paragraph change:

> The provisions of SR 3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that are required to comply with ACTIONS. In addition, the provisions of SR 3.0.4 shall not prevent changes in MODES or other specified conditions in the Applicability that result from any unit shutdown. In this context, a unit shutdown is defined as a change in MODE or other specified condition in the Applicability associated with transitioning from MODE 1 to MODE 2, ~~and~~ MODE 2 to MODE 3 and not PASSIVELY COOLED, and not PASSIVELY COOLED to PASSIVELY COOLED.

Pending resolution of this suggested clarification, the staff is tracking the Subsection B 3.0 Bases for SR 3.0.4 as part of the open item under RAI 9642, Question 16-63.

16.4.4.3 Conclusion for Section 3.0

The staff has not completed its review of Section 3.0 due to the pending resolution of the identified open items.

16.4.5 LCO statements (Chapter 3, Sections 3.1 through 3.8)

The staff reviewed the LCO statement in each Subsection of Sections 3.1 through 3.8 for technical accuracy and consistency with the NuScale design, as described in DCA Part 2, Tier 2, regarding the number of subsystems, trains, channels, divisions, or separation groups of the specified SSC required to be operable; or the value of the limit that the specified process variable must be within. The staff also reviewed each LCO statement for clarity and consistency with STS writer's guide phrasing, formatting, and punctuation conventions, and for overall nomenclature consistency with the GTS and Bases, and DCA Part 2. In most cases, the staff determined that the LCO statements were clear and accurate. The following describes the resolution of LCO-related issues for selected LCOs, which were brought to the attention of the applicant by the staff in RAI questions.

- LCO 3.1.9, “Boron Dilution Control”

This subsection specifies CVCS DWSI valve operability, boric acid storage tank boron concentration limits, and CVCS makeup pump flow path flowrate limits.

The makeup flow is limited to the capacity of one makeup pump when Thermal Power is at or below a specified level in Mode 1; DCA Part 2, Tier 2, Section 15.4.6.2 indicates this is when Thermal Power is at or below 50% RTP. In a public meeting teleconference with NuScale on September 14, 2018, the staff asked NuScale whether the value of this minimum power level for operation of two makeup pumps should be stated either in the LCO or Bases, in addition to DCA Part 2, Tier 2, and the COLR. The applicant asserted its view that the minimum thermal power level for operation of two makeup pumps at full capacity is appropriately maintained in the COLR, which LCO 3.1.9 refers to by stating “flowrate [shall be] within the limits specified in the COLR.” The staff concurs with this approach provided the flowrate limits, as stated in DCA Part 2, Tier 2, Section 15.4.6.2, are maintained consistent with the limits specified in the COLR.

With regard to the maximum CVCS makeup pump demineralized water flow path flowrate, the LCO should state that the “flowrate ~~is~~ shall be within the limits specified in the COLR,” which is appropriate for an LCO statement, and consistent with the other two LCO statements about CVCS DWSI valve operability and boric acid storage tank boron concentration limits. **The staff is tracking this correction as an open item under RAI 512-9634 (ML18333A021**), Question 16-60, Subquestion 31.

DCA Part 2, Tier 2, Section 15.4.6.3.4, “Input Parameters and Initial Conditions,” states: “A minimum makeup temperature of 40 degrees F [40°F (~4.4°C)] is assumed for the analysis of boron dilution of the RCS during Modes 1 through 3.” As this temperature assumption is not explicitly surveilled or specified by LCO 3.1.9, the staff requested in RAI 512-9634 (ML18333A021), Question 16-60, Subquestion 31, that the applicant include the rationale for omitting this makeup water minimum temperature limit from LCO 3.1.9 both in the Applicable Safety Analyses section of Subsection B 3.1.9, and in DCA Part 2, Tier 2, Section 15.4.6.3.4. That rationale may be stated as follows: Because there is a reasonable expectation of ambient temperatures always exceeding 40°F (~4.4°C) in the vicinity of the demineralized water storage tank, the injection of water with a temperature of < 40°F (~4.4°C) into the RCS with the unit in Mode 1, 2, or 3 is precluded. **The staff is tracking the incorporation of this rationale into the Bases for Subsection 3.1.9 and into DCA Part 2, Tier 2, Section 15.4.6.3.4, as a part of the open item under RAI 512-9634 (ML18333A021), Question 16-60, Subquestion 31**.

- LCO 3.3.1, “Module Protection System Instrumentation”

There is one CVCS-CIS manual override switch, O-1, per ESFAS Logic and Actuation division. This non-safety spring return switch, which must be preceded by manual operation of the non-safety enable switch, is used in a beyond DBE involving a containment bypass leak of radioactivity. In a public meeting teleconference on March 14, 2018, the applicant stated that it would clarify the Bases of Subsection 3.3.1 to discuss O-1 in a supplemental response to RAI 196-9050, Question 16-18, Subquestion d. In Revision 2 of DCA Part 4, on page B 3.3.1-17, the applicant subsequently included the following discussion:

> Containment System Isolation Override, O-1
>
> The containment system isolation override, O-1, is established when the manual override switch (one for each division) in the main control room is in the override position for the respective ESFAS division and the RT-1

> permissive is established. The O-1 override allows for manual control of the CVCS RCS injection and pressurizer spray containment isolation valves and the containment flood and drain containment isolation valves, from the module control system with an active automatic containment system isolation or automatic CVCS isolation signal present. The override does not affect the CVCS containment isolation valves closure signal when the isolation signal is generated on High Pressurizer Level. The O-1 override switch must be manually taken out of override when the override O-1 is no longer needed. The override is automatically removed if the RT-1 permissive is removed.

The staff finds that the above passage adequately describes the override O-1 switch. Therefore, RAI 196-9050, Question 16-18, Subquestion d, is resolved and closed.

- LCO 3.4.10, "RCS Low Temperature Overpressure Protection (LTOP) Valves"

This subsection specifies that each RVV that is in the closed position shall be operable, but does not state the implied requirement that all three RVVs shall be closed and operable for LTOP. Three RVVs are required, since two RVVs are necessary to perform the overpressure prevention function; the third RVV accounts for the assumed worst case single active failure of an RVV to open on an LTOP actuation signal. This leads to a rather unconventional construction of the associated Actions. The staff considers a clearer presentation would be for the LCO to explicitly require three RVVs to be closed and operable for LTOP or at least two RVVs be open. Then the LCO, Applicability, and Actions could be written as shown in the markup of Specification 3.4.10, as proposed in Revision 2 of DCA Part 4, in Figure 16.4.5-1.

In RAI 506-9614 (ML18289A751), Question 16-53, Subquestion B, the staff requested that the applicant consider revising Subsection 3.4.10 consistent with the clarifications presented in Figure 16.4.5-1. In its response (ML18347A619), the applicant declined to revise the LCO, Applicability, and Actions as suggested, and stated:

> NuScale technical specifications are developed in close coordination and consultation with the operating staff. Experience with the technical specifications in simulator operations and in support of DCA development has not identified the need for a modified presentation of this LCO.
>
> The staff observation of the LCO as 'unconventional' is accurate, however it is appropriate for the NuScale design. The proposed presentation would reduce clarity and introduce unnecessary complexity to the specifications. Therefore the current construction of the LCO is being retained.

Based on the response, the staff accepts that the suggested clarifications are not needed to ensure the LTOP function of the RVVs is operable when wide range RCS cold temperature is below the T-1 interlock setting. Therefore, Specification 3.4.10 operability and action requirements, and associated Bases, are acceptable, and Subquestion B of RAI 506-9614, Question 16-53, is resolved and closed.

LCO 3.4.10 Three reactor vent valves (RVVs) shall be closed and OPERABLE for LTOP, or two RVVs shall be open each with an OPERABLE vent flow path to the containment vessel. ~~Each closed reactor vent valve (RVV) shall be OPERABLE.~~

APPLICABILITY: MODE 3 with wide range RCS cold temperature ~~below~~ ≤ T-1 interlock, the LTOP enable temperature specified in the PTLR.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ~~--------------NOTE----------~~ ~~Not applicable with two RVVs open.~~ ~~--------------------------------~~ One closed RVV inoperable.	A.1 Restore affected RVV to OPERABLE status. OR A.2.1 Depressurize the RCS. AND A.2.2 Open the affected ~~inoperable~~ RVV.	72 hours 72 hours 72 hours
B. Two closed RVVs inoperable.	B.1 Restore one affected RRV ~~two closed RVVs~~ to OPERABLE status. OR B.2.1 Depressurize the RCS. AND B.2.2 Open two RVVs.	4 hours 4 hours 4 hours
C. Required Action and associated Completion time of Condition A or B not met. OR Three closed RVVs inoperable.	C.1 Cease all activity with a potential for increasing RCS pressure above the LTOP valve actuation setpoint. AND C.2~~1~~ Initiate action to depressurize the RCS. AND C.3~~2~~ Initiate action to open two RVVs.	Immediately Immediately ~~2 hours~~ Immediately ~~2 hours~~

Figure 16.4.5-1

Conclusion for Chapter 3 LCO Statements

The staff will complete the review of the LCO statements following resolution of the identified open items.

16.4.6 Applicability Statements (Chapter 3, Sections 3.1 through 3.8)

The applicability statements of LCOs for SSCs, process parameters, and other operational restrictions must be sufficiently broad to ensure the safety-related function, initial condition, or other restriction specified by the LCO protects the validity of the transient and accident analyses, thereby ensuring safe operation of the reactor facility and adequate protection of the public health and safety.

The operational Mode definitions in GTS Section 1.1, Table 1.1-1 reflect the unique characteristics of the design and operation of an NPM. The Mode definitions therefore differ from the Mode definitions used in the STS. The equivalence of STS and GTS Mode definitions are described in Section 3.1 of Revision 1 of the RCDR, which states the following:

> The MODE definitions applicable to PWRs were determined consistent with the NuScale design and operation. Individual NPMs use a comparatively small reactor that depends on natural circulation for flow in the reactor, NPMs are passively cooled in postulated accident conditions, and the design includes relocation of NPMs to perform refueling operations. Therefore, NuScale developed a new MODE structure that more appropriately addresses the NuScale operations paradigm.

For most GTS LCOs, the applicability statement includes one or more of Mode 1, Mode 2, and some part or all of Mode 3. The GTS definition of Mode 1 (Operations) encompasses the W-AP1000-STS definitions of Mode 1 (Power Operation) and Mode 2 (Startup). The GTS Mode 1 is defined by the core reactivity condition ($k_{eff} \geq 0.99$) and reactor coolant temperature indication (all temperature indications ≥ 420°F (~216°C)); W-AP1000-STS definitions of Modes 1 and 2 use the same core reactivity condition ($k_{eff} \geq 0.99$), but use core Thermal Power as a percent of Rated Thermal Power (% RTP) (> 5% RTP for Mode 1 and ≤ 5% RTP for Mode 2) instead of reactor coolant temperature indication. Because the minimum reactor coolant system temperature for criticality (MTC) specified by GTS LCO 3.4.2 is also 420°F (~216°C), the GTS Mode 1 definition is seen to be equivalent to the W-AP1000-STS Mode 1 and Mode 2 definitions combined. The broader RCS temperature range for the NuScale Mode 1 definition reflects the need to use the module heating system of the CVCS to reach the MTC and then core Thermal Power to reach RCS normal operating temperatures (beginning around 15% RTP) because core flow is by natural circulation. An AP1000 unit achieves MTC, which is RCS average temperature near RCS normal operating temperature, by adding heat with forced core flow from running RCPs. Defining GTS Mode 1 in this way results in GTS applicability and action statements that appear different, but which are generally no more or less restrictive than equivalent requirements in the W-AP1000-STS for Modes 1 and 2.

The GTS definition of Mode 2 (Hot Shutdown) is equivalent to the W-AP1000-STS definition of Mode 3 (Hot Standby). The GTS Mode 2 is defined by the core reactivity condition ($k_{eff} < 0.99$) and reactor coolant temperature indication (any temperature indication ≥ 420°F (~216°C)); the W-AP1000-STS definition of Mode 3 uses the same core reactivity condition ($k_{eff} < 0.99$), and a similar reactor coolant temperature indication (reactor coolant average temperature > 420°F (~216°C)). Defining GTS Mode 2 in this way results in GTS applicability and action statements that appear different, but which are generally no more or less restrictive than equivalent requirements in the W-AP1000-STS for Mode 3.

The GTS definition of Mode 3 (Safe Shutdown) encompasses the W-AP1000-STS definitions of Mode 4 (Safe Shutdown) and Mode 5 (Cold Shutdown). The GTS Mode 3 is defined by the core reactivity condition (k_{eff} < 0.99) and reactor coolant temperature indication (all temperature indications < 420°F) (~216°C)); the W-AP1000-STS definition of Mode 4 uses the same core reactivity condition (k_{eff} < 0.99), and a part of the reactor coolant temperature indication range (reactor coolant average temperature ≤ 420°F (~216°C) but > 200°F (~93.3°C)); the W-AP1000-STS definition of Mode 5 also uses the same core reactivity condition (k_{eff} < 0.99), but the lower part of the reactor coolant temperature indication range (reactor coolant average temperature ≤ 200°F (~93.3°C)). Defining GTS Mode 3 in this way results in GTS applicability and action statements that appear different, but which are generally no more or less restrictive than equivalent requirements in the W-AP1000-STS for Modes 4 and 5.

In Revision 2 of DCA Part 4, regarding the GTS definition of Mode 3 in Table 1.1-1, in addition to meeting the reactor coolant temperature condition (all indications < 420°F (~93.3°C)) and the core reactivity condition (k_{eff} < 0.99), being in Mode 3 also includes meeting one or more of three conditions, as specified by table footnote (a):

> (a) Any CRA capable of withdrawal, any CVCS or CFDS connection to the module not isolated.

To enter Mode 4 (Transition) from Mode 3, the unit must satisfy all of the following conditions: (1) k_{eff} < 0.95; (2) all CRAs are incapable of withdrawal; (3) all CVCS module connections are isolated; (4) all CFDS module connections are isolated; and (5) all RVVs are electrically isolated. The latter four conditions are specified by table footnote (b):

> (b) All CRAs incapable of withdrawal, [all] CVCS and CFDS connections to the module isolated, and all reactor vent valves electrically isolated.

The GTS definition of Mode 4, although equivalent to the portion of the W-AP1000-STS definition of Mode 5 in which the RCS is filled, but vented to the containment, is unique to NuScale design because during Mode 4, the unit staff can move the NPM to the refueling pool. Also, the core reactivity condition in Mode 4 is more limiting, with k_{eff} < 0.95 instead of k_{eff} < 0.99.

The GTS definition of Mode 5 (Refueling) is equivalent to the W-AP1000-STS definition of Mode 6 (Refueling) during which the reactor vessel closure head is removed to permit movement of irradiated fuel assemblies in the reactor vessel, the refueling pool, and the spent fuel pool.

In addition to the reactivity condition and reactor coolant temperature indication, GTS applicability statements are further defined in relation to the active or not active status of RTS and ESFAS Operating Bypass interlocks and permissives. These interlocks and permissive Functions use sensor signals of NPM process variables and open or closed status of valves and circuit breakers, and the functional status of the CRA drive mechanisms. Typically, there are four sensor channels for each process variable. When at least 2-out-of-4 channels send an enable signal to the coincidence logic in each of the two actuation logic divisions, each division of the interlock Function outputs a signal in the same division to the actuation logic of the RTS and ESFAS Functions that use the interlock signal. Interlock bypass signals typically require three out of four sensor channels indicating the RTS or ESFAS Function is no longer needed to be operable in order to bypass the Function. Depending on how an RTS or ESFAS Function is designed to use the interlock or permissive signal, the signal will: (1) cause the Function to be automatically bypassed or allow it to be manually bypassed, or (2) cause the Function to be automatically unbypassed or enabled. Because the process variable instrument channels that are used for MPS Functions are also used for interlock and permissive Functions, Section 3.3 does not explicitly state duplicate operability requirements for process variable instrument channels that also generate interlock and permissive signals. Thus an MPS Function's applicability statement Mode requirements, which are modified by whether a relevant process variable is above or below the trip setting of the associated interlock, implicitly requires the interlock to automatically bypass, or automatically permit the manual bypassing of, the associated RTS or ESFAS Function when the Function is not needed to be operable and to automatically unbypass or enable the Function when it is needed to be operable.

Applicability statements are specified using the Modes defined in Table 1.1-1 and interlock definitions, which are based on the values of the following listed variables, and the status of the following listed SSCs. This list only describes LCO applicability statements that modify the range of a defined MODE, or include other specified conditions. The list also shows that the LCO applicabilities of instrumentation and actuation logic Functions are consistent with or bound the LCO applicabilities of the supported actuated devices.

1) <u>Core reactivity condition</u>

   a) In MODE 1 with $k_{eff} < 1.0$, the SDM requirements of LCO 3.1.1 are applicable.

   b) In MODE 1 with $k_{eff} \geq 1.0$, the regulating group CRA insertion limits of LCO 3.1.6 are applicable.

2) <u>Core power level</u>

   a) In MODE 1 with THERMAL POWER ≥ 25% RTP, the following LCOs are applicable:

      3.2.1 Enthalpy Rise Hot Channel Factor
      3.2.2 AXIAL OFFSET

   b) <u>N-2H – Power Range Linear Power Interlock</u>

      N-2H is active or established if
      at least 3 of 4 power range channels indicate < 15% RTP.

      N-2H is not active or established if
      at least 2 of 4 power range channels indicate ≥ 15% RTP.

      When active, N-2H automatically bypasses the following MPS Functions of LCO 3.3.1 in MODE 1 with THERMAL POWER < 15% RTP:

      2.a RTS on High Power Range Positive and Negative Rate
      2.b DWSI on High Power Range Positive and Negative Rate
      18.a RTS on Low Main Steam Pressure
      18.b DHRS on Low Main Steam Pressure
      18.c PHT on Low Main Steam Pressure
      18.d DWSI on Low Main Steam Pressure

When not active, N-2H automatically enables the above MPS Functions of LCO 3.3.1 in MODE 1 with THERMAL POWER ≥ 15% RTP.

Regardless of whether the N-2H Interlock is active, in MODE 1:

(1) The operability of the two divisions of the RTS Logic and Actuation Function of LCO 3.3.2 is required. Note that this includes each RTB.

(2) The operability of the two divisions of the following ESFAS Logic and Actuation Functions of LCO 3.3.3 is required:

1 DHRS
4 DWSI
6 PHT -- Note that this includes each PHT breaker.

(3) The operability of the two divisions of the following Manual Actuation Functions of LCO 3.3.4 is required:

1 RTS
3 DHRS
5 DWSI
7 PHT

(4) The operability of the two CVCS demineralized water isolation valves is required by LCO 3.1.9.

(5) The operability of the two DHRS trains is required by LCO 3.5.2.

(6) The operability of the two MSIVs and two MSIV bypass valves per steam line is required by LCO 3.7.1 (supports DHRS actuation).

(7) The operability of the one FWIV and the one FWRV for each steam generator is required by LCO 3.7.2 (supports DHRS actuation).

c) N-2L – Power Range Linear Power Interlock

N-2L Interlock is active or established if
at least 3 of 4 power range channels indicate > 15% RTP.

N-2L Interlock is not active or established if
at least 2 of 4 power range channels indicate ≤ 15% RTP.

When active, N-2L Interlock automatically bypasses the following MPS Functions of LCO 3.3.1 in MODE 1 with THERMAL POWER > 15% RTP:

3.a RTS on High Intermediate Range Log Power Rate
3.b DWSI on High Intermediate Range Log Power Rate

When not active, N-2L Interlock automatically enables the above MPS Functions of LCO 3.3.1 in MODE 1 with THERMAL POWER ≤ 15% RTP.

Regardless of whether the N-2L Interlock is active, in MODE 1:

(1) The operability of the two divisions of the RTS Logic and Actuation Function of LCO 3.3.2 is required. Note that this includes each RTB.

(2) The operability of the two divisions of the following ESFAS Logic and Actuation Function of LCO 3.3.3 is required:

4 DWSI

(3) The operability of the two divisions of the following Manual Actuation Functions of LCO 3.3.4 is required:

1 RTS
5 DWSI

(4) The operability of the two CVCS demineralized water isolation valves is required by LCO 3.1.9.

d) <u>N-2L – Power Range Linear Power Permissive</u>

N-2L Permissive is active or established if at least 3 of 4 power range channels indicate > 15% RTP.

N-2L Permissive is not active or established if at least 2 of 4 power range channels indicate ≤ 15% RTP.

When active, N-2L Permissive allows manual bypass of the following MPS Functions of LCO 3.3.1 in MODE 1 with THERMAL POWER > 15% RTP:

1.a	RTS	on High-1 Power Range Linear Power
1.b	DWSI	on High-1 Power Range Linear Power

When not active, N-2L Permissive automatically enables the above MPS Functions of LCO 3.3.1 in MODE 1 with THERMAL POWER ≤ 15% RTP.

e) <u>N-1 – Intermediate Range Log Power Permissive and Interlock</u>

N-1 Permissive and Interlock are active or established if at least 3 of 4 intermediate range log power channels indicate > 1E5 cps.

N-1 Permissive and Interlock are not active or established if at least 2 of 4 intermediate range log power channels indicate ≤ 1E5 cps.

When active, N-1 Permissive allows manual bypass of the following MPS Functions of LCO 3.3.1 in MODE 1 with intermediate range log power > 1E5 cps:

4.a	RTS	on High Source Range Count Rate
4.b	DWSI	on High Source Range Count Rate
5.a	RTS	on High Source Range Log Power Rate
5.b	DWSI	on High Source Range Log Power Rate

When active, N-1 Interlock automatically bypasses the following MPS Function of LCO 3.3.1 in MODE 1 with intermediate range log power > 1E5 cps:

6.a DWSI on High Source Range Subcritical Multiplication

When not active, N-1 Permissive and Interlock automatically enable the above MPS Functions of LCO 3.3.1 in MODE 1 with intermediate range log power ≤ 1E5 cps.

Regardless of whether the N-2L and N-1 Interlocks and Permissives are active, in MODE 1:

(1) The operability of the two divisions of the RTS Logic and Actuation Function of LCO 3.3.2 is required. Note that this includes each RTB.

(2) The operability of the two divisions of the following ESFAS Logic and Actuation Function of LCO 3.3.3 is required:

4 DWSI

(3) The operability of the two divisions of the following Manual Actuation Functions of LCO 3.3.4 is required:

1 RTS
5 DWSI

(4) The operability of the two CVCS demineralized water isolation valves is required by LCO 3.1.9.

3) <u>RTB position</u>

a) <u>RT-1 – Reactor Tripped Permissive</u>

RT-1 is active or established if
two of the two divisional RTBs indicate open.

RT-1 is not active or established if
one or two of the two divisional RTBs indicate closed.

The RT-1 Permissive is used in conjunction with the T-2, F-1, and L-1 interlocks, and the override function O-1, in LCO applicability statements described below.

4) <u>Containment vessel water level</u>

a) <u>L-1 – Containment Water Level Interlock</u>

L-1 is active or established if
at least 3 of 4 containment water level channels indicate > 45 ft
and RT-1 is also active (two divisional RTBs indicate open).

L-1 is not active or established if
at least 2 of 4 containment water level channels indicate ≤ 45 ft
or RT-1 is not active (one or two divisional RTBs indicate closed).

The L-1 interlock is used in conjunction with the T-1 (325°F), T-2 (200°F) and T-3 (350°F) interlocks, in LCO applicability statements described below.

5) RCS flow

a) F-1 – RCS Flow Interlock

F-1 is active or established if
at least 3 of 4 RCS flow channels indicate ≤ low low RCS flow setpoint
(≤ 0.0 cubic feet per second (ft^3/sec))
for > specified time period
and RT-1 is also active (two divisional RTBs indicate open).

F-1 is not active or established if
at least 2 of 4 RCS flow channels indicate > low low RCS flow setpoint
(≤ 0.0 ft^3/sec)
or RT-1 is not active (one or two divisional RTBs indicate *closed*).

When active, F-1 automatically bypasses the following MPS Function of LCO 3.3.1 in MODE 3, to allow using the CVCS and module heatup system to establish RCS flow and to heat up the RCS during reactor startup.

15.b CVCSI on Low Low RCS Flow

When not active, F-1 automatically enables the above MPS Function of LCO 3.3.1.

Regardless of whether the F-1 Interlock is active in MODE 3, the normally open CVCS CIVs (inboard and outboard, respectively) on the injection line (CVC-331 and CVC-329), the discharge line (CVC-334 and CVC-336), and pressurizer spray line (CVC-325 and CVC-323) are required to be operable by LCO 3.4.6 in MODE 3, and by LCO 3.6.2 in MODE 3 with RCS hot temperature ≥ 200ºF.

6) Reactor coolant temperature (200°F, 325°F, 350°F, 420°F, and 600°F),

a) MODE 3 with any RCS temperature ≥ 200°F, the lower MTC limit of LCO 3.1.3 is applicable.

b) MODE 3 with RCS hot temperature ≥ 200°F and all ECCS valves closed, the following LCOs are applicable:

3.4.5 RCS Operational LEAKAGE
3.4.7 RCS Leakage Detection Instrumentation (except during containment flooding operations)

c) MODE 3 with RCS hot temperature ≥ 200°F, the following LCOs are applicable:

3.6.1 Containment
3.6.2 Containment Isolation Valves

d) T-2 – Wide Range RCS Hot Temperature Interlock

T-2 is active or established if
at least 3 of 4 wide range RCS hot temperature channels indicate < 200°F
provided 2 of 4 containment water level channels are ≤ 45 ft (L-1 not active)
or both divisional RTBs are open (RT-1 active).

T-2 is not active or established if
at least 2 of 4 wide range RCS hot temperature channels indicate ≥ 200°F
provided 3 of 4 containment water level channels are > 45 ft (L-1 active) or at least one divisional RTB is closed (RT-1 not active), or both.

When active, T-2 Interlock automatically bypasses the following MPS Functions of LCO 3.3.1 in MODE 3 with wide range RCS hot temperature < 200°F:

12.a	DHRS	on Low Low Pressurizer Level
12.b	CIS	on Low Low Pressurizer Level
12.c	CVCSI	on Low Low Pressurizer Level

and the operability of the two divisions of the following ESFAS Logic and Actuation Function of LCO 3.3.3 is not required in MODE 3 with T-2 active (Table 3.3.3-1 Note (b) implies all RCS temperatures < 200°F)

3 CIS

and the operability of the two divisions of the following Manual Actuation Function of LCO 3.3.4 is not required in MODE 3 with T-2 active (Table 3.3.4-1 Note (c) implies all RCS temperatures < 200°F):

4 CIS

When not active, T-2 Interlock automatically enables the above MPS Functions of LCO 3.3.1 in MODE 3 with wide range RCS hot temperature ≥ 200°F,

and with any RCS temperature ≥ 200°F, Function 3 of LCO 3.3.3 and Function 4 of LCO 3.3.4 are required to be operable.

e) T-1 – Wide Range RCS Cold Temperature Interlock

T-1 is active or established if
3 of 4 WR RCS cold temperature channels indicate > LTOP enable temperature specified in the PTLR (approximately 325°F)

T-1 is not active or established if
2 of 4 WR RCS cold temperature channels indicate ≤ LTOP enable temperature specified in the PTLR (approximately 325°F)

When active, T-1 interlock automatically bypasses the following MPS Function of LCO 3.3.1 in MODE 3 with WR RCS cold temperature > approximately 325°F *or more than one RVV open*:

24.a LTOP on High RCS Pressure

and the operability of the two divisions of the following ESFAS Logic and Actuation Function of LCO 3.3.3 is not required in MODE 3 with T-1 active *or more than one RVV open*:

7 LTOP

and the operability of the two divisions of the following Manual Actuation Function of LCO 3.3.4 is not required in MODE 3 with T-1 active *or more than one RVV open*:

8 LTOP

but the operability of the two RSVs of LCO 3.4.4 is required in MODE 3 with T-1 active,

and the operability of at least two closed RVVs of LCO 3.4.10 is not required in MODE 3 with T-1 active.

When not active, T-1 Interlock automatically enables the above MPS Function 24.a of LCO 3.3.1 in MODE 3 with WR RCS cold temperature ≤ approximately 325°F, and more than one RVV closed (LTOP RVV lift setting, in terms of wide range pressurizer pressure, is a function of wide range RCS cold temperature),

and in MODE 3 with WR RCS cold temperature below approximately 325°F *and more than one RVV closed*, Function 7 of LCO 3.3.3 and Function 8 of LCO 3.3.4 are required to be operable,

but the operability of the two RSVs of LCO 3.4.4 is not required in MODE 3 with T-1 not active,

and the operability of three closed RVVs of LCO 3.4.10 is required in MODE 3 with T-1 not active.

f) T-3 – WR RCS Hot Temperature Interlock

T-3 is active or established if
3 of 4 WR RCS hot temperature channels indicate < 350°F.

T-3 is not active or established if
2 of 4 WR RCS hot temperature channels indicate ≥ 350°F.

When active, T-3 interlock automatically bypasses the following MPS Functions of LCO 3.3.1 in MODE 3:

9.b DHRS on Low Low Pressurizer Pressure
9.d PHT on Low Low Pressurizer Pressure

if not already bypassed by 3 of 4 channels of containment water level > 45 ft (L-1 active), and

9.c CVCSI on Low Low Pressurizer Pressure
22.c CIS on High Narrow Range Containment Pressure
22.d CVCSI on High Narrow Range Containment Pressure,

(even though 9.b, 9.c, and 9.d are not required to be operable in MODE 3 [9]), and

22.b	DHRS	on High Narrow Range Containment Pressure
23.a	ECCS	on High Containment Water Level

provided the NPM is not Passively Cooled.

When not active, T-3 interlock automatically enables the following MPS Functions of LCO 3.3.1 in MODE 3:

9.b	DHRS	on Low Low Pressurizer Pressure
9.d	PHT	on Low Low Pressurizer Pressure

provided 2 of 4 channels of containment water level are ≤ 45 ft (L-1 not active); and

9.c	CVCSI	on Low Low Pressurizer Pressure
22.c	CIS	on High Narrow Range Containment Pressure
22.d	CVCSI	on High Narrow Range Containment Pressure,

(even though 9.b, 9.c, and 9.d are not required to be operable in MODE 3), and

22.b	DHRS	on High Narrow Range Containment Pressure
23.a	ECCS	on High Containment Water Level

provided the NPM is Passively Cooled (Table 3.3.1-1 Footnote (e) "When not PASSIVELY COOLED," modifies MODE 3 applicability for MPS Functions 22.b and 23.a of LCO 3.3.1.)

g) T-4 – Narrow Range RCS Hot Temperature Interlock

T-4 is active or established if
3 of 4 NR RCS hot temperature channels indicate < 600°F.

T-4 is not active or established if
2 of 4 NR RCS hot temperature channels indicate ≥ 600°F.

When active, T-4 Interlock automatically bypasses the following MPS Functions of LCO 3.3.1 in MODE 1:

8.a	RTS	on Low Pressurizer Pressure
8.b	DHRS	on Low Pressurizer Pressure
8.c	CVCSI	on Low Pressurizer Pressure
8.d	PHT	on Low Pressurizer Pressure

[9] DCA Revision 2, Part 4, pages B 3.3.1-14 and 15 describe the T-3 interlock as automatically bypassing MPS Functions 9.b, 9.c, and 9.d when wide range RCS hot temperature is < 350°F (T-3 interlock); but an RCS hot temperature below 350°F implies the NPM is in MODE 3, which is outside the stated Applicability of these Functions, which is MODES 1 and 2. The Bases rationale for not including MODE 3 seems to be the passage on page B 3.3.1-26: "Four Low Low Pressurizer Pressure DHRS, CVCSI and Pressurizer Heater Trip channels are required to be OPERABLE when operating in MODES 1 and 2. In MODES 3, 4, and 5 the reactor is subcritical." In RAI 512-9634, Question16-60, Subquestion 70, the staff requested that the applicant clarify this rationale. The staff is tracking Subquestion 70 as an open item.

8.e DWSI on Low Pressurizer Pressure

When not active, T-4 Interlock automatically enables the above MPS Functions of LCO 3.3.1 in MODE 1.

7) Status of Passive Cooling. The NPM is Passively Cooled if (a) one or more RVVs are open and one or more RRVs are open; (b) DHRS is in operation; or (c) containment vessel water level is > 45 ft (L-1 active). In MODE 3 with Passive Cooling in operation, the safety function of the ECCS and DHRS is being fulfilled.

a) LCO 3.0.3 is only applicable in MODES 1 and 2, and in MODE 3 when not Passively Cooled.

b) If Passive Cooling is in operation, the operability of the four channels of the following MPS Functions of LCO 3.3.1 is not required in MODE 3:

7.b DHRS on High Pressurizer Pressure
13.b DHRS on High Narrow Range RCS Hot Temperature
17.b DHRS on High Main Steam Pressure
22.b DHRS on High Narrow Range Containment Pressure
23.a ECCS on High Containment Water Level
25.b DHRS on Low AC Voltage to ELVS Battery Chargers

and the operability of the two divisions of the following ESFAS Logic and Actuation Functions of LCO 3.3.3 is not required in MODE 3:

1 ECCS
2 DHRS

and the operability of the two divisions of the following Manual Actuation Functions of LCO 3.3.4 is not required in MODE 3:

2 ECCS
3 DHRS

and the Remote Shutdown Station (RSS) instrumentation of LCO 3.3.5, RSS, is not required to be operable in MODE 3,

and the requirements of LCO 3.4.9, SG Tube Integrity, are not required to be met in MODE 3,

and the requirements of LCO 3.5.1, ECCS, for the two RRVs and the three RVVs to be operable, are not required to be met,

and the requirement of LCO 3.5.2, DHRS, for the two DHRS trains to be operable, is not required to be met,

and the requirement of LCO 3.7.1, for two MSIVs and two MSIV bypass valves in each main steam line to be operable, is not required to be met,

and the requirement of LCO 3.7.2, for one FWIV and one FWRV for each SG to be operable, is not required to be met.

If Passive Cooling is not in operation, the above LCOs are required to be met in MODE 3.

8) Position of pressurizer heater trip (PHT) breakers (open or closed). If pressurizer heater breakers are open, the operability of the four channels of the following MPS Functions is not required in MODES 2 and 3:

7.b	PHT	on High Pressurizer Pressure
11.b	PHT	on Low Pressurizer Level
12.d	PHT	on Low Low Pressurizer Level
13.c	PHT	on High Narrow Range RCS Hot Temperature
17.c	PHT	on High Main Steam Pressure
19.c	PHT	on Low Low Main Steam Pressure (Mode 2 only)
22.e	PHT	on High Narrow Range Containment Pressure
25.e	PHT	on Low AC Voltage to ELVS Battery Chargers (Mode 2 only)
26.e	PHT	on High Under-the-Bioshield Temperature

and provided the pressurizer heater trip breakers are deactivated as well as being open, the operability of the two divisions of the following ESFAS Logic and Actuation Function of LCO 3.3.3 is not required in MODES 2 and 3:

6 PHT

and provided the pressurizer heater trip breakers are deactivated as well as being open, the operability of the two divisions of the following Manual Actuation Function of LCO 3.3.4 is not required in MODES 2 and 3:

7 PHT

9) Status of CRA withdrawal capability (one or more capable; none capable). If no CRA is capable of withdrawal, the operability of the four channels of the following MPS Functions of LCO 3.3.1 is not required in MODES 2 and 3:

1.a	RTS	on High-1 Power Range Linear Power
1.b	DWSI	on High-1 Power Range Linear Power
3.a	RTS	on High Intermediate Range Log Power Rate
3.b	DWSI	on High Intermediate Range Log Power Rate
4.a	RTS	on High Source Range Count Rate
4.b	DWSI	on High Source Range Log Power Rate
5.a	RTS	on High Source Range Count Rate
5.b	DWSI	on High Source Range Log Power Rate
6.a	DWSI	on High Source Range Subcritical multiplication
7.a	RTS	on High Pressurizer Pressure
7.d	DWSI	on High Pressurizer Pressure
9.a	RTS	on Low Low Pressurizer Pressure (Mode 2 only)
9.e	DWSI	on Low Low Pressurizer Pressure (Mode 2 only)
10.a	RTS	on High Pressurizer Level
10.c	DWSI	on High Pressurizer Level
11.a	RTS	on Low Pressurizer Level
11.c	DWSI	on Low Pressurizer Level
15.a	RTS	on Low Low RCS Flow
15.c	DWSI	on Low Low RCS Flow
17.a	RTS	on High Main Steam Pressure (Mode 2 only)
17.d	DWSI	on High Main Steam Pressure (Mode 2 only)
19.a	RTS	on Low Low Main Steam Pressure (Mode 2 only)
19.d	DWSI	on Low Low Main Steam Pressure (Mode 2 only)
22.a	RTS	on High Narrow Range Containment Pressure
22.f	DWSI	on High Narrow Range Containment Pressure
25.a	RTS	on Low AC Voltage to ELVS Battery Chargers
25.d	DWSI	on Low AC Voltage to ELVS Battery Chargers
26.a	RTS	on High Under-the-Bioshield Temperature
26.d	DWSI	on High Under-the-Bioshield Temperature

and the operability of the two divisions of the RTS Logic and Actuation Function of LCO 3.3.2 is not required in MODES 2 and 3;

and the operability of the two divisions of the following Manual Actuation Function of LCO 3.3.4 is not required in MODES 2 and 3:

1 RTS

but the operability of the two CVCS demineralized water isolation valves is required by LCO 3.1.9 in MODES 2 and 3, regardless of CRA capability, because MPS Function 14.a, DWSI on Low RCS Flow, is also required in MODES 2 and 3 regardless of CRA capability.

If one or more CRAs are capable of being withdrawn, the above LCOs are required to be met in the specified MODES.

The staff compared the ASA and Applicability sections of the Bases of each LCO subsection to check that each SSC credited by a PA, IE, or AOO is required to be operable for the safety analysis assumed range of operational modes or other specified conditions in which the analyzed event could occur and require mitigation by RTS and ESF systems.

The staff verified that the limiting applicability of each MPS instrumentation Function spans the applicability of all associated RTS and ESFAS Logic and Actuation Functions. Although the applicability of an MPS Function may span a smaller range of unit operational conditions for one associated RPS or ESFAS Function, the Actuation Function with the broadest applicability determines the limiting applicability for the MPS instrumentation Function.

The staff verified that the applicability of each LCO required support system bounds the LCO applicability of all of its LCO required supported systems.

Conclusion for Chapter 3 LCO Applicability Statements

The staff will complete the review of applicability statements following resolution of the identified open items.

16.4.7 Action Requirements (Chapter 3, Sections 3.1 through 3.8)

The staff reviewed the Actions table for each LCO Subsection to determine whether the action requirements (Actions) are appropriate for the safety significance of each Condition of not meeting the associated LCO.

For each LCO requiring operability of redundant trains of a safety system, the staff verified that the Actions table includes: (1) a Condition for one train inoperable (loss of redundancy) with a Required Action (or, in some cases, an implied Required Action) to restore the affected train to operable status within an appropriate associated Completion Time and (2) a Condition for failure to meet the Required Action and associated Completion Time with Required Actions to place the unit in a Mode in which meeting the LCO is not required. An Actions table of an LCO for a safety system may also include alternative Required Actions, which if completed, would allow unit operation to continue indefinitely in a loss of redundancy Condition. The staff assessed such Required Actions for whether they provide an equivalent level of safety to that provided by meeting the LCO. An Actions table of an LCO for a safety system may also include a Condition for both redundant trains being inoperable (loss of function); in such cases, the staff verified that the Completion Times of the Required Actions for unit shutdown are consistent with the times allowed for unit shutdown by LCO 3.0.3.

For each LCO that requires staying within limits specified for a unit process variable, such as SDM, core reactivity, moderator temperature coefficient, CRA position alignment deviation, core power distribution, RCS pressure and temperatures, pressurizer level, UHS water level and bulk average temperature, and UHS boron concentration, the staff verified that the Actions table includes: (1) an appropriate Condition for each variable outside its specified limits, with a Required Action to restore the variable to within limits within an appropriate associated Completion Time and (2) a Condition for failure to meet the Required Action and associated Completion Time with Required Actions to place the unit in a Mode in which meeting the LCO is not required.

It is possible that some LCO Subsections have an Actions table with Conditions and Required Actions for a unit status not captured by the kinds of LCOs described above. It is also possible that some LCO Subsections include Surveillances for which it is unclear how meeting the Surveillance supports meeting the LCO. In such cases, the Actions table may need to include a Condition for when the Surveillance is not met. Some LCOs specify that a particular subsystem or component be in operation, or in a standby configuration, in addition to being operable; such an LCO Subsection may have an Actions table with a Condition addressing when the subsystem or component is not in operation with appropriate Required Actions to restore operation, or other measures to compensate for the out-of-operation system or component, including a unit shutdown.

The staff also reviewed the Actions table of each LCO to ascertain consistency with the use and application rules of Sections 1.2, 1.3, and 3.0.

16.4.7.1 Conditions for a loss of redundancy

The staff reviewed the Chapter 3 Actions Conditions, in Revision 2 of DCA Part 4, that involve a loss of protection from a single active failure (i.e., a loss of system functional redundancy). In most instances, 72 hours are allowed to restore redundancy, which is consistent with STS. These Conditions (and the Completion Time to restore redundancy or to complete another remedial action) are as follows:

•	LCO 3.1.7	Condition A.	One [rod position indication (RPI)] per [control rod drive mechanism (CRDM)] inoperable for one or more CRDMs. (Verify affected CRA position with MCS once per 8 hours)
•	LCO 3.1.9	Condition A.	One CVCS demineralized water isolation valve inoperable. (72 hours)
•	LCO 3.3.1	Condition A.	One or more Functions with one channel inoperable. (6 hours to place channel in trip or bypass)
		Condition B.	One or more Functions with two channels inoperable. (6 hours to place one channel in trip and other channel in bypass)
•	LCO 3.3.2	Condition A.	One reactor trip breaker (RTB) inoperable. (48 hours to open or restore RTB)
		Condition B.	One division of RTS logic and actuation inoperable. (6 hours)
•	LCO 3.3.3	Condition A.	*One* or more divisions of the LTOP Logic and Actuation Function inoperable. (Open two RVVs within 1 hour.)
		Condition B.	One division of required ESFAS function in Table 3.3.3-1 inoperable other than LTOP function. (Enter Condition listed for affected Function within 6 hours.)
	ECCS, DHRS	Condition C(1)	As required by Required Action B.1 and referenced in Table 3.3.3-1. (Be in Mode 2 in 6 hours; Mode 3 and Passively Cooled within 36 hours)

CIS	Condition D(1)	As required by Required Action B.1 and referenced in Table 3.3.3-1. (Be in Mode 2 in 6 hours; Mode 3 below T-2 interlock (< 200°F) within 48 hours)
DWSI	Condition E(1)	As required by Required Action B.1 and referenced in Table 3.3.3-1. (Isolate the flow path from the demineralized water storage tank to the RCS within 1 hour.)
CVCSI	Condition F(1)	As required by Required Action B.1 and referenced in Table 3.3.3-1. (Isolate CVCS charging and letdown flow paths to the RCS within 1 hour.)
PHT	Condition G(1)	As required by Required Action B.1 and referenced in Table 3.3.3-1. (De-energize Pressurizer Heaters within 6 hours.)

- LCO 3.3.4 Condition A. One or more Functions with one manual division inoperable. (48 hours)

RTS	Condition C	As required by Required Action A.1 or B.1 and referenced in Table 3.3.4-1. (Immediately open RTBs.)
ECCS, DHRS	Condition D	As required by Required Action A.1 or B.1 and referenced in Table 3.3.4-1. (Be in Mode 2 within 24 hours; be in Mode 3 and Passively Cooled within 72 hours.)
DWSI	Condition E	As required by Required Action A.1 or B.1 and referenced in Table 3.3.4-1. (Isolate the flow path from the demineralized water storage tank to the RCS within 1 hour.)
CVCSI	Condition F	As required by Required Action A.1 or B.1 and referenced in Table 3.3.4-1. (Isolate the flow paths from the CVCS to the RCS within 1 hour.)
PHT	Condition G	As required by Required Action A.1 or B.1 and referenced in Table 3.3.4-1. (De-energize affected pressurizer heaters within 24 hours.)
LTOP	Condition H	As required by Required Action A.1 or B.1 and referenced in Table 3.3.4-1. (Immediately open two RVVs.)
CIS	Condition I	As required by Required Action A.1 or B.1 and referenced in Table 3.3.4-1. (Be in MODE 2 within 6 hours and in MODE 3 with RCS temperature below the T-2 interlock within 48 hours.)

The staff notes that the Actions for one inoperable division are the same as the Actions for two inoperable divisions, except that entry into the referenced Condition for the affected Manual Actuation Function is required within 48 hours instead of 6 hours. In addition, compared to the Required Action Completion Times of LCO 3.3.3, the corresponding Completion Times for the Manual Actuation Functions are significantly longer. The staff requested that the applicant explain the rationale for the time differences to achieve similar shutdown conditions in Mode 3 for Containment Isolation and Manual Actuation Functions compared to the other automatic RTS and ESFAS Functions, in RAI 157-9033 (ML17220A108), Question 16-7. SER Section 16.4.4.1, "LCO Use and Applicability," under the discussion of LCO 3.0.3, gives the staff's evaluation of the applicant's response (ML17257A450) to RAI 157-9033, Question 16-7. Further, SER Section 16.4.7.6, "Shutdown Required Actions and Completion Times," provides additional discussion about relaxing shutdown action Completion Times for specified systems of lesser safety significance. These SER sections provide the staff's rationale for finding the applicant's response acceptable, and concluding that the shutdown action Completion Times are acceptable. Therefore, RAI 157-9033, Question 16-7 is resolved and closed.

- LCO 3.4.4 Condition A. One [reactor safety valve (RSV)] inoperable. (72 hours)
- LCO 3.4.6 Condition A. One or more CVCS flow paths with one CVCS valve inoperable. (72 hours)
- LCO 3.4.7 Condition A. One or more required leakage detection instrumentation methods with one required channel inoperable. (14 days)

  Condition B. One required leakage detection instrumentation method with all required channels inoperable. (72 hours)
- LCO 3.4.10 Condition A. One closed RVV inoperable. (72 hours)
- LCO 3.5.1 Condition A. One RVV inoperable. (72 hours)

  Condition B. One RRV inoperable. (72 hours)
- LCO 3.5.2 Condition A. One DHRS train inoperable. (72 hours)
- LCO 3.6.2 Condition A. *One* or more penetration flow paths with one containment isolation valve inoperable. (72 hours)
- LCO 3.7.1 Condition A. *One* or more required MSIV valves inoperable. (72 hours to isolate MS line or restore MSIV) (Actions table Note 1, "Separate Condition entry is allowed for each inoperable valve.")

  LCO 3.7.1 Condition B. *One* or more required MSIV bypass valves inoperable. (72 hours to isolate MS bypass line or restore MSIV bypass valve) (Actions table Note 1, "Separate Condition entry is allowed for each inoperable valve.")

In RAI 506-9614 (ML18289A751), Question 16-52, the staff requested that the applicant consider editorial and presentation improvements to Subsection 3.7.1 Actions A, B, and

C, to resolve ambiguities about separate condition entry and what constitutes a main steam flow path. In its response (ML18347A619) to RAI 506-9614, Question 16-52, the applicant revised the Actions of Subsection 3.7.1 to more clearly reflect the NuScale design and assure that the LCO requirements are consistent with the main steam system description in DCA Part 2, Tier 2, the credited function, and the writer's guide. The response clarified that each of the two main steam lines contains a safety-related isolation valve and isolation bypass valve in parallel upstream of the module steam line disconnect, and a nonsafety-related isolation valve and isolation bypass valve in parallel downstream of the module steam line disconnect. Each valve is considered to be in its own flowpath. Isolation of a main steam line requires closure of at least one of the two pairs of isolation valves in the steam line. Conditions A and B are combined into new Condition A which is changed to state:

Condition A. ------------------------NOTE--------------------
Separate Condition entry is allowed for each inoperable valve.

One or more required valves inoperable.

The Actions table Note 1 is moved to Condition A; Note 2 ("Main steam line flow path(s) may be unisolated intermittently under administrative controls.") remains with its enumeration removed. Although contrary to the writer's guide, by keeping the adjective "required" and removing the designators "main steam isolation" and "MSIV bypass," the meaning of the revised Condition A is clear and therefore acceptable.

Condition C is renamed Condition B, and is changed to state:

Condition B. Steam line that cannot be isolated.

The staff finds that only allowing separate Condition entry for new Condition A is appropriate, since new Condition B and relabeled Condition C would require a unit shutdown if one valve in each pair of valves in a steam line cannot be isolated automatically, and the associated, affected flow paths cannot be isolated. The staff concludes that proposed Conditions A and B are acceptable because they adequately account for (1) having up to all eight steam line isolation valves inoperable, and (2) an inability to isolate a valve in each pair of valves on one or both steam lines.

The staff reviewed the applicant's proposed changes to the Background, LCO, Applicability, and Actions sections of Subsection B 3.7.1, and found they are consistent with the revised Actions table. Based on its review of the response, the staff finds that the Condition A and Condition B aspect of RAI 506-9614, Question 16-52, is resolved; **the staff is tracking the associated changes to Subsections 3.7.1 and B 3.7.1 as a confirmatory item.**

- LCO 3.7.2 Condition A. *One* or two FWIVs inoperable. (72 hours to isolate FWIV flow path or restore FWIV.)
  (Actions table Note 1, "Separate Condition entry is allowed for each inoperable valve.")

  Condition B. *One* or two FWRVs inoperable. (72 hours to isolate FWRV flow path or restore FWRV.)

(Actions table Note 1, “Separate Condition entry is allowed for each inoperable valve.”)

The staff finds that the restoration actions and remedial actions, and the associated Completion Times for the loss of redundancy Conditions are appropriate for the NuScale design, provide an adequate level of safety during operation within each Condition, and are consistent with STS. Therefore, the staff concludes that these Actions are acceptable.

16.4.7.2 Conditions for when a Required Action and associated Completion Time are not met

The staff reviewed the Chapter 3 Actions Conditions, in Revision 2 of DCA Part 4, that require a unit shutdown from MODE 1 above 25-percent RTP (25% RTP) whenever a Required Action for another entered Condition of the LCO Subsection is not met within the associated Completion Time. In a few instances, the initially entered Condition specifies an Action to exit the applicability (e.g., LCO 3.1.4 Required Action A.2). Table 16.4.7-1 summarizes the default Required Actions and Completion Times, in Revision 2 of DCA Part 4, to facilitate comparison of times to reach different RCS temperatures in Mode 3 based on the affected systems, parameter limits, and instrumentation functions, and their relative importance to safety.

As indicated in the heading of the last column of Table 3.4.7-1, the various Required Actions to isolate the demineralized water source to the CVCS makeup pumps are phrased in a variety of ways; these Actions are LCO 3.1.9 Action B, LCO 3.3.1 Actions F, H, and M, LCO 3.3.3 Actions E and F, and LCO 3.3.4 Actions E and F. In RAI 512-9634 (ML18333A021), Question 16-60, regarding editorial comments, in Subquestions 37.1 and 37.2, the staff suggested that the applicant consider phrasing these Required Actions more consistently, since they all intend to accomplish the same objective, which is precluding the CVCS system from injecting demineralized water into the RCS. In its response to RAI 512-9634, Question 16-60, Subquestions 37.1 (ML19010A409) and 37.2 (ML19010A409), the applicant proposed modifications to Subsection 3.3.1 Required Actions F.1, H.1 and M.4 to be phrased consistently with the Required Actions of Subsections 3.1.9, 3.3.3, and 3.3.4, as indicated by the following markup (Shaded text denotes additional recommended clarifications by the staff.):

LCO 3.1.9 Required Action B.1

-----------------------------NOTE------------------------------
Flow ~~path(s)~~ paths may be unisolated intermittently under administrative controls.

Isolate dilution source flow paths in the CVCS makeup line by use of at least one closed manual or one closed and ~~deactivated~~ de-activated automatic valve. | 1 hour

LCO 3.3.1 Required Action F.1

-----------------------------NOTE-------------------------------
~~CVCS flow path(s)~~ Flow paths may be unisolated intermittently under administrative controls.

Isolate the CVCS flow to the Reactor Coolant System (RCS). | 6 hours

H.1 Isolate dilution source flow paths in the CVCS makeup line by use of at least one closed manual or one closed and de-activated automatic valve. Isolate demineralized water flow path to RCS. | 1 hour

M.4 Isolate dilution source flow paths in the CVCS makeup line by use of at least one closed manual or one closed and de-activated automatic valve. Isolate demineralized water flow path to RCS. | 96 hours

LCO 3.3.3 Required Action E.1 ------------------------------NOTE------------------------------
Flow path(s) paths may be unisolated intermittently under administrative controls.

Isolate the flow path from the demineralized water storage tank to the reactor coolant system Isolate dilution source flow paths in the CVCS makeup line by use of at least one closed manual or one closed and de-activated automatic valve. | 1 hour

Required Action F.1 ------------------------------NOTE------------------------------
Flow path(s) paths may be unisolated intermittently under administrative controls.

Isolate the CVCS charging and letdown flow paths from the CVCS to the Reactor Coolant System by use of at least one closed manual or one closed and de-activated automatic valve. | 1 hour

LCO 3.3.4 Required Action E.1 ------------------------------NOTE------------------------------
Flow path(s) paths may be unisolated intermittently under administrative controls.

Isolate the flow path from the demineralized water storage tank to the Reactor Coolant System Isolate dilution source flow paths in the CVCS makeup line by use of at least one closed manual or one closed and de-activated automatic valve. | 1 hour

Required Action F.1 ------------------------------NOTE------------------------------
Flow path(s) paths may be unisolated intermittently under administrative controls.

Isolate the flow paths from the CVCS to the Reactor Coolant System by use of at least one closed manual or one closed and de-activated automatic valve. | 1 hour

The staff finds the above changes acceptable, provided the additional edits denoted by shading are also incorporated, because these changes achieve the requested phrasing consistency among the listed action statements and associated Notes.

The staff notes that LCO 3.1.9, “Boron Dilution Control,” Action B, requires isolating the dilution source, which completes the safety function of the DWSI makeup isolation valves. It appears that the Applicability of LCO 3.1.9 would be more accurate by stating: “MODES 1, 2, and 3 <u>with any CVCS demineralized water isolation valve open</u>.” **The staff is tracking the resolution of this Applicability suggestion, as well as the above suggested edits, as an editorial open item under RAI 512-9634, Question 16-60, Subquestions 37.1 and 37.2**.

Table 16.4.7-1
Default Shutdown Action Completion Times

LCO ACTION	Be in Mode 1 below 25% RTP	Be in Mode 1 below 15% RTP	Be in Mode 1 with k_{eff} < 1.0	Open all RTBs *Open PHT breakers	Be in Mode 2 *Open 2 RVVs	Be in Mode 3 & Passively Cooled *Be in Mode 3	Be in Mode 3 with T_{hot} < 200°F *with T_{cold} < 325°F (< T-1)	Be in Mode 3 with **all** RCS temps < 200°F	Be in Mode 3 with T_{hot} < 200°F (< T-2)	Be in Mode 3 with CNV level > L-1 (> 45 ft)	Isolate (1) CVCS DI water makeup. (2) CVCS flow to RCS. (3) DI water flow path to RCS.
LCO 3.0.3					7 hours	37 hours					
3.1.2 Action B					6 hours						
3.1.3 Action B					6 hours			48 hours			
3.1.4 Action A					6 hours						
3.1.5 Action B					6 hours						
3.1.6 Action B			6 hours								
3.1.7 Action E					6 hours						
3.1.9 Action B											(1) 1 hour
3.2.1 Action A	6 hours										
3.2.2 Action A	6 hours										
3.3.1 Actions C&**D** for RTS Functions 1a, 3a, 4a, 5a, 7a, 8a, 9a, 10a, 11a, 13a, 15a, 17a, 19a, 20a, 21a, 22a				6 hours							
3.3.1 Actions C&**D** for DHRS Functions 8b, 20b, 21b,				6 hours							
3.3.1 Actions C&**E** for RTS Functions 2a, 18a		6 hours (<N-2**L**)									
3.3.1 Actions C&**E** for DHRS Function 18b		6 hours (<N-2**L**)									
3.3.1 Actions C&**E** for PHT Function 18c		6 hours (<N-2**L**)									
3.3.1 Actions C&**F** for CVCSI Functions 8c, 9c, 10b, 12c, 15b, 22d											(2) 6 hours
3.3.1 Actions C&**G** for PHT Functions 7c, 8d, 9d, 11b, 12d, 13c, 17c, 19c, 20c, 21c, 22e				* 6 hours							

LCO ACTION	Be in Mode 1 below 25% RTP	Be in Mode 1 below 15% RTP	Be in Mode 1 with k_{eff} < 1.0	Open all RTBs *Open PHT breakers	Be in Mode 2 *Open 2 RVVs	Be in Mode 3 & Passively Cooled *Be in Mode 3	Be in Mode 3 with T_{hot} < 200°F *with T_{cold} < 325°F (< T-1)	Be in Mode 3 with **all** RCS temps < 200°F	Be in Mode 3 with T_{hot} < 200°F (< T-2)	Be in Mode 3 with CNV level > L-1 (> 45 ft)	Isolate (1) CVCS DI water makeup. (2) CVCS flow to RCS. (3) DI water flow path to RCS.
3.3.1 Actions C&**H** for DWSI Functions 1b, 2b, 3b, 4b, 5b, 6a, 7d, 8e, 9e, 10c, 11c, 13d, 14a, 15c, 17d, 18d, 19d, 20d, 21d, 22f											(3) 1 hour
3.3.1 Actions C&**I** for ECCS Functions *16a*, 23a and DHRS Functions 7b, 9b, 13b, 17b, 22b					6 hours	36 hours					
3.3.1 Actions C&**J** for LTOP Function 24a					* 1 hour						
3.3.1 Actions C&**K** for DHRS Function 19b					6 hours	36 hours					
3.3.1 Actions C&**L** for CIS Function 12b					6 hours				48 hours		
3.3.1 Actions C&**M** for Functions 25a, 26a RTS 25b, 26b DHRS 25c, 26c CIS 25d, 26d DWSI 25e, 26e PHT				*96 hours	72 hours	96 hours			96 hours		M.4 (3) 96 hours
3.3.1 Actions C&**N** (N.2.1 <u>OR</u> N.2.2) for DHRS Function 12a					N.1 6 hours				N.2.1 48 hours	N.2.2 48 hours	
3.3.2 Action C				Imme- diately							
3.3.3 Actions B&**C** for Functions 1. ECCS 2. DHRS					6 hours	36 hours					
3.3.3 Actions B&**D** for Function 3. CIS					6 hours				48 hours		
3.3.3 Actions B&**E** for Function 4. DWSI											(3) 1 hour
3.3.3 Actions B&**F** for Function 5. CVCSI											(2) 1 hour
3.3.3 Actions B&**G** for Function 6. PHT					6 hours Note 1						
3.3.4 Action **C** for Manual Function 1. RTS				Imme- diately							
3.3.4 Action **D** for Manual Functions 2. ECCS 3. DHRS					24 hours	72 hours					
3.3.4 Action **E** for Manual Function 5. DWSI											(3) 1 hour
3.3.4 Action **F** for Manual Function 6. CVCSI											(2) 1 hour

LCO ACTION	Be in Mode 1 below 25% RTP	Be in Mode 1 below 15% RTP	Be in Mode 1 with k_{eff} < 1.0	Open all RTBs *Open PHT breakers	Be in Mode 2 *Open 2 RVVs	Be in Mode 3 & Passively Cooled *Be in Mode 3	Be in Mode 3 with T_{hot} < 200°F *with T_{cold} < 325°F (< T-1)	Be in Mode 3 with **all** RCS temps < 200°F	Be in Mode 3 with T_{hot} < 200°F (< T-2)	Be in Mode 3 with CNV level > L-1 (> 45 ft)	Isolate (1) CVCS DI water makeup. (2) CVCS flow to RCS. (3) DI water flow path to RCS.
3.3.4 Action **G** for Manual Function 7. PHT				*24 hours Note 1							
3.3.4 Action **H** for Manual Function 8. LTOP					* Imme-diately						
3.3.4 Action **I** Manual Function 4. CIS					6 hours				48 hours		
3.3.5 Action B					6 hours	36 hours					
3.4.1 Action C					6 hours						
3.4.2 Action A					30 min						
3.4.3 Action B					6 hours	36 hours Note 2					
3.4.3 Action D					Imme-diately	36 hours Note 3					
3.4.4 Action B					6 hours		* 36 hours Note 4				
3.4.5 Action B					6 hours		48 hours				
3.4.6 Action C					6 hours		48 hours				
3.4.7 Action C					6 hours		48 hours				
3.4.8 Action C					6 hours	36 hours					
3.4.9 Action B					6 hours	36 hours					
3.5.1 Action C					6 hours	36 hours					
3.5.2 Action B					6 hours	36 hours					
3.5.3 Action D					6 hours	36 hours					
3.6.1 Action B					6 hours		48 hours				
3.6.2 Action C					6 hours		48 hours				
3.7.1 Action C					6 hours	36 hours					
3.7.2 Action D					6 hours	36 hours					

Note 1: Required Action G.1 of LCO 3.3.3 and LCO 3.3.4 says "De-energize Pressurizer Heaters." not "Open pressurizer heater trip breakers."

Note 2: Required Action B.2 of LCO 3.4.3 says "Be in MODE 3 with RCS pressure < 500 psia."

Note 3: Required Action D.2 of LCO 3.4.3 says "Be in MODE 3 with RCS temperature less than or equal to the containment flooding RCS temperature limit allowed by the PTLR.

Note 4: Required Action B.2 of LCO 3.4.4 says "Be in MODE 3 with RCS cold temperature below LTOP enable interlock T-1 temperature."

Required Action E.1 of LCO 3.3.1 states "Reduce THERMAL POWER to below the N-2L interlock. | 6 hours"; this Action applies to the following MPS Functions which are applicable in Mode 1 with power above the N-2H interlock according to Footnote (b) of Table 3.3.1-1.

2.a RTS on High Power Range Positive and Negative Rate
18.a RTS on Low Main Steam Pressure
18.b DHRS on Low Main Steam Pressure
18.c PHT on Low Main Steam Pressure

The staff notes that to be consistent, Required Action E.1 should say N-2H instead of N-2L. However, because both interlocks use 15-percent RTP (15% RTP) to switch from active to inactive, this error appears to have no practical impact on the meaning of the action statement.

In RAI 512-9634 (ML18333A021), Question 16-60, Subquestion 37.3, the staff requested that the applicant change N-2L to N-2H. In its response (ML19010A409) to RAI 512-9634, Question 16-60, Subquestion 37.3, the applicant appears to have misunderstood the issue because the response focused on Subsection 3.3.1, Function 1.a, which is not associated with Condition E. Pending a revised response, which corrects or justifies Required Action E.1 for the above listed MPS Functions, **the staff is tracking RAI 512-9634, Question 16-60, Subquestion 37.3, as an editorial open item**.

The staff will complete the review of Actions with Conditions for when a Required Action and associated Completion Time are not met, following resolution of the identified editorial open items.

16.4.7.3 Conditions for a Loss of Function

The staff reviewed the Chapter 3 Actions Conditions, in Revision 2 of DCA Part 4, that involve a loss of function caused by all redundant trains of a system being inoperable, or because fewer than the minimum number of trains needed to perform the system function are operable. In most cases, the associated Required Actions and Completion Times are identical to those listed in SER Table 16.4.7-1, "Default Shutdown Action Completion Times," in SER Section 16.4.7.2. In the following quotations of Condition statements, for statements that address both loss of redundancy and loss of function, italics are used to emphasis the portion of the statement corresponding to a loss of function condition.

A. One or more of a set of nonredundant but identical components inoperable

- LCO 3.1.4 Condition A(1). One or more CRAs inoperable.

- LCO 3.4.9 Condition A. One *or more* SG tubes satisfying the tube plugging criteria and not plugged in accordance with the Steam Generator Program. (Verify tube integrity of the affected tube(s) is maintained until the next refueling outage or SG tube inspection within 7 days, and plug the affected tube(s) in accordance with the Steam Generator Program prior to entering MODE 3 following the next refueling outage or SG tube inspection.)

  Condition B(2). SG tube integrity not maintained. (SER Table 16.4.7-1 gives the associated Required Actions and Completion Times.)

B. Redundant trains of a two train system inoperable, or more than two of four channels inoperable, or two of two divisions inoperable

- LCO 3.1.7 Condition B. More than one RPI per CRDM inoperable.

- LCO 3.1.9 Condition B(2). Two CVCS demineralized water isolation valves inoperable.

- LCO 3.3.1 Condition C(2). One or more Functions with three or more channels inoperable. (Immediately enter Condition referenced in Table 3.3.1-1 for the channel(s). SER Table 16.4.7-1 gives the associated Required Actions and Completion Times.)

- LCO 3.3.2 Condition C(2). Both divisions of RTS logic and actuation inoperable. (Immediately open all RTBs.)

  Condition C(3). More than one RTB inoperable. (Immediately open all RTBs.)

- LCO 3.3.3 Condition A. One or more divisions of the LTOP Logic and Actuation Function inoperable. (Open two RVVs within 1 hour.)

In Condition A with wide range RCS cold temperature below the T-1 interlock (< 325°F) and RCS pressure above the associated saturation pressure, and the pressure difference between the containment vessel and the reactor vessel less than the inadvertent actuation block differential pressure setting, opening two RVVs (which are required to be closed) within 1 hour in accordance with Required Action A.1, would increase containment pressure until the reactor vessel and containment pressures are in equilibrium. In RAI 506-9614 (ML18289A751), Question 16-53, Subquestion A, the staff requested the applicant to: (1) point out where such a transient is discussed in DCA Part 2, Tier 2 (or where it will be added, if it is not described), (2) clarify in the discussion whether such a transient is part of the expected normal operation of the unit in Mode 3 below the T-1 interlock, and (3) explain why opening the RVVs within 1 hour is a prudent action with RCS temperature above the T-2 interlock (> 200°F) but below the T-1 interlock (< 325°F). In its response to Question 16-53, Subquestion A, the applicant stated the following:

1) The LTOP function is described in FSAR section 5.2, and FSAR section 3.9 describes the Service Level B cold overpressure protection transient. LTOP actuation results in opening of a vent path between the reactor coolant system (RCS) inside of the reactor vessel and the containment volume. This is similar to, but at reduced temperatures and pressures compared to the ECCS actuation transients from operating conditions described in [DCA Part 2, Tier 2, FSAR] Chapter 15.

2) An LTOP actuation event is not considered a normal operation - it is a protective system actuation. However the NuScale design includes the availability of PASSIVE COOLING through use of open reactor vent valves (RVV) and reactor recirculation valves (RRV) when conditions permit. This evolution may be manually initiated or otherwise implemented in accordance with operating procedures, and includes the opening of at least two reactor vent valves. Normal operations include de-energization of the reactor module resulting in opening of the RVVs and RRVs when transitioning to a PASSIVELY COOLED configuration before entering MODE 4.

3) The purpose of the LTOP logic and actuation function is to detect and mitigate a low temperature overpressure

> condition. Opening RVVs above the T-2 interlock but below the T-1 interlock establishes a vent path from the reactor vessel to the containment atmosphere ensuring a low temperature overpressure event cannot jeopardize the reactor vessel integrity.

The staff verified that Revision 2 of DCA Part 2, Tier 2, Section 3.9.1.1.2, Service Level B Conditions, describes the cold overpressure protection transient under the heading “Service Level B Transient 11 - Cold Overpressure Protection Transient.” DCA Part 2, Tier 2, Table 3.9-1, Summary of Design Transients, also lists this transient. In addition, Revision 2 of DCA Part 2, Tier 2, Section 5.2.2.2.2 states the following:

> The spurious actuation of the pressurizer heaters is the limiting RCS cold overpressurization event. ... The analysis results indicate the peak pressure remains below the brittle fracture stress limit.

And Revision 2 of DCA Part 2, Tier 2, Section 5.2.2.4.2 states the following:

> The inadvertent actuation block arming setpoint is above the limiting RPV pressure at LTOP conditions and, as such, will not prevent LTOP actuation of the RVVs when LTOP enabling setpoint is reached. ... Three RVVs, associated actuators, and controls ensure LTOP protection is maintained assuming a single active component failure. The RVVs are designed with sufficient pressure relief capacity to accommodate the most limiting single active failure assuming the most limiting allowable operating condition and system configuration.

The staff concludes from the above passages that the automatic opening of two RVVs at the LTOP actuation pressurizer pressure setting (which is a function of RCS cold temperature) will limit RCS peak pressure to below the low temperature pressure limit for the limiting RCS cold overpressurization event. Since the containment vessel is designed to accommodate the pressure transient of this limiting event, manually opening two valves when the automatic actuation capability is inoperable, is acceptable. Therefore, RAI 506-9614 (ML18289A751), Question 16-53, Subquestion A, is resolved and closed.

Note that Question 16-53, Subquestion A, is related to the review of GTS Subsection 3.4.10, and the evaluation of the applicant’s response to RAI 506-9614, Question 16-53, Subquestion B. SER Section 16.4.5 further discusses Subsection 3.4.10.

- LCO 3.3.3

LCO 3.3.3	Condition C(2).	Both divisions of ECCS actuation function inoperable. (Be in Mode 2 in 6 hours; Mode 3 and Passively Cooled within 36 hours)
	Condition C(3).	Both divisions of DHRS actuation function inoperable. (Be in Mode 2 in 6 hours; Mode 3 and Passively Cooled within 36 hours)
	Condition D(2).	Both divisions of Containment Isolation actuation function inoperable. (Be in Mode 2 within 6 hours; Mode 3 below T-2 interlock (< 200°F) within 48 hours)

Condition E(2). Both divisions of Demineralized Water Supply Isolation actuation function inoperable. (Isolate the flow path from the demineralized water storage tank to the RCS within 1 hour.)

Condition F(2). Both divisions of CVCS Isolation actuation function inoperable. (Isolate CVCS charging and letdown flow paths to the RCS within 1 hour.)

Condition G(2). Both divisions of Pressurizer Heater de-energization function inoperable. (De-energize Pressurizer Heaters within 6 hours.)

- LCO 3.3.4 Condition B. One or more Functions with two manual divisions inoperable.

The staff notes that the Actions for two inoperable divisions are the same as the Actions for one inoperable division, except that entry into the referenced Condition for the affected Manual Actuation Function is required within 6 hours instead of 48 hours.

- LCO 3.3.5 Condition A. Instrumentation in the [Remote Shutdown Station (RSS)] inoperable.
- LCO 3.4.4 Condition B(2). Two RSVs inoperable.
- LCO 3.3.5 Condition B. One or more CVCS flow paths with two CVCS valves inoperable.
- LCO 3.4.7 Condition C(2). Two required leakage detection instrumentation methods with all required channels inoperable.
- LCO 3.4.10 Condition B. Two closed RVVs inoperable. (4 hours)

SER Section 16.4.5 discusses the clarity of Subsection 3.4.10 and gives the staff's evaluation of the applicant's response to RAI 506-9614, Question 16-53, Subquestion B.

- LCO 3.5.1 Condition C(2). Two or more RVVs inoperable. (Be in Mode 2 within 6 hours and in Mode 3 and Passively Cooled within 36 hours.)

  Condition C(3). Two RRVs inoperable. (Be in Mode 2 within 6 hours and in Mode 3 and Passively Cooled within 36 hours.)

- LCO 3.5.2 Condition B(2). Both DHRS trains inoperable. (Be in Mode 2 within 6 hours and in Mode 3 and Passively Cooled within 36 hours.)
- LCO 3.6.1 Condition A. Containment inoperable. (Restore containment to OPERABLE status within 1 hour.)

- LCO 3.6.2 Condition B. One or more penetration flow paths with two containment isolation valves inoperable. (Isolate the affected penetration flow path within 1 hour.)

- LCO 3.7.1 Condition A. -------------------------NOTE---------------------
Separate Condition entry is allowed for each inoperable valve.

One or more required valves inoperable. (72 hours to isolate MS line or restore MSIV)

Condition B. Steam line that cannot be isolated.

In its response to RAI 506-9614, Question 16-52, which is discussed further in SER Section 16.4.7.1, the applicant combined Conditions A and B of Revision 2 of DCA Part 4, Subsection 3.7.1. The new Condition A is quoted above. The applicant also revised the DCA Revision 2 version of Condition C, which is relabeled Condition B, and also quoted above.

In RAI 512-9634 (ML18333A021), Question 16-60, Subquestion 34, the staff had requested that the applicant consider removing the word "required" from the DCA Revision 2 version of Conditions A and B, because it appears to be unnecessary. As long as the MSIV and associated MSIV bypass valve in either the inner valve set or outer valve set (or pair), are capable of closing with leakage within the specified limits, the main steam line isolation function to support the actuation of the associated DHRS train remains operable, although there is no capability to withstand a single failure of one of these valves. The staff also requested that the applicant clarify the Note for Condition A (as revised in response to RAI 506-9614, Question 16-52), as indicated: "Separate Condition entry is allowed for each ~~inoperable~~ valve." It is understood that Conditions are entered for inoperable valves, which are required to be operable by the LCO. **The staff is tracking these requests as an editorial open item under RAI 512-9634, Question 16-60, Subquestion 34**.

- LCO 3.7.2 Condition A. One *or two* FWIVs inoperable. (72 hours to isolate FWIV flow path or restore FWIV.) (Note, separate Condition entry allowed for each valve.)

Condition B. One *or two* FWRVs inoperable. (72 hours to isolate FWRV flow path or restore FWRV.) (Note, separate Condition entry allowed for each valve.)

Note that as long as one isolation valve in each FW flow path remains operable for closing, the situation is a loss of redundancy, not a loss of function. SER Section 10.4 provides the staff's evaluation of the suitability of the FWRVs to function as backup FWIVs.

Condition C. Two valves in the same flow path inoperable. (8 hours to isolate affected FW flow path or restore one of the affected valves.)

The staff will complete its evaluation of Conditions for a loss of function following resolution of the open items identified above in this SER section.

16.4.7.4 Actions Notes Allowing Separate Condition Entry

Whenever a system contains two or more identical subsystems, which function independently of each other, and the system's LCO Actions table includes a Note allowing separate Condition entry for each subsystem, the control room operator may track a separate Completion Time for each subsystem, if they are concurrently inoperable. The Actions table Note defines the basis for separate Condition entry. Guidance for applying such an Actions table Note is provided in Section 1.3 by Example 1.3-5.

- LCO 3.1.7 Separate Condition entry is allowed for each inoperable [Control Rod Drive System (CRDS)] rod position indicator (RPI) and each CRA counter position indicator (CPI).
- LCO 3.3.1 Separate Condition entry is allowed for each [MPS instrumentation] Function.
- LCO 3.3.3 Separate Condition entry is allowed for each [ESF Logic and Actuation] Function.
- LCO 3.3.4 Separate Condition entry is allowed for each [RTS and ESF Manual] Function.
- LCO 3.4.6 Separate Condition entry is allowed for each [CVCS] flow path.
- LCO 3.4.7 Separate Condition entry is allowed for each [CES] condensate channel and each [CES] pressure channel.
- LCO 3.4.9 Separate Condition entry is allowed for each SG tube.
- LCO 3.6.2 Separate Condition entry is allowed for each [containment vessel] penetration flow path.
- LCO 3.7.1 (Condition A) Separate Condition entry is allowed for each inoperable [main steam isolation valve (MSIV) and each MSIV bypass] valve.
- LCO 3.7.2 Separate Condition entry is allowed for each inoperable [feedwater isolation valve (FWIV) and each feedwater regulating] valve[(FWRV)].

The staff points out that there is no need to insert the word "inoperable" in the above Actions Notes for LCOs 3.1.7, 3.7.1, and 3.7.2, because it is understood that Conditions are entered for inoperable valves, which are required to be operable by the LCO. **The staff is tracking the removal of "inoperable" from these Actions Notes as an editorial open item under RAI 512-9634, Question 16-60, Subquestion 34**.

The staff finds that the above Actions Notes are appropriate because the basis for each separate Condition entry involves a set of independent components, Functions, valves, flow paths, or channels consistent with the W-STS. Therefore, the staff concludes that these Notes are acceptable, with the noted exception. The staff will complete its evaluation of Actions Notes that allow separate condition entry following resolution of the identified open item.

16.4.7.5 Conditions for Process Variable Outside Limits

When an LCO limit on a process variable is not met, the Actions specify a Completion Time to restore the variable to within limits. Such Actions are provided for the following Conditions (The Completion Time to restore the variable within limits is also provided.); staff suggested clarifying edits are indicated by markup:

- LCO 3.1.1 Condition A. SDM not within limits. (15 minutes)
- LCO 3.1.2 Condition A. Core reactivity balance not within limit. (7 days)
- LCO 3.1.3 Condition A. MTC not within limits. (Be in Mode 2 in 6 hours)

  Condition B. MTC not within lower limit. (Be in MODE 3 with all RCS temperatures < 200°F.)
- LCO 3.1.4 Condition A(2). One or more CRAs not within alignment limits. (1 hour)
- LCO 3.1.5 Condition A. One shutdown ~~Shutdown~~ group with one CRA not within shutdown group insertion limits. (2 hours)

  Pending incorporation of the above suggested change for consistency with Condition A of Subsection 3.1.6, or an appropriate equivalent change, **the staff is tracking Condition A as an editorial open item under RAI 512-9634, Question 16-60**, Subquestions 24.1 and 24.2.
- LCO 3.1.6 Condition A. Regulating group insertion limits not met. (2 hours)
- LCO 3.1.9 Condition B(3). Boric Acid supply concentration not within limits. (Isolate dilution source flow paths in the CVCS makeup line... within 1 hour.)

  Condition B(4). CVCS makeup pump demineralized water flow path not configured to ensure maximum flowrate is within limits. (Isolate dilution source flow paths in the CVCS makeup line... within 1 hour.)
- LCO 3.2.1 Condition A. $F_{\Delta H}$ not within limit. (Reduce THERMAL POWER to < 25% RTP within 6 hours.)
- LCO 3.2.2 Condition A. [AXIAL OFFSET (AO)] not within limits. (Reduce THERMAL POWER to < 25% RTP within 6 hours.)
- LCO 3.4.1 Condition A. RCS pressurizer pressure or RCS cold temperature CHF parameters not within limits. (2 hours)

  Condition B. RCS flow resistance not within limits. (Verify RCS flow rate acceptable for operation within 7 days.)
- LCO 3.4.2 Condition A. One or more RCS temperatures not within [minimum temperature for criticality] limit[of ≥ 420°F]. (Be in Mode 2 within 30 minutes.)

- LCO 3.4.3 Condition A. Requirements of LCO [for PTLR limits on RCS pressure, temperature, and heatup and cooldown rates] not met in MODE 1, 2, or 3. (Restore parameters to within limits in 30 minutes, and determine RCS is acceptable for continued operation within 72 hours.)

  Condition C. Requirements of LCO not met any time in other than MODE 1, 2, or 3. (Immediately initiate action to restore parameters to within limits, and determine RCS is acceptable for continued operation prior to entering MODE 3 [from MODE 4].)

  Condition D. Containment flooding initiated while RCS temperature greater than allowed by PTLR. (Be in MODE 2 immediately; be in MODE 3 below the PTLR RCS temperature limit within 36 hours; and determine RCS is acceptable for continued operation prior to entering MODE 2 from MODE 3.)

  The staff is tracking Action D as an open item under RAI 9642, Question 16-61, because of an outstanding question about whether this provision is the appropriate means of addressing prevention and mitigation of the postulated inadvertent actuation of the CFDS to flood the containment vessel with RCS temperature above the RCS temperature limit in the PTLR.

- LCO 3.4.5 Condition A. RCS operational LEAKAGE not within limits for reasons other than pressure boundary LEAKAGE or primary to secondary LEAKAGE.

  Condition B(2). Pressure boundary LEAKAGE exists.

  Condition B(3). Primary to secondary LEAKAGE not within limit.

  These Conditions and the Required Actions and Completion Times of these Conditions are consistent with the W-STS and the W-AP1000-STS. Therefore the Actions of LCO 3.4.5 are acceptable.

- LCO 3.4.8 Condition A. DOSE EQUIVALENT I-131 > 0.037 μCi/gm.

  Condition B. DOSE EQUIVALENT XE-133 > 10 μCi/gm.

  Condition C. DOSE EQUIVALENT I-131 > 2.2 μCi/gm.

  These Conditions and the Required Actions and Completion Times of these Conditions are consistent with the W-STS and the W-AP1000-STS. Therefore the Actions of LCO 3.4.8 are acceptable. SER Section 16.4.2.4 and SER Section 12.2.4 provide additional discussion of the basis for the LCO 3.4.8 specific activity limits.

- LCO 3.5.3 Condition A. Ultimate Heat Sink Level < 68 ft and > 55 ft. (30 days)

  Condition B. Ultimate Heat Sink Level ≤ 55 ft. (24 hours)

Condition C.	Ultimate Heat Sink bulk average temperature not within limits. (14 days)
Condition E.	Ultimate Heat Sink bulk average boron concentration not within limits. (Immediately initiate action)

The staff will complete its evaluation of Conditions for a process variable outside limits following resolution of the identified open items.

16.4.7.6 Shutdown Required Actions and Completion Times

As previously discussed in the Section 16.4.4 evaluation of GTS LCO 3.0.3 shutdown Completion Times, and the Section 16.4.6 evaluation of GTS Section 1.1 definitions of operational modes, the times allowed by shutdown action requirements to place the unit in Mode 2 and Mode 3 appeared to be inconsistent.

In RAI 157-9033 (ML17220A108), Question 16-7, the staff requested that the applicant justify Completion Times of Required Actions for unit shutdown. In its response (ML17257A450) to RAI 157-9033, regarding Question 16-7, the applicant indicated that GTS Required Action Completion Times are based on consideration of the following:

- the NPM design
- operational processes required to perform the associated evolutions
- operating experience of legacy nuclear power plants
- the relative significance of the affected safety function and the availability of alternative means to compensate for a reduced or lost capability to perform the safety function
- industry standard Completion Times times reflected in STS
- the reliability and capability of remaining (i.e., redundant) operable specified SSCs to perform required safety functions
- the low probability of a DBA occurring with the LCO not met during the specified Required Action Completion Time
- the time needed to perform the Required Action, including reaching the prescribed plant conditions, collect data, complete evaluations, and perform surveillances
- the urgency of exiting the emergent plant conditions

In general, the NuScale GTS Conditions and associated Required Actions and Completion Times are comparable to the action requirements in STS. In particular, LCO 3.0.3 specifies a 1-hour period to begin initiating action for placing the unit in Mode 2 within 7 hours, and in Mode 3 and Passively Cooled within 37 hours of entry into LCO 3.0.3. Individual LCO Actions tables specify similar shutdown requirements but without the 1 hour period. The standard Completion Times are 6 hours to Mode 2, and 36 hours to Mode 3 and Passively Cooled. Longer times are provided for systems such as Manual Actuation Functions of LCO 3.3.4. Also, a longer time of 48 hours is specified to reach the final state in Mode 3 for inoperable containment isolation instrumentation, logic and actuation, and CIVs, because RCS temperature must be taken below the Wide Range RCS Hot Temperature Interlock, T-2, which is active below 200°F. In contrast, the standard end state in Mode 3 with Passive Cooling in operation may be reached at a much higher RCS temperature, with the DHRS in operation.

In RAI 157-9033 (ML17220A108), Question 16-7, the staff requested that the applicant justify the proposed shutdown sequence Completion Times of LCO 3.0.3. In its response (ML17257A450), the applicant modified the Bases for LCO 3.0.3 by adding a paragraph describing the reasons the shutdown sequence Completion Times are appropriate. The staff finds the response acceptable, as described in SER Section 16.4.4.1, which discusses the resolution of RAI 157-9033, Question 16-7.

Based on its review and the explanation and additional justification provided by the applicant in its response, the staff concludes that the Completion Times for the shutdown actions in the GTS are appropriate, consistent with the STS, and therefore acceptable. The staff confirmed that Revision 2 of DCA Part 4 incorporated the proposed change to the Bases for LCO 3.0.3. As previously stated in Section 16.4.4.1 of this SER, RAI 157-9033, Question 16-7, is resolved and closed.

16.4.7.7 Conclusion for Action Requirements

The staff will complete the review of action requirements following resolution of the above identified open items.

16.4.8 Surveillance Requirements (Chapter 3, Sections 3.1 through 3.8)

The staff reviewed the SRs specified for each LCO Subsection to verify they satisfy 10 CFR 50.36(c)(3), which states that SRs "are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within the safety limits, and that the limiting conditions for operation will be met." For each LCO on an SSC or parameter, the associated SRs verify the capability of the SSC to perform its specified safety function, or that the parameter is within specified limits. The staff also reviewed each surveillance frequency to verify test or performance intervals are consistent with both the reliability and availability assumed in the NuScale design's probabilistic risk assessment (PRA). The choice of an SR frequency for an SSC should also take into consideration past precedents, and the operating and test history for similar TS-required SSCs, and recommendations of the SSC's manufacturer. The staff reviewed the basis for each SR frequency provided in the Bases of each Chapter 3 LCO Subsection. DCA Part 2, Section 16.1, in Table 16.1-1, provides the Bases for the initial or base Frequency of each SR for which the Frequency is specified to be governed by Subsection 5.5.11, "Surveillance Frequency Control Program." Table 16.4.8-1 below lists Surveillances with Frequencies governed not by the SFCP, but according to the Inservice Testing Program (ISTP), the Containment Leakage Rate Testing Program (CLRTP), or the Steam Generator Program (SGP), or by an event-driven surveillance performance requirement.

16.4.8.1 Surveillance Statements

The staff verified that the SRs of each LCO are adequate to ensure the LCO is being met. The proposed surveillances are phrased[10] in a manner consistent with the phrasing of equivalent kinds of STS SRs involving SSC performance tests, inspections, and status checks and verification that the unit is operating within the specified limits of selected process variables. Surveillances that are unique to the NuScale design are quoted below (surveillance frequency is indicated in parenthesis) (Text markup denotes staff suggested editorial clarifications to Revision 2 of DCA Part 4, or in some cases, to draft Revision 3.):

- SR 3.1.9.1 Verify that CVCS makeup pump demineralized water flow path is configured to ensure that ~~it~~ the maximum demineralized water flowrate remains within the limits specified in the COLR. (SFCP/31 days)

  In RAI 512-9634 (ML18333A021), Question 16-60, Subquestion 33, the staff requested that the applicant clarify SR 3.1.9.1, as indicated by the above markup. In its initial partial response (ML19010A409) to RAI 512-9634, Question 16-60, regarding Subquestion 33, the applicant incorporated the requested change into SR 3.1.9.1. Therefore, **the staff concludes that RAI 512-9634, Question 16-60, Subquestion 33, is resolved and is tracking it as a confirmatory item.**

  SR 3.1.9.4 Verify each CVCS makeup pump maximum flowrate is ≤ 25 gpm. (SFCP/24 months)

  These surveillances verify that, when Thermal Power is below the limit specified in the COLR, the two makeup pumps are aligned so that just one pump can supply the RCS through the CVCS injection line to satisfy initial conditions of the inadvertent RCS boron dilution event analysis.

- SR 3.4.1.3 Verify RCS flow resistance is within the limits specified in the COLR. (Once prior to exceeding 75% RTP after each refueling)

  This surveillance verifies that the flow resistance of the reactor coolant flow paths inside the reactor vessel is still within limits following operation in Mode 5 with module disassembly for refueling and subsequent reassembly. The 12-hour surveillance to verify RCS flow is above a lower limit, which is specified in the TS of PWRs using forced circulation, is not appropriate for the NuScale design because reactor coolant flow is by natural circulation, which is caused by coolant density differences across the core and the steam generator tubes and is a function of core Thermal Power (reactor coolant mass flow rate is proportional to the cube root of core Thermal Power).

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[10] In this list of SRs, material is added to define acronyms in the quoted passage. Lined out text indicates material that the staff recommends for removal; underlined text indicates material that the staff recommends for addition. Text in bold face indicates apparent inconsistencies. The staff is tracking the disposition of these items as an editorial open item under RAI 512-9634 (ML18333A021), Question 16-60, unless stated otherwise.

- SR 3.3.1.5 Perform CHANNEL CALIBRATION on each required Class 1E isolation device. (SFCP/24 months)

Instrumentation Subsections 3.3.1, 3.3.2, and 3.3.3 include this Surveillance to ensure that the MPS is protected from an electrical fault in the nonsafety-related electrical power system by isolating the MPS on overcurrent or undervoltage. **The staff is tracking the inclusion of a similar SR in Subsection 3.3.4 as part of the open item under RAI 197-9051 (ML17237C008), Question 16-28**. SER Section 16.4.8.5 discusses RAI 197-9051, Question 16-28.

- SR 3.3.2.1 Perform ACTUATION LOGIC TEST. (SFCP/24 months)

The definition of this Surveillance in Section 1.1 differs from the W-AP1000-STS definition of Actuation Logic Test. SER Sections 16.4.2.2 and 16.4.8.4 provide additional discussion of this definition.

- SR 3.3.2.3 Perform CHANNEL CALIBRATION on each required Class 1E isolation device. (SFCP/24 months)
- SR 3.3.3.1 Perform ACTUATION LOGIC TEST. (SFCP/24 months)
- SR 3.3.3.3 Perform CHANNEL CALIBRATION on each required Class 1E isolation device. (SFCP/24 months)
- SR 3.3.3.4 Verify each pressurizer heater trip breaker ~~(PHTB)~~ actuates to the open position on an actual or simulated actuation signal. (SFCP/24 months)

This Surveillance verifies that the PHT breakers will open if the MPS detects reactor conditions that could lead to uncovery of the heaters. The PHT ESFAS Function is designed to protect the pressurizer heaters from uncovering, overheating, and potentially compromising the RCS pressure boundary. SER Section 16.4.1, Table 16.4.1-3, “ESFAS Logic and Actuation Functions,” lists the MPS Functions that initiate a PHT.

- SR 3.3.4.1 Perform actuation device operational test. (SFCP/24 months)

This Surveillance exercises manual switches that actuate the two divisions of RTBs, and ESF-actuated valves and PHT breakers. It is equivalent to the manual actuation testing part of the TADOT included in W-AP000-STS; but NuScale GTS do not include this defined term. SER Section 16.4.2.4 provides the staff’s reasoning for finding that omitting the W-STS TADOT definition from the GTS is acceptable.

- SR 3.3.5.2 Verify that the [Remote Shutdown Station (RSS)] communicates indication with each required function of the Module Control System and Plant Control System. (SFCP/24 months)

This Surveillance reflects the NuScale design in which only flat panel displays of selected process variables and system status are required to be operable to monitor the safe shutdown condition of each NPM, defined as Mode 3 with Passive Cooling established. In the event of control room evacuation, operators would first shutdown all NPMs and actuate passive core cooling systems, which will establish and maintain the modules in safe shutdown conditions.

- SR 3.4.6.1 Verify ~~required valves~~ accumulator pressure~~s are~~ of each automatic CVCS valve is within limits. (SFCP/12 hours)

  This Surveillance ensures that valves necessary to initiate the ESF Function of CVCSI have sufficient accumulator pressure to actuate to the required position. The staff is tracking the suggested edits as a part of the open item under RAI 506-9614, Question 16-54, which is described below under SR 3.7.1.1.

- SR 3.4.10.3 Verify the inadvertent actuation block function for each RVV is OPERABLE. (SFCP/24 months)

  The staff is tracking the 24-month Frequency under RAI 512-9634, Question 16-60, Subquestion 1, as a confirmatory item pending verification that DCA Part 2, Tier 2, Table 16.1-1, has been updated to include this Frequency.

  SR 3.4.10.4 Verify the inadvertent actuation block setpoint is within limits for each RVV. (ISTP)

  These Surveillances ensure that the mechanical block of the RVVs to open will not prevent opening of these three valves on a high RCS pressure LTOP signal in Mode 3 below the T-1 interlock.

- SR 3.5.1.3 Verify the inadvertent actuation block function of each RVV and RRV is OPERABLE. (SFCP/24 months)

  SR 3.5.1.4 Verify the inadvertent actuation block setpoint is within limits for each RVV and RRV. (ISTP)

  These Surveillances ensure that the mechanical block of the three RVVs and two RRVs will prevent opening of these five valves upon an ECCS ESFAS signal until the pressure difference between the RCS and the CNV is below the specified setting. This block also prevents inadvertent ECCS actuation in Modes 1, 2, and 3.

- SR 3.5.2.1 Verify ~~required valves~~ accumulator pressure~~s are~~ of each DHRS actuation valve is within limits. (SFCP/12 hours)

  This Surveillance ensures that valves necessary to initiate the ESF Function of DHRS have sufficient accumulator pressure to actuate to the required position. The staff is tracking the suggested edits as a part of the open item under RAI 506-9614, Question 16-54, which is described below under SR 3.7.1.1.

- SR 3.5.2.2 Verify DHRS loops are filled. (SFCP/24 hours)

- SR 3.5.3.3 Verify Ultimate Heat Sink bulk average boron concentration is within limits. (SFCP/31 days)

  This Surveillance reflects the multiple Functions of the NuScale reactor pool; besides serving as the UHS for the decay heat of the NPMs following shutdown, the reactor pool also provides reactivity control during refueling.

- SR 3.6.2.1 Verify ~~required valves~~ accumulator pressure~~s are~~ of each automatic containment isolation valve is within limits. (SFCP/12 hours)

  This Surveillance ensures that valves necessary to initiate the ESF Function of CIS have sufficient accumulator pressure to actuate to the required position. The staff is tracking the suggested edits as a part of the open item under RAI 506-9614, Question 16-54, which is described below under SR 3.7.1.1.

- SR 3.6.2.5 Verify the combined leakage rate for all containment bypass leakage paths is ≤ 0.6 L_a when pressurized to ≥ 951 psia. (CLRTP)

  This Surveillance in lieu of conducting an integrated containment leak rate test, which FSAR Section 6.2.6.1 describes and explains, while FSAR Section 6.2.6.2 describes containment penetration leakage rate testing and FSAR Section 6.2.6.3 describes CIV leakage rate testing. SER Section 6.2 describes the evaluation of the NuScale CNV leak rate testing. The staff could not determine: (1) why this surveillance statement does not identify the pressure criterion of 951 psia as the calculated peak containment internal pressure (P_a), and (2) how this SR relates to SR 3.6.1.1 ("Perform required visual examinations and leakage rate testing in accordance with the Containment Leakage Rate Testing Program.")

  In RAI 506-9614 (ML18289A751), Question 16-55, the staff requested that the applicant clarify the above items in the Bases for SR 3.6.1.1 and SR 3.6.2.5. The staff also requested that the applicant confirm the pressure value of 951 psia against the most up to date value. In its response (ML18347A619) to Question 16-55, the applicant stated, "Surveillance Requirement 3.6.2.5 has been deleted from the proposed generic Technical Specifications as duplicative of the requirements of technical specification 5.5.9, Containment Leakage Rate Testing Program." **Based on the removal of SR 3.6.2.5, which clarified the Bases for SR 3.6.1.1, RAI 506-9614, Question 16-55 is resolved confirmatory. This confirmatory item includes updating the P_a pressure value of 951 psia, which is stated in the ASA section of Subsection B 3.6.1.**

- SR 3.7.1.1 Verify ~~required valves~~ the accumulator pressure of each applicable MSIV and MSIV bypass valve is ~~pressures are~~ within limits. (SFCP/12 hours)

  In Revision 2 of DCA Part 2, Tier 2, the Section 10.3.2.2 description of the secondary MSIV and MSIBV provide no details about the design of the valve actuator. Whether the secondary MSIVs and secondary MSIBVs have hydraulic operators to stay open and nitrogen gas accumulators to close; or whether they are air operated, is a needed Bases clarification. In RAI 506-9614 (ML18289A751), Question 16-54, the staff requested that the applicant revise Subsection B 3.7.1 to describe the type of valve operator provided for each secondary MS line isolation valve (MSIV and MSIBV), and which SR applies to these valves, since it appears that SR 3.7.1.1 does not apply. The staff also requested that the applicant revise SR 3.7.1.1 as indicated above.

  In its response (ML18347A619) to RAI 506-9614, Question 16-54, the applicant stated it had determined that the existing SRs are more appropriate for the NuScale design. It asserted that the existing phrasing would allow the SR to apply to secondary isolation valves in the main steam and feedwater flow paths which have actuators that use pressurized accumulators with an unspecified type of gas, and not just to the safety-related valves that use nitrogen gas accumulators to move to the safety actuated position. The staff agrees with this assertion. However, the staff insists that the Surveillance should not contain the word “required” because all eight steam isolation valves are required to be operable by LCO 3.7.1, and the SR only applies to valves with pressurized gas accumulators. The applicant’s assertion that including this word conforms to writer’s guide Section 4.1.3 is incorrect. In addition, to be more consistent with SR 3.7.1.2 and SR 3.7.1.3, this Surveillance should say “Verify accumulator pressure of *each* MSIV and MSIV bypass valve is within limits” or just “Verify accumulator pressure of *each* valve is within limits.” **Pending resolution of the phrasing of SR 3.7.1.1, the staff is tracking RAI 506-9614, Question 16-54, as an open item**.

- SR 3.7.2.1 Verify ~~required~~ the ~~FWIV~~ accumulator pressure of each FWIV is ~~pressures are~~ within limits. (SFCP/12 hours)

  SR 3.7.1.1 and SR 3.7.2.2 ensure that MSIVs and FWIVs, which are necessary to initiate the ESF Functions of CIS and DHRS, have sufficient accumulator pressure to actuate to the required position. The staff suggested changes, as indicated above, are based on the fact that only a subset of the automatic isolation valves required to be operable by LCO 3.7.1 and LCO 3.7.2 have nitrogen accumulator actuators for closing. The Surveillance should not contain the word “required” because both FWIVs are required to be operable by LCO 3.7.2, and the SR only applies to valves with pressurized gas accumulators. As noted above, the applicant’s assertion, in the response to Question 16-54, that including “required” conforms to writer’s guide Section 4.1.3 is incorrect. In addition, to be more consistent with SR 3.7.2.2 and SR 3.7.2.3, this Surveillance should say “Verify accumulator pressure of each FWIV is within limits” or just “Verify accumulator pressure of each valve is within limits.” The staff is tracking the resolution of the phrasing of SR 3.7.2.1 as a part of the open item under RAI 506-9614, Question 16-54, which is described above under SR 3.7.1.1.

The staff will complete the evaluation of Surveillance statements after the resolution of the identified open items.

16.4.8.2 Surveillance Frequencies Not Governed by the Surveillance Frequency Control Program

The staff reviewed the Surveillances with a performance Frequency that is contingent on (1) having exceeded a specified Thermal Power level; (2) not having exceeded a specified Thermal Power level; (3) having exceeded a specified fuel expenditure expressed as a number of effective full power days (EFPD**s**); (4) not having exceeded a specified number of EFPD**s**; (5) having entered a specified Mode or other specified condition; (6) not having entered a specified Mode or other specified condition; (7) having completed a specified task; (8) not having completed a specified task; (9) a specified event having occurred; (10) a specified event not having occurred; or (11) a specified time interval having elapsed or not elapsed. In addition, there are Surveillances governed by other requirements, such as the Steam Generator Program and the Inservice Testing Program. These Frequencies are stated below in Table 16.4.8-1 and may not be changed in accordance with the SFCP.

Table 16.4.8-1[11]

SURVEILLANCE		FREQUENCY
SR 3.1.2.1	Verify overall core reactivity balance is within ±1% Δk/k of predicted values.	Once prior to exceeding 5% RTP after each **refueling** AND -------------------------NOTE----------------------- Only required after 60 EFPDs**.** --- In accordance with the SFCP
SR 3.1.3.1	Verify moderator temperature coefficient (MTC) is within the upper limit.	Once prior to exceeding 5% RTP after each **fuel loading**
SR 3.1.3.2	Verify MTC is within the lower limit.	Once within 7 EFPD**s** after reaching 40 EFPD**s** fuel burnup from beginning of cycle (BOC) AND Once within 7 EFPD**s** after reaching 2/3 fuel burnup from BOC AND -------------------------NOTE----------------------- Only required when projected end of cycle MTC is not within limit**.** --- 7 EFPD**s** thereafter
SR 3.1.4.3	Verify each control rod assembly (CRA) drop time is ≤ 2.2 seconds.	Prior to **reactor criticality** after each removal of the upper reactor pressure vessel section
SR 3.1.7.1	Verify each rod position indicator (RPI) agrees within 6 steps of the group demand position for the full indicated range of CRA travel.	Prior to **criticality** after coupling ~~of one or more~~ a CRA to the associated control rod drive mechanism (CRDM) for one or more CRAs
SR 3.2.1.1	Verify Enthalpy Rise Hot Channel Factor ($F_{\Delta H}$) is within the limits specified in the COLR.	Once after each **refueling** prior to THERMAL POWER exceeding 25% RTP AND In accordance with the SFCP

[11] In this table, material is added to define acronyms in the quoted passage. Lined out text indicates material that the staff recommends for removal; underlined text indicates material that the staff recommends for addition. Text in bold face indicates text with apparent inconsistencies. The staff is tracking disposition of these items as an open item under RAI 512-9634 (ML18333A021), Question 16-60. The quoted requirements are based on Revision 2 of DCA Part 4.

	SURVEILLANCE	FREQUENCY
SR 3.4.1.3	-------------------NOTE-------------------- Not required to be performed until 96 hours after exceeding 50% RTP. -- Verify RCS flow resistance is within the limits specified in the COLR.	Once prior to exceeding 75% RTP after each **refueling**
SR 3.4.4.1	Verify each reactor safety valve (RSV) is OPERABLE in accordance with the INSERVICE TESTING PROGRAM. Following testing, lift settings shall be within 1% of the nominal setpoints of 2075 psia and 2100 psia as shown below: Valve 1 Setpoint: ≥ 2055 psia and ≤ 2095 psia. Valve 2 Setpoint: ≥ 2079 psia and ≤ 2121 psia.	In accordance with the INSERVICE TESTING PROGRAM
SR 3.4.6.2	Verify the isolation time of each automatic power operated CVCS valve is within limits.	In accordance with the INSERVICE TESTING PROGRAM
SR 3.4.9.1	Verify steam generator (SG) tube integrity in accordance with the Steam Generator Program.	In accordance with the Steam Generator Program
SR 3.4.9.2	Verify that each inspected SG tube that satisfies the tube plugging criteria is plugged in accordance with the Steam Generator Program.	Prior to entering MODE 3 following a SG tube inspection
SR 3.4.10.2	Verify the open actuation time of each reactor vent valve (RVV) is within limits.	In accordance with the INSERVICE TESTING PROGRAM
SR 3.4.10.4	Verify the inadvertent actuation block setpoint is within limits for each RVV.	In accordance with the INSERVICE TESTING PROGRAM
SR 3.5.1.2	Verify the open actuation time of each RVV and reactor recirculation valve (RRV) is within limits.	In accordance with the INSERVICE TESTING PROGRAM
SR 3.5.1.4	Verify the inadvertent actuation block setpoint is within limits for each RVV and RRV.	In accordance with the INSERVICE TESTING PROGRAM

SURVEILLANCE		FREQUENCY
SR 3.5.2.4	Verify the open actuation time of each DHRS actuation valve is within limits.	In accordance with the INSERVICE TESTING PROGRAM
SR 3.6.2.3	Verify the isolation time of each automatic containment isolation valve is within limits ~~except for valves that are open under administrative controls~~.	In accordance with the INSERVICE TESTING PROGRAM
~~SR 3.6.2.5~~	~~Verify the combined leakage rate for all containment bypass leakage paths is ≤ 0.6 L_a when pressurized to ≥ 951 psia.~~	~~In accordance with the Containment Leakage Rate Testing Program~~ This SR was deleted in response (ML18347A619) to RAI 506-9614 (ML18289A751), Question 16-55. See SER Section 16.4.8.1.
SR 3.7.1.2	Verify isolation time of each MSIV and MSIV bypass valve is within limits on an actual or simulated actuation signal.	In accordance with the INSERVICE TESTING PROGRAM
SR 3.7.1.3	Verify each MSIV and MSIV bypass valve leakage is within limits.	In accordance with the INSERVICE TESTING PROGRAM
SR 3.7.2.2	Verify isolation time of each FWIV and FWRV is within limits on an actual or simulated actuation signal.	In accordance with the INSERVICE TESTING PROGRAM
SR 3.7.2.3	Verify each FWIV and FWRV leakage is within limits.	In accordance with the INSERVICE TESTING PROGRAM
SR 3.8.2.1	Verify reactor has been subcritical for ≥ 48 hours.	Once prior to movement of irradiated fuel assemblies in the reactor pressure vessel

The Actions section of the Bases for Subsection 3.7.2 states that “An inoperable FWIV/FWRV may be utilized to isolate the line only if its leak tightness has not been compromised.” The Applicability section states “In MODE 3 and not PASSIVELY COOLED, the FWIVs and FWRV[s] are required to be OPERABLE, to support DHRS operability.” The ASA section states “The FWIV and FWRV have a specific leakage criteria to maintain DHRS inventory.” To complete its review of SR 3.7.2.3, the staff needs to evaluate the FW valve leakage limits, including the flowrate value of these limits. Similarly, the staff needs to evaluate the MSIV and MSIV bypass valve leakage limits of SR 3.7.1.3, including the flowrate value of these limits. In RAI 506-9614 (ML18289A751), Question 16-58, the applicant was requested to explain in the Bases where these valve leakage limits, including the flowrate value of these limits, are specified.

In its response (ML18347A619) to Question 16-58, Subquestions 1 and 2, the applicant summarized the inservice testing requirements as described in Revision 2 of DCA Part 2, Tier 2, for the eight main steam system valves and the four feedwater system valves required to be operable by LCO 3.7.1 and LCO 3.7.2, and leak tested by SR 3.7.1.3 and SR 3.7.2.3, respectively. In the response, the applicant stated the following:

> The eight main steam isolation valves (2 MSIVs, 2 MSIBVs, 2 non-safety secondary MSIVs, and 2 non-safety secondary MSIBVs), and the feedwater isolation valve (FWIV), feedwater regulating valve (FWRV), and feedwater check valve (FCV) [in each FW line] are required to be tested in accordance with the IST program required by 10 CFR 50.55a, regardless of technical specification surveillance requirements. OPERABILITY of the main steam isolation system and the feedwater isolation system will require that the IST program testing be accomplished in a timely manner to demonstrate the ability of the components to perform their safety or back-up credited functions.

The staff is tracking these Surveillance acceptance criteria for main steam and feedwater valve leakage limits, which are needed to support DHRS operation, as an open item under RAI 506-9614, Question 16-58.

The staff determined that the Frequencies of the above Surveillances are appropriate and consistent with W-STS and W-AP1000-STS, and are therefore acceptable. However, completion of the review of Surveillance Frequencies not included in the SFCP is pending resolution of the identified open items.

16.4.8.3 Surveillance Frequencies Governed by the Surveillance Frequency Control Program

The applicant initially proposed to include Subsection 5.5.11, "Surveillance Frequency Control Program (SFCP)," in GTS Section 5.5 without stating the base (or initial) Surveillance Frequency in each SR that references the SFCP. In order for a COL holder who references the NuScale GTS to correctly initiate a SFCP, the GTS should incorporate staff-approved base Frequencies in applicable SRs, and the GTS Bases should include a staff-accepted rationale for each base Frequency. This should also be done to be consistent with the conditions of approved traveler TSTF-425-A. Upon issuance of a COL that references the NuScale design certification, the base Frequencies and associated Bases will have been relocated from the generic TS portion of the plant-specific TS and associated Bases to the SFCP documents. In RAI 228-9034 (ML17257A227), Question 16-30, Subquestion d, the staff requested that the applicant incorporate the base Frequencies and associated rationales in the GTS and Bases, similar to how they are included in the STS. Since this would entail significant administrative effort on the part of the applicant to extensively revise both the Specifications and Bases by adding this information, in Question 16-30, Subquestion e, the staff suggested that the base Surveillance Frequencies and rationales could be incorporated in a list as part of a "Reviewer's Note" in GTS Subsection 5.5.11.

In its response (ML17317B552) to RAI 228-9034, Question 16-30, Subquestion d, the applicant provided the suggested list of base Surveillance Frequencies and rationales, but presented the list in DCA Part 2, Tier 2, Chapter 16, as Table 16.1-1, "Surveillance Frequency Control Program Base Frequencies," instead of in GTS Subsection 5.5.11. (The staff considers Table 16.1-1 information to be a part of the GTS and Bases of DCA Part 4, and thus is not Tier 2 information.)

In Revision 2 of DCA Part 2, Section 16.1.1, “Introduction to Technical Specifications,” below the heading “Completion Times and Surveillance Frequencies,” in its response, the applicant also added the following discussion about Table 16.1-1:

> 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.

Because adding Table 16.1-1 will make the base Frequency of each SR, which references the SFCP, and the basis of that Frequency a part of the GTS and Bases in DCA Part 4, the staff concludes that the proposed addition of Table 16.1-1 to DCA Part 2 is an acceptable approach for a DCA to incorporate an SFCP Specification into the GTS. Therefore, RAI 228-9034, Question 16-30, Subquestion e, is resolved and closed.

The staff noted that the 30 minute base Frequency of SR 3.4.3.1 (“Verify RCS pressure, RCS temperature, and RCS heatup and cooldown rates are within limits specified in the PTLR. | In accordance with the SFCP”) is proposed for inclusion in the SFCP. The Note to this Surveillance states “Only required to be performed during RCS heatup and cooldown operations and inservice leak and hydrostatic testing.” The staff finds no basis for ever relaxing this 30-minute Frequency during RCS heatup and cooldown operations and inservice leak and hydrostatic testing. In RAI 506-9614 (ML18289A751), Question 16-56, the staff requested the applicant to explain why including the Frequency of this Surveillance in the SFCP is appropriate. In its response (ML18347A619) to RAI 506-9614, Question 16-56, the applicant concluded that maintaining the 30-minute Frequency according to the requirements of Specification 5.5.11 is appropriate because these requirements “are adequate to ensure adequate data and justification is developed before any changes are made. If adequate data and justification are not available, the test interval will remain at the value [of 30 minutes] established in [Table] 16.1-1 consistent with that used at plants of a different design. However if data and justification becomes available the test interval may be adjusted to more appropriately reflect the NuScale power plant.” The staff agrees that the SFCP has adequate controls to ensure that relaxing the 30 minute Frequency will be sufficiently justified. Accordingly, the staff concludes that including the Frequency of SR 3.4.3.1 in the SFCP is acceptable, and that RAI 506-9614, Question 16-56, is resolved and closed.

The staff observed that Revision 1 of DCA Part 4 included new GTS Subsection 3.4.10, “LTOP Valves.” However, the applicant had not updated DCA Part 2, Table 16.1-1, by listing the base Frequencies of new SR 3.4.10.1 and SR 3.4.10.3 and their Bases, as of DCA Revision 2. In its response (ML19010A409) to RAI 512-9634, Question 16-60, Subquestion 1, the applicant revised DCA Part 2, Table 16.1-1 to include the base frequencies of SR 3.4.10.1 and SR 3.4.10.3. Therefore, RAI 512-9634, Question 16-60, Subquestion 1, is resolved. **The staff is tracking RAI 512-9634, Question 16-60, Subquestion 1, as a confirmatory item**.

The applicant stated it would consider apparent deficiencies in the rationales of base Frequencies pointed out by the staff in a public meeting with NuScale on February 21, 2018, and provide clarifications where appropriate in a supplemental response to RAI 228-9034 (ML17257A227), Question 16-30, Subquestion d. For example, the rationale for the 24 month Frequency of SR 3.3.1.4 (Channel Calibration of MPS instrumentation function channels) needs an additional rationale because output signal drift over a 30-month interval must be assumed for calculating trip setpoints, since the Frequency is 24 months, not the other way around. In a public meeting teleconference with NuScale on November 6, 2018 (ML18337A019), the applicant again stated it would provide a supplemental response to RAI 228-9034, Question 16-30, Subquestion d, to improve the quality of the base Frequency rationales in Table 16.1-1. **The staff is tracking the completion of its review of DCA Part 2, Table 16.1-1, as an open item under RAI 228-9034, Question 16-30, Subquestion d**.

The staff will complete its review of Surveillance Frequencies governed by the SFCP after resolution of the identified open items.

16.4.8.4 Instrumentation Surveillances

Channel Check

A Channel Check with a base performance frequency of 12 hours is specified for each MPS function listed in Table 3.3.1-1, which is consistent with the testing described in Revision 2 of DCA Part 2, Tier 2, Section 7.2.15 for RTS and ESFAS instrumentation. DCA Part 2, Tier 2, Section 7.2.15.1, "System Calibration," states:

> The MPS and NMS are designed with the capability for calibration and surveillance testing, including channel checks, calibration verification, and time response measurements, as required by the technical specifications to verify that I&C safety systems perform required safety functions.

FSAR Section 7.2.15.2, "I&C system testing," states in part

> The MPS and NMS allow [structures, systems, and components (SSC)] to be tested while retaining the capability to accomplish required safety functions. The MPS uses modules from the [Highly Integrated Protection System (HIPS)] platform which are designed to eliminate non-detectable failures through a combination of built-in self-testing and periodic surveillance testing.
>
> Testing from the sensor inputs of the MPS through to the actuated equipment is accomplished through a series of overlapping sequential tests, and the majority of the tests may be performed with the NPM at power. Where testing final equipment at power has the potential to upset plant operation or damage equipment, provisions are made to test the equipment when the NPM is shut down.
>
> The MPS provides a means for checking the operational availability of the sense and command feature input sensors relied upon for a safety function during reactor operation.
>
> This capability is provided by one of the following methods:
>
> - Perturbing the monitored variable
> - Cross-checking between channels that have a known relationship (i.e., channel check)
> - Introducing and varying a substitute input to the sensor.

The staff finds that the specified Channel Checks are consistent with the MPS testing described in DCA Part 2, Tier 2, Section 7.2.15, and are therefore acceptable.

COT

The staff requested that the applicant clarify its justification for not proposing to specify a COT for MPS instrumentation functions, the RTS logic and actuation function, ESFAS logic and actuation functions, and the CES inlet pressure monitor channels, which are used for RCS leak detection, in RAI 156-9031, Question 16-2, Subquestion c (ML17220A038), RAI 196-9050, Question 16-16, Subquestion e (ML17237C007), and RAI 197-9051, Question 16-25, Subquestion a4.2 (ML17237C008).

In its responses to Subquestion 16-2c (ML17269A210), Subquestion 16-16e (ML17291A482), and Subquestion 16-25.a4.2 (ML17291A299), NuScale stated that a COT would not add to the assurance of operability provided by the MPS continuous self-testing features, which verify sensor input to the output switching logic for MPS instrumentation functions, the RTS logic and actuation function, ESFAS logic and actuation functions, and the CES inlet pressure monitor channels. The staff notes that a COT was not proposed for the RCS leak detection instrument function of CES inlet pressure, because this monitor is implemented by the MPS.

The staff recognizes that upon receipt of an alarm generated by the MPS self-testing feature, the control room staff would promptly determine the operability of the affected MPS instrumentation function channel or MPS logic and actuation function division. This operability determination would include following the alarm response procedure, which is required by Specification 5.4.1. This procedure can be expected to account for the built-in redundancy of the MPS power supplies and the logic within each SFM, SVM, and communication module provided for each MPS function channel and actuation logic division. An alarm associated with a single redundant component within a module would likely not make the associated channel or division inoperable, but would be addressed by the licensee's corrective action program. The combination of the MPS continuous self-testing capability and the 12 hour Frequency Channel Check, which includes verifying alarm status, provide adequate assurance that any component malfunction in an MPS channel or division will not go undetected for more than a brief period. This will ensure that an MPS degraded condition is identified and its effect on channel or division operability determined in a timely manner. For these reasons, the staff concludes that omission of a COT SR for MPS instrumentation functions and MPS logic and actuation functions, and MPS supported RCS leakage detection instrumentation is acceptable. Therefore, RAI 196-9050, Question 16-16, Subquestion e, RAI 156-9031, Question 16-2, Subquestion c, and RAI 197-9051, Question 16-25, Subquestion a4.2, are resolved and closed.

A COT with a base Frequency of 92 days is specified for the CES gaseous radioactivity monitor channel by SR 3.4.7.4, and the two CES condensate monitor channels by SR 3.4.7.5. These SRs are needed because these monitors are implemented using the MCS, which lacks the MPS capability to perform automatic self testing of the instrument loop. In addition, in its response to Subquestion 16-2c, the applicant revised the Section 1.1 definition of COT to that for analog instrumentation based on the W-STS definition of COT, but with a modification based on recently approved STS change traveler TSTF-563, Revision 0. As such, the staff concludes that this definition is acceptable. The proposed base test Frequency of 92 days is consistent with the COT Frequency of similar instrumentation in current use at operating power reactor facilities, and also with the W-STS and the W-AP1000-STS. The rationale for this base Frequency, provided in DCA Part 2, Section 16.1, Table 16.1-1, states:

> The Frequency of 92 days considers instrument reliability, and industry operating experience has shown that it is proper for detecting degradation.

This is consistent with the basis for the 92-day Frequency of the COT for the F18 radioactive particulate monitor leakage detection instrumentation in W-AP1000-STS Subsection B 3.4.9, and therefore, acceptable. The proposed modification of the COT definition, and other instrumentation surveillance definitions, based on recently approved STS change traveler TSTF-563, on adoption of an SFCP, is described in SER Section 16.4.2 under the discussion of the resolution of RAI 156-9031, Question 16-2, Subquestion c.

<u>Channel Calibration</u>

A Channel Calibration with a base Frequency of 24 months is specified for each MPS function listed in Table 3.3.1-1, which is consistent with the testing described in FSAR Section 7.2.15 for RTS and ESFAS instrumentation. The proposed base test Frequency is consistent with the Channel Calibration Frequency of similar instrumentation in current use at operating power reactor facilities, and also with the W-STS and the W-AP1000-STS. The rationale for this base Frequency, provided in Revision 2 of DCA Part 2, Section 16.1, Table 16.1-1, for SR 3.3.1.4, states as follows:

> The Frequency is justified by the assumption of a 30 month calibration interval in the determination of the magnitude of equipment drift in the setpoint analysis.

The staff notes that pending completion of its review of Revision 2 of DCA Part 2, Tier 2, Table 16.1-1, the above rationale is a part of the open item being tracked under RAI 228-9034, Question 16-30, Subquestion d.

A Channel Calibration with a base Frequency of 24 months is specified for each RCS leakage detection instrument function channel. The proposed base test Frequency is consistent with the Channel Calibration Frequency of similar instrumentation in current use at operating power reactor facilities, and also with the W-STS and the W-AP1000-STS.

The rationale for this base Frequency, provided in Revision 2 of DCA Part 2, Tier 2, Section 16.1, Table 16.1-1, for SR 3.4.7.6 for the CES condensate channel, and SR 3.4.7.8 for the CES gaseous radioactivity monitor channel, states:

> The Frequency of 24 months considers instrument reliability, and industry operating experience that has proven that this Frequency is acceptable.

The rationale for this base Frequency, provided in Revision 2 of DCA Part 2, Section 16.1, Table 16.1-1, for SR 3.4.7.7 for the CES inlet pressure channel, states:

> 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.

Note that pending completion of its review of Revision 2 of DCA Part 2, Table 16.1-1, the above rationale is a part of the open item the staff is tracking under RAI 228-9034, Question 16-30, Subquestion d.

A Channel Calibration with a base Frequency of 24 months is specified for SR 3.8.1.2 for the two refueling neutron flux channels and one refueling neutron flux audible count rate channel. The rationale for this base Frequency, provided in Revision 2 of DCA Part 2, Section 16.1, Table 16.1-1, states the following:

Industry operating experience has shown that similar components usually pass this Surveillance when performed at the 24 month Frequency.

The staff notes that the rationales for the 24-month Frequency of the above Channel Calibration SRs are not fully consistent with the W-STS and the W-AP1000-STS, and are therefore not acceptable. Accordingly, the staff cannot yet conclude that the 24-month base Frequency for the Channel Calibration SRs is acceptable. Pending completion of its review of Revision 2 of DCA Part 2, Table 16.1-1, the staff is tracking RAI 228-9034, Question 16-30, Subquestion d, as an open item.

SER Chapter 7 describes the individual components comprising a measurement channel of an MPS instrument loop and subject to calibration. However, for the present evaluation of the Channel Calibration Surveillance, the following description is provided as background.

A channel (separation group) of an MPS instrument loop typically consists of a:

- A process sensor and field transmitter, which generate an analog output signal;
- A safety function module (SFM), which provides three redundant sub-modules, each with:
    - An analog signal conditioning block, which includes
        - An analog to digital signal converter; followed by
        - A serial interface to the trip determination block.
    - A trip determination block, which
        - Performs the safety function algorithm,
        - Makes a trip determination based on a predetermined setpoint, and
        - Using the SFM communication engine, provides
            - Reactor trip demand signal through *isolated*, <u>redundant</u>, *transmit only*, serial connections (using three safety data buses (SDBs) to three scheduling and bypass modules (SBMs)) to RTS safety voter modules (SVMs) in both logic and actuation divisions;
            - ESF actuation demand signal through *isolated, transmit only*, serial connections (using three SDBs to three SBMs), to ESF SVMs in both logic and actuation divisions; or
            - Interlock or permissive signal through *isolated, transmit only,* serial connections (using three SDBs to three SBMs), to RTS or ESF SVMs in both logic and actuation divisions to enable or inhibit associated RTS or ESFAS Functions.

Each of the four separation groups has three SBMs. Each SBM transmits a signal from the corresponding SFM to the corresponding SVMs in both RTS logic and actuation divisions (RTS I SVM and RTS II SVM) and/or both ESFAS logic and actuation divisions (ESFAS I SVM and ESFAS II SVM). Each of the three SVMs in a logic and actuation division generates a trip or actuation signal if the 2 out of 4 coincidence (or voter) logic is satisfied, and provides that signal to the equipment interface module (EIM) for each actuated component associated with the affected trip or actuation function. If 2 out of 3 SVMs generate a reactor trip signal, the two reactor trip breakers of that RTS division will open. Likewise, if 2 out of 3 SVMs generate an ESF actuation signal, the associated component will actuate to the safe position (e.g., a containment isolation valve will close). If the trip or actuation function requires an interlock signal to not be bypassed (or to be enabled), the necessary output signal from the associated SVM for the interlock must be present (or active) in order for the function's signal to be sent from the function's SVM to the associated component's EIM.

The staff notes that Subsection B 3.3.1 includes discussions that clarify the scope and intent of the Channel Calibration. One discussion explains that when determining the as-found trip setting at the beginning of the instrument channel calibration, as-found tolerances for the output signal of each sensor and device in the instrument loop must be satisfied for the sensor or device to be considered functioning normally. Provided the actual trip setting of the channel as a whole is within the as-found tolerance specified by the SP, the channel is considered operable. However, any sensor or device found to be outside its as-found tolerance should be entered into the corrective action program. Specifically, the Background section of Subsection B 3.3.1 discusses the NTSP as follows (emphasis added):

> The trip and actuation setpoints used in the [safety function module (SFM)] core logic function are based on the analytical limits derived from accident analysis (Ref. 5). The calculation of the limiting trip setpoint (LTSP) specified in the Setpoint Program (SP) is such that adequate protection is provided when all sensor and processing time delays are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrument drift, and severe environment errors for those MPS channels that must function in harsh environments as defined by 10 CFR 50.49 (Ref. 6), the LTSP specified in the SP is conservative with respect to the analytical limits. The nominal trip setpoint (NTSP) is the LTSP with margin added and is always equal to or more conservative than the LTSP. A detailed description of the methodology used to calculate the NTSPs is provided in the "NuScale Instrument Setpoint Methodology" (Ref. 7). The as-left tolerance and as-found tolerance band methodology is provided in the SP. The as-found OPERABILITY limit for the purpose of the CHANNEL CALIBRATION is defined as the as-left limit plus the acceptable drift about the NTSP.
>
> The NTSPs listed in the SP are based on the methodology described in Reference 7, which incorporates all of the known uncertainties applicable for each channel. The magnitudes of these uncertainties are factored into the determination of each NTSP. *All field sensors and signal processing equipment for these channels are assumed to operate within the allowances of these uncertainty magnitudes. Transmitter and signal processing equipment calibration tolerances and drift allowances must be specified in plant calibration procedures, and must be consistent with the values used in the setpoint methodology.*
>
> The OPERABILITY of each transmitter or sensor can be evaluated when its "as-found" calibration data are compared against the "as-left" data and are shown to be within the setpoint methodology assumptions. The as-left and as-found tolerances listed in the SP define the OPERABILITY limits for a channel during a periodic CHANNEL CALIBRATION that requires trip setpoint verification.

Another discussion in the Background section of Subsection B 3.3.1 explains that an RTS trip Function division requires its associated interlock to be in the correct state to be operable. Likewise, for an ESFAS function that has an enabling interlock. The Applicable Safety Analyses, LCO, and Applicability section of Subsection B 3.3.1 (and by reference in Subsections B 3.3.2 and B 3.3.3) state the following, in part:

> ... Proper operation of these permissive[s] and interlocks supports OPERABILITY of the associated reactor trip and ESF functions and/or the requirement for actuation logic OPERABILITY. The permissives and interlocks must be in the required state, as appropriate, to support OPERABILITY of the associated functions. The permissives and interlocks associated with each MPS Instrumentation Function channel, each Reactor Trip System (RTS) Logic and Actuation Function division, and each Engineered Safety Features Actuation System (ESFAS) Logic and Actuation Function division, respectively, must be OPERABLE for the associated Function channel or Function division to be OPERABLE. ...

In addition, since the sensors and transmitters for process variables used by the RTS and ESFAS are also used to generate the interlock and permissive signals, a Channel Calibration of an MPS sensor and transmitter satisfies the calibration requirement for the shared interlock sensor and transmitter. However, it is unclear to the staff whether the settings for interlock activation and deactivation are determined using the setpoint methodology specified by the SP and verified to be set correctly in the SFM as a part of the Channel Calibration of each associated MPS Function. The Applicable Safety Analyses, LCO, and Applicability section of Subsection B 3.3.1 also also state the following, in part:

> ...The combination of the continuous self-checking features of the MPS and the CHANNEL CALIBRATION specified by SR 3.3.1.4 verify the OPERABILITY of the interlocks and permissives.

In RAI 9642, Question 16-62, the applicant was requested to clarify in the Subsection 3.3.1 Bases the relationship of the MPS Instrumentation Functions, and their bypassing or enabling interlocks and permissives, to the SP controls and Channel Calibration Surveillances. **The staff is tracking RAI 9642, Question 16-62 as an open item.**

The proposed modification of the Channel Calibration definition, and other instrumentation Surveillance definitions, which is based on recently approved STS change traveler TSTF-563, regarding adoption of a Surveillance Frequency Control Program, is described in Section 16.4.2 of this SER under the discussion of the resolution of RAI 156-9031, Subquestion 16-2c.

<u>MPS Class 1E Isolation Devices</u>

Each Class 1E isolation device has both over-current (OC) and under-voltage (UV) trip functions. In Revision 2 of DCA Part 4, SR 3.3.1.5, SR 3.3.2.3, and SR 3.3.3.3 state, “Verify associated Class 1E isolation devices are OPERABLE. | In accordance with the Surveillance Frequency Control Program.” However, in Revision 2 of DCA Part 4, the Bases for SR 3.3.1.5, SR 3.3.2.3, and SR 3.3.3.3 in Subsections B 3.3.1, B 3.3.2, and B 3.3.3, respectfully, do not describe the OC and UV trip functions and whether both are required to be demonstrated to verify isolation device operability. The Bases also do not describe whether the associated OC and UV trip settings are determined and controlled by the Setpoint Program (SP), which is specified by Subsection 5.5.10. If the SP governs the specified Class 1E isolation devices, it seems logical to specify that the Channel Calibration of SR 3.3.1.4 also applies to them. In addition, the staff noted that SR 3.3.1.5 does not include the surveillance column Note specified in similar Surveillances, SR 3.3.2.3 and SR 3.3.3.3. This Note states: “Not required to be met for Class 1E isolation devices that have isolated 1E circuits from non-1E power.” This Note, which is part of an open item about (1) proposed surveillance provisions, which are apparently motivated by unapproved traveler TSTF-541, and (2) the applicant’s response (ML17291A299) to RAI 197-9051 (ML17237C008), Question 16-28, is mentioned here because its omission from SR 3.3.1.5 is inconsistent with the two other similar Surveillances.

These points were included in the discussion of the response (ML17291A482) to RAI 196-9050, Question 16-17, during a November 6, 2018, public meeting teleconference (ML18337A019) with NuScale, because the markup of GTS and Bases pages, in the response to Question 16-17, show the addition of SR 3.3.1.5, SR 3.3.2.3, and SR 3.3.3.3 and their Bases. Subsequent to the meeting, the applicant provided a supplemental response (ML17291A482) to Question 16-17 to address the above issues. In the supplemental response to Question 16-17, the applicant stated, in part, the following:

> ...SR 3.3.1.5, SR 3.3.2.3, and SR 3.3.3.3 have been changed to require CHANNEL CALIBRATION of the Class 1E isolation devices. The definition of CHANNEL CALIBRATION will ensure appropriate testing of the Class 1E isolation devices including their setpoints. The Bases of SR 3.3.1.5, SR 3.3.2.3, and SR 3.3.3.3 have been modified to describe the Class 1E isolation devices to include the OC and UV function as a required part of their function and OPERABILITY. The revised bases also indicate that the OC and UV setpoints are considered variable[s] having significant safety functions and are therefore within the scope of applicability of the Setpoint Program as described in specification 5.5.10.a.
>
> The Note at SR 3.3.2.3 and SR 3.3.3.3 has been added to SR 3.3.1.5 and associated bases stating that the SR is not required to be met for Class 1E isolation devices that have isolated 1E circuits from non-1E power. This allowance is appropriate because with the 1E circuits isolated from the non-1E power, the safety function of the device has been performed.

The staff noted that the supplemental response to RAI 196-9050, Question 16-17, included a markup of pages from Revision 2 of DCA Part 4 showing the described changes.

Revision 2 of DCA Part 2, Chapter 16, Table 16.1-1 states that the 24-month initial or base Frequency of SR 3.3.1.5 “is acceptable based on consideration of the design reliability of the equipment.” Table 16.1-1 also states that the 24-month base Frequency of similar Surveillances, SR 3.3.2.3 and SR 3.3.3.3 “is based on the potential for unplanned plant transients if the Surveillances were performed with the unit at power” and “is acceptable based on consideration of the design reliability of the equipment.” The Frequency basis for SR 3.3.1.5 appeared to be inconsistent by not including the first sentence of the Frequency basis for the other two Surveillances. In the supplemental response to Question 16-17, the applicant justified the difference as follows; edits have been inserted to clarify the staff’s understanding of the intended meaning of the applicant’s statement:

> The ~~latter basis~~ additional basis for the 24 month Frequency of SR 3.3.2.3 and SR 3.3.3.3 describes a potential for unplanned plant transients that could occur with the unit at power~~,~~; however SR 3.3.1.5 does not include this basis. The difference in justification is that SR 3.3.1.5 applies to portions of MPS with additional redundancy~~ such that~~, which has reduced the likelihood of unplanned

> plant transients ~~has reduced so that~~ while performing SR 3.3.1.5 during power operation such that the likelihood of a transient is considered negligible.

Based on the applicant's supplemental response, the staff finds that (a) specifying a Channel Calibration for the Class 1E isolation devices is appropriate, (b) the 24-month initial Frequency is adequately justified, and (c) the associated Bases are acceptable. **Therefore, RAI 196-9050, Question 16-17, is resolved. The staff is tracking the associated changes as a confirmatory item.**

However, the applicant needs to address the following concerns: (1) To ensure the SP will govern all Channel Calibration SRs, each Channel Calibration Surveillance statement needs to append the phrase "in accordance with the Setpoint Program." And (2) LCO 3.3.4 needs to specify a Channel Calibration for the Class 1E isolation devices associated with the manual RTS and ESF actuation Functions. **The staff is tracking these concerns as a part of the open item under RAI 197-9051 (ML17237C008), Question 16-28.** SER Section 16.4.8.5 provides the evaluation of the response to RAI 197-9051, Question 16-28.

Actuation Logic Test

SER Section 16.4.2.2 discusses the NuScale definition of the defined term Actuation Logic Test.

An Actuation Logic Test with a base Frequency of 24 months is specified for the two divisions of the RTS logic and actuation for the reactor trip function, which is addressed by Subsection 3.3.2, and the two divisions of the ESFAS logic and actuation for each ESF logic and trip initiation function listed in Table 3.3.3-1.

The Actuation Logic Test includes testing of the actuation and priority logic (APL) on all RTS and ESFAS EIMs, the enable nonsafety control switches, the main control room isolation switches, the override switches, and the operating bypass switches. The Actuation Logic Test includes a review of any alarms or failures reported by the self-testing features.

In Revision 2 of DCA Part 4, the SRs section of Subsection B 3.3.2, for SR 3.3.2.1, states the following, in part:

> ...The RTS logic and actuation circuitry functional testing is accomplished with continuous system self-testing features on the SVMs and EIMs and the communication between them. The self-testing features are designed to perform complete functional testing of all circuits on the SVM and EIM, with the exception of the actuation and priority logic (APL) circuitry. The self-testing includes testing of the voting and interlock/permissive logic functions. The built-in self-testing will report a failure to the operator and place the SVM or EIM in a fail-safe state.
>
> The ACTUATION LOGIC TEST includes testing of the APL on all RTS ~~and ESFAS~~ EIMs, the enable nonsafety control switches, the main control room isolation switches, the override switches, and the operating bypass switches. The ACTUATION LOGIC TEST includes a review of any alarms or failures reported by the self-testing features.

In Revision 2 of DCA Part 4, the SRs section of Subsection B 3.3.3, for SR 3.3.3.1, similarly states, in part, the following:

> The ESFAS logic and actuation circuitry functional testing is accomplished with continuous system self-testing features on the SVMs and EIMs and the communication between them. The self-testing features are designed to perform complete functional testing of all circuits on the SVM and EIM, with the exception of the actuation and priority logic (APL) circuitry. The self-testing includes testing of the voting and interlock/permissive logic functions. The built-in self-testing will report a failure to the operator and place the SVM or EIM in a fail-safe state.
>
> The ACTUATION LOGIC TEST includes testing of the APL on all ESFAS EIMs, the enable nonsafety control switches, the main control room isolation switches, the override switches, and the operating bypass switches. The ACTUATION LOGIC TEST includes a review of any alarms or failures reported by the self-testing features.

Revision 2 of DCA Part 2, Tier 2, Section 7.2.15.2, "I&C system testing," addresses testing that cannot be performed during normal power operation, as follows:

> Where testing final equipment at power has the potential to upset plant operation or damage equipment, provisions are made to test the equipment when the NPM is shut down.

The staff will complete the review of instrumentation Surveillances following resolution of the identified open items.

16.4.8.5 Proposed exceptions to meeting certain surveillances for isolation valves and circuit breakers

The TSTF submitted unapproved traveler TSTF-541, Revision 0, "Add Exceptions to Surveillance Requirements When the Safety Function is Being Performed," for NRC review on September 10, 2013 (ML13253A390). The traveler's proposed changes would provide exceptions to certain SRs for ventilation system dampers and cooling water system valves that are in certain positions. For example, the traveler proposes to revise the quoted SRs of the following W-STS Subsections, by adding text denoted by *italics*:

- W-STS Subsection 3.6.11, "Iodine Cleanup System (ICS)"
  - SR 3.6.11.3 *[-----------------------------NOTE-----------------------------*
    Not required to be met for dampers and valves locked, sealed or otherwise secured in the actuated position.
    ---]

    Verify each ICS train actuates on an actual or simulated actuation signal.

- W-STS Subsection 3.7.10, “Control Room Emergency Filtration System (CREFS)”

  - SR 3.7.10.3 *[-----------------------------NOTE-----------------------------
    Not required to be met for dampers and valves locked, sealed or otherwise secured in the actuated position.
    ---]*

    Verify each CREFS train actuates on an actual or simulated actuation signal.

- W-STS Subsection 3.7.12, “ECCS Penetration Room Exhaust Air Cleanup System (PREACS)”

  - SR 3.7.12.3 *[-----------------------------NOTE-----------------------------
    Not required to be met for dampers and valves locked, sealed or otherwise secured in the actuated position.
    ---]*

    Verify each ECCS PREACS train actuates on an actual or simulated actuation signal.

- W-STS Subsection 3.7.13, “Fuel Building Air Cleanup System (FBACS)”

  - SR 3.7.13.3 *[-----------------------------NOTE-----------------------------
    Not required to be met for dampers and valves locked, sealed or otherwise secured in the actuated position.
    ---]*

    Verify each FBACS train actuates on an actual or simulated actuation signal.

- W-STS Subsection 3.7.14, “Penetration Room Exhaust Air Cleanup System (PREACS)”

  - SR 3.7.14.3 *[-----------------------------NOTE-----------------------------
    Not required to be met for dampers and valves locked, sealed or otherwise secured in the actuated position.
    ---]*

    Verify each PREACS train actuates on an actual or simulated actuation signal.

In addition to CE-STS Subsections equivalent to these W-STS Subsections, the traveler also proposes to revise the quoted SR of the following CE-STS Subsection:

- CE-STS Subsection 3.7.10, “Essential Chilled Water (ECW)”

    - SR 3.7.10.2 *[------------------------------NOTE------------------------------*
      Not required to be met for valves locked, sealed or otherwise secured in the actuated position.
      ---]

      Verify the proper actuation of each ECW System component on an actual or simulated actuation signal.

Similar changes are proposed for the B&W-STS, GE-BWR4-STS, and GE-BWR6-STS.

In a letter dated February 25, 2016 (ML16012A427), for the second time, the staff asked the TSTF for additional information about TSTF-541, Revision 0. This letter contained 15 information requests from three technical branches and 5 information requests from the technical specifications branch. As of April 2018, with the response to the letter still pending, the TSTF was planning to submit a revision to the traveler to clarify its scope and intent.

The entry for this traveler in Table C-1, “TSTF traveler evaluation,” of DCDR, Revision 0, indicates its adaptation to the NuScale GTS would affect Subsection 3.6.2, “Containment Isolation Valves,” and states the following:

> The passive NuScale design includes a limited number of valves with potential for the addressed condition to exist. Exceptions consistent with the traveler were incorporated into the surveillance requirements of [GTS Subsection] 3.6.2.

The staff compared the changes proposed in TSTF-541 with SR 3.6.2.3 of Revision 0 of DCA Part 4, which states the following (emphasis added):

> SR 3.6.2.3 Verify each automatic containment isolation valve *that is not locked, sealed, or otherwise secured in position,* actuates to the isolation position on an actual or simulated actuation signal.

This surveillance statement appears to include the intent of the bracketed surveillance column Notes proposed by the traveler for similar automatic valve actuation SRs in STS, as quoted above.

Compared to these Notes, the GTS surveillance statement uses the phrase “locked, sealed, or otherwise secured in position” instead of “locked, sealed, or otherwise secured in *the actuated* position.”

In Revisions 1 and 2 of DCA Part 4, SR 3.6.2.3 is numbered SR 3.6.2.4, and includes an additional phrase, indicated by underline below, that provides an exception to when the Surveillance must be met as follows:

> SR 3.6.2.4 Verify each automatic containment isolation valve *that is not locked, sealed, or otherwise secured in position,* actuates to the isolation position on an actual or simulated actuation signal <u>except for valves that are open under administrative controls</u>.

In Revision 0 of DCA Part 4, the Bases for SR 3.6.2.3 contain the first sentence of the passage quoted below. This statement also appears similar to the intent of the traveler's bracketed surveillance column Note (emphasis added). In Revisions 1 and 2 of DCA Part 4, the Bases for SR 3.6.2.4 (as renumbered beginning in DCA Revision 1) also includes the second sentence of this passage, regarding the added exception, that states the following:

> The Surveillance is not required for valves that are locked, sealed, or otherwise secured in the *required* position *under administrative controls*. An exception to the SR is also provided for valves that are open under administrative control.

Compared to the traveler's surveillance column bracketed Note, the first of the above GTS Bases sentences uses the phrases: (1) "not required for valves" instead of "not required <u>to be met</u> for <u>automatic</u> valves"; and (2) "required position" instead of "<u>actuated</u> position." The first sentence also includes the phrase "under administrative controls," which inappropriately specified an implied exception to meeting the valve position verification requirement. The addition of an explicit exception to meeting the valve position verification requirement in Revision 1 of the SR and the associated Bases statement, corrected this inappropriate use of the Bases to modify the applicability of a Surveillance. Since the phrasing of the surveillance statement and associated Bases differ only in presentation from the traveler's proposed bracketed surveillance column Note, the staff concludes that the exception to meeting SR 3.6.2.4 is editorially consistent with the intent of TSTF-541, Revision 0. However, since this traveler does not address exceptions to automatic CIV testing, the staff concludes that the proposed exception to meeting SR 3.6.2.4 is not supported by the intended scope of the traveler.

In Revision 1 of DCA Part 4, the applicant included the following SRs for verifying [automatic] valve actuation on an "actual or simulated [actuation] signal," to the position stated in the Surveillance, which is also quoted below, on a Frequency of "In accordance with the Surveillance Frequency Control Program." (Note that the SR enumeration is that of Revision 2 of DCA Part 4. Also, listed here are the Surveillance base Frequencies, which are given in the latest revision of DCA Part 2, Table 16.1-1.)

SR 3.1.9.2	CVCS demineralized water isolation valves	isolation position	24 months
SR 3.4.6.3	CVCS automatic [isolation] valves	isolation position	24 months
SR 3.4.10.1	LTOP RVVs	open position	24 months
SR 3.5.1.1	ECCS RVVs and RRVs	open position	24 months
SR 3.6.2.4	automatic containment isolation valves	isolation position	24 months

In each of these SRs, (1) the surveillance statement includes either the phrase, "except for valves that are open under administrative controls," or the phrase, "that is not locked, sealed, or otherwise secured in [the isolated] position," or (2) the SR includes a surveillance column Note or surveillance table Note that states, "Not required to be met for valves that are open."

Because the staff has not approved TSTF-541, Revision 0, and considering the above observations, the staff could not determine whether the proposed application of the intent of the traveler is needed for the NuScale GTS.

The staff issued RAI 197-9051 (ML17237C008), Question 16-28, with the above observations and to request that the applicant revise the evaluation of TSTF-541 in RCDR Table C-1 to indicate that it is not applicable to automatic valve actuation surveillances in the GTS (i.e., withdraw allowances based on the intent of the traveler for valves that are not within the scope of the traveler).

In its response (ML17291A299) to RAI 197-9051, Question 16-28, the applicant stated the following (emphasis added):

> NuScale has adopted and incorporated the conceptual basis of TSTF traveler 541 into the proposed GTS *independent of the outcome of the TSTF-NRC traveler review and approval activities*.
>
> The conceptual basis and underlying issue is that as described in Section SR 3.0, if a surveillance requirement cannot be met, then the associated LCO is not being met and the associated Condition must be entered. However in some circumstances *the OPERABILITY of the equipment* that cannot meet the surveillance requirement *is being met* because the safety function has been met. *A commonly used example is a valve that is in the position to perform its safety function, and is not assumed to move following actuation.*
>
> The NuScale safety systems include various valves and breakers that align to a particular position to perform their specified safety function. In each case, the valve or breaker has a single credited actuation position - the design does not include any valve or breakers that must move to alternative positions after they have performed their required safety function.

The staff notes that the above response is consistent with the rationale of a Reviewer's Note that the traveler proposed to add to the Bases for each affected STS SR. This Reviewer's Note states the following:

> -----------------------------------REVIEWER'S NOTE-----------------------------------
> Adoption of the Note excluding valves that are locked, sealed, or otherwise secured in the actuated position requires confirmation by the licensee that movement of the valves following an accident is not assumed in the safety analysis.
> ---

The traveler also proposed to insert the following passage in the Bases of each affected SR:

> [The SR is modified by a Note excluding valves that are locked, sealed, or otherwise secured in the actuated position. It is not necessary to test valves that are locked, sealed, or otherwise secured in the actuated position because the affected valves were verified to be in the actuated position assumed in the accident analysis prior to being locked, sealed, or otherwise secured, and because movement following an accident is not assumed in the accident analysis.]

The above quoted response to RAI 197-9051, Question 16-28, also appears consistent with this passage. However, the staff observes that the applicant's proposed exceptions to meeting selected SRs, which verify automatic valve and breaker actuation, are not always specified by a surveillance column Note. Several of the proposed exceptions are specified by inserting exception language in the surveillance statement instead of in a Note.

The response to RAI 197-9051, Question 16-28, proposed to broadly apply the traveler's "conceptual basis" to selected SRs for (1) CVCS demineralized water isolation valves – when closed; (2) Class 1E isolation devices for MPS instrumentation Function channels – when opened; (3) Class 1E isolation devices for RTS and ESFAS actuation logic divisions – when opened; (4) reactor trip breakers – when opened; (5) pressurizer heater trip breakers – when opened; (6) CVCS isolation valves – when closed; (7) ECCS valves (RRVs and RVVs) – when opened; (8) LTOP RVVs – when opened; (9) containment isolation valves – when closed; (10) decay heat removal actuation valves – when opened; (11) main steam isolation valves and main steam isolation bypass valves – when closed; and (12) feedwater isolation valves and feedwater regulation valves – when closed.

In RCDR Revision 1, the applicant revised Table C-1 to address draft Revision 1 of TSTF-541, dated May 29, 2018; as of February 14, 2019, formal submission of this revised traveler for staff review was pending. The revised Table C-1 states the following :

> Although not directly applicable, the Intent of the traveler was adopted in the NuScale GTS. NuScale safety-related reactor trip system and ECCS components are credited with a single safety-related position, each of which is achieved by the component being de-energized.
>
> The implementation of this traveler is under additional review and consideration as requested by the NRC staff at the time this technical report was developed. See RAI [197-9051, Question] 16-28.

In RCDR Revision 1, Table C-1 listed the affected GTS Specifications influenced by TSTF-541, draft Revision 1. These Specifications, along with the affected SRs, are listed below. The staff notes that Specification 3.3.1, "MPS Instrumentation," should also be included in the list because the supplemental response to RAI 196-9050, Question 16-17, revised Subsection 3.3.1 of Revision 2 of DCA Part 4 so that SR 3.3.1.5 specifies performing a Channel Calibration of Class 1E isolation devices for MPS instrumentation components. The supplemental response to Question 16-17 similarly revised SR 3.3.2.3 and SR 3.3.3.3; the revised SRs are quoted below. SER Section 16.4.8.4 discusses RAI 196-9050, Question 16-17.

In the below quotations of the affected SRs, the Frequencies are abbreviated: "IAW SFCP" stands for "In accordance with the Surveillance Frequency Control Program"; and "IAW ISTP" stands for "In accordance with the INSERVICE TESTING PROGRAM." Staff suggested clarification edits are indicated by shaded text markup.

3.1.9, Boron Dilution Control

SR 3.1.9.2 Verify each automatic CVCS demineralized water isolation valve that is not...secured in the isolated position, actuates to the isolated position on an actual or simulated actuation signal *except for valves that are open under administrative controls*. | IAW SFCP

3.3.1, MPS Instrumentation

SR 3.3.1.5 -----------------------------NOTE----------------------------------
Not required to be met for Class 1E isolation devices that have isolated 1E circuits from non-1E power.

Perform CHANNEL CALIBRATION on each ~~required~~ Class 1E isolation device. | IAW SFCP

3.3.2, Reactor Trip System Logic and Actuation

SR 3.3.2.1 -----------------------------NOTE----------------------------------
Not required to be met for reactor trip breakers that are open.

Perform ACTUATION LOGIC TEST. | IAW SFCP

SR 3.3.2.2 -----------------------------NOTE----------------------------------
Not required to be met for reactor trip breakers <u>(RTBs)</u> that are open.

Verify ~~required~~ response time is within limits. | IAW SFCP

SR 3.3.2.3 -----------------------------NOTE----------------------------------
Not required to be met for Class 1E isolation devices that have isolated 1E circuits from non-1E power.

Perform CHANNEL CALIBRATION on each ~~required~~ Class 1E isolation device. | IAW SFCP

SR 3.3.2.4 -----------------------------NOTE----------------------------------
Not required to be met for reactor trip breakers that are open.

Verify each RTB actuates to the open position on an actual or simulated actuation signal. | IAW SFCP

3.3.3, Engineered Safety Feature Actuation System Logic and Actuation

SR 3.3.3.2 -----------------------------NOTE----------------------------------
Not required to be met for pressurizer heater <u>trip</u> breakers that are open or closed under ~~manual control~~ <u>administrative controls</u>.

Verify ~~required~~ pressurizer heater trip breaker response time is within limits. | IAW SFCP

SR 3.3.3.3 -----------------------------NOTE----------------------------------
Not required to be met for Class 1E isolation devices that have isolated 1E circuits from non-1E power.

Perform CHANNEL CALIBRATION on each ~~required~~ Class 1E isolation device. | IAW SFCP

SR 3.3.3.4 -----------------------------NOTE----------------------------------
Not required to be met for pressurizer heater trip breakers that are open or ~~breakers~~ closed under administrative controls.

Verify each pressurizer heater trip breaker ~~(PHTB)~~ actuates to the open position on an actual or simulated actuation signal. | IAW SFCP

3.4.6, Chemical and Volume Control System Isolation Valves

SR 3.4.6.2 -----------------------------NOTE----------------------------------
Not required to be met for valves that are closed or open under administrative controls.

Verify the ~~required~~ isolation time of each automatic power operated CVCS valve is within limits. | IAW ISTP

SR 3.4.6.3 Verify each automatic CVCS valve that is not locked, sealed, or otherwise secured in position, actuates to the isolation position on an actual or simulated actuation signal *except for valves that are open under administrative controls*. | IAW SFCP

3.4.10, Low Temperature Overpressure Protection Valves

In Revision 2 of DCA Part 4, the Subsection 3.4.10 SR table Note ("Not required to be met for valves that are open.") provides an explicit exception to meeting the SRs for the RVVs, and the RVV inadvertent actuation block, when an RVV is open. In its response (ML18347A619) to RAI 506-9614 (ML18289A751), Question 16-53, Subquestion B, regarding the LTOP function of the RVVs and LCO 3.4.10, the applicant stated:

> An RVV that is not closed has completed its safety function and providing a vent path and no further action or actuation is required. Therefore any RVV not closed is outside the scope of required components in this LCO.
>
> An editorial correction has been made by removal of the Note at the Surveillance Requirements table. *The Note was removed as unnecessary because the LCO only applies to closed reactor vent valves.*

This exception provided by the Note, however, is also implied by LCO 3.4.10, which states, "Each *closed* reactor vent valve (RVV) shall be OPERABLE."

The staff concludes that the SRs only support the operability of the LTOP automatic open function of three closed RVVs. SER Section 16.4.5 further discusses the resolution of RAI 506-9614, Question 16-53, Subquestion B.

3.5.1, Emergency Core Cooling System

SR 3.5.1.1 -----------------------------NOTE-----------------------------------
Not required to be met for valves that are open.

Verify each RVV and RRV actuates to the open position on an actual or simulated actuation signal. | IAW SFCP

SR 3.5.1.2 -----------------------------NOTE-----------------------------------
Not required to be met for valves that are open.

Verify the open actuation time of each RVV and RRV is within limits. | IAW ISTP

Subsection 3.5.1 specifies SR 3.5.1.3 ("Verify the inadvertent actuation block function of each RVV and RRV is OPERABLE. | IAW SFCP") and SR 3.5.1.4 ("Verify the inadvertent actuation block setpoint is within limits for each RVV and RRV. | IAW ISTP"). However, there is no explicit exception to meeting these SRs "for valves that are open."

3.5.2, Decay Heat Removal System

Subsection 3.5.2 specifies SR 3.5.2.3 ("Verify that each DHRS actuation valve actuates to the open position on an actual or simulated actuation signal. | IAW SFCP") and SR 3.5.2.4 ("Verify the open actuation time of each DHRS actuation valve is within limits. | IAW ISTP"). However, there is no explicit exception to meeting these SRs "for DHRS actuation valves that are open" specified in Revision 2 of DCA Part 4. Therefore, it appears that including LCO 3.5.2 in the list of affected LCOs in Revision 1 of DCDR Table C-1 is an error.

3.6.2, Containment Isolation Valves

SR 3.6.2.2 Verify each containment isolation manual valve...that is...required to be closed...is closed, *except for containment isolation valves that are open under administrative controls.* | IAW SFCP

SR 3.6.2.3 Verify the isolation time of each automatic containment isolation valve is within limits *except for valves that are open under administrative controls*. | IAW ISTP

SR 3.6.2.4 Verify each automatic containment isolation valve... actuates to the isolation position on an actual or simulated actuation signal *except for valves that are open under administrative controls*. | IAW SFCP

3.7.1, Main Steam Isolation Valves

Subsection 3.7.1 specifies SR 3.7.1.2 ("Verify isolation time of each MSIV and MSIV bypass valve is within limits on an actual or simulated actuation signal. | IAW ISTP"). However, there is no explicit exception to meeting this SR "for isolation valves that are closed" specified in Revision 2 of DCA Part 4. Therefore, it appears that including LCO 3.7.1 in the list of affected LCOs in Revision 1 of DCDR Table C-1 is an error.

3.7.2, Feedwater Isolation

Subsection 3.7.2 specifies SR 3.7.2.2 ("Verify the closure time of each FWIV and FWRV is within limits on an actual or simulated actuation signal. | IAW ISTP"). However, there is no explicit exception to meeting this SR "for isolation and regulation valves that are closed" specified in Revision 2 of DCA Part 4. Therefore, it appears that including LCO 3.7.2 in the list of affected LCOs in Revision 1 of DCDR Table C-1 is an error.

The staff needs the applicant to address the following concerns: (1) To ensure the SP will govern all Channel Calibration SRs, each Channel Calibration Surveillance statement needs to append the phrase "in accordance with the Setpoint Program." (2) LCO 3.3.4 needs to specify a Channel Calibration for the Class 1E isolation devices associated with the manual RTS and ESF actuation Functions. (3) The applicant needs to provide additional justification for why the surveillance column Notes for SR 3.3.1.5, SR 3.3.2.3, and SR 3.3.3.3 are needed. Specifically, address the expected operational restrictions or burdens that would be avoided by invoking the Note. Also, explain how the action requirements would be applied if an associated Class 1E isolation device is known to be unable to open on an OC or UV condition for an MPS Function, an RTS Function, an ESFAS Function, and a manual Function. (4) The applicant needs to address the expected operational restrictions that would be avoided by invoking the exception to meeting the automatic actuation verification Surveillance for each valve and trip breaker specified by the SRs quoted above. (5) In STS, since an Actions table Note is usually used to specify an allowance to open (or close) a valve (or circuit breaker), which is closed (or open) to comply with a Required Action, provided the valve is operated using administrative controls (which are usually defined and described in the Bases discussion of the Note), the applicant needs to explain the need for specifying such an exception in a Surveillance statement, such as proposed in SR 3.1.9.2, SR 3.4.6.3, SR 3.6.2.2, SR 3.6.2.3, and SR 3.6.2.4; or in a surveillance column Note, such as proposed in SR 3.3.3.2, SR 3.3.3.4, and SR 3.4.6.2. (6) The applicant needs to resolve the apparent error noted above about listing LCO 3.5.2, LCO 3.7.1, and LCO 3.7.2 in the discussion of TSTF-541 in Table C-1 of RCDR Revision 1.

Pending satisfactory disposition of the above concerns, completion of the staff's review of this response, and the above proposed allowances to not require meeting certain SRs, **the staff is tracking RAI 197-9051, Question 16-28, as an open item**. In a November 6, 2018, public meeting teleconference (ML18337A019), the applicant stated it will provide a supplemental response to Question 16-28 to address the above issues. As of January 25, 2019, formal submission of this supplemental response to Question 16-28 for staff review was pending. The staff issued RAI 520-9642, Question 16-64, to request that the applicant address the above concerns not already addressed by the supplemental response to RAI 197-9051, Question 16-28.

16.4.8.6 Additional issues stemming from unique NuScale operations

In RAI 228-9034 (ML17257A227), Question 16-30, Subquestion a1, the staff requested that the applicant explain how the SDM limits of LCO 3.1.1 would be ensured when an NPM is being moved in the reactor pool in Mode 4, during which no neutron monitoring of the core is provided, and sampling of the reactor coolant to verify boric acid concentration is within limits to satisfy

SR 3.1.1.1 is not possible. Based on the applicant's response (ML17317B552) to RAI 228-9034, Question 16-30, Subquestion a1, the staff understands that entry into Mode 4 will require the unit operating staff to verify by calculations and supporting analyses that the boron concentration will remain adequate to assure that reactivity stays within limits. Implementation will be by plant procedures prepared by the COL holder. The response also revised the Bases for the surveillance column Note ("Not required to be performed in MODE 4.") for SR 3.1.1.1 ("Verify SDM to be within limits specified in the COLR.") to clarify that: (1) the SDM shall remain within limits during MODE 4 operations; (2) the reactivity calculations in the SDM verification must account for MODE 4 conditions, and (3) SR 3.0.4 requires verifying that SDM will be met in MODE 4 before entry from MODE 5, as well as before entry from MODE 3.

The staff believes the last sentence of the revised passage of the SR 3.1.1.1 Bases would be clearer with the following suggested edits, indicated by markup:

> Therefore reactivity calculations performed to verify the SDM conservatively account for passive phenomena<u>,</u> ~~that may occur~~ such as temperature changes and Xenon decay<u>,</u> ~~affects~~ that ~~could~~ <u>may</u> occur <u>and affect reactivity</u> during ~~the~~ MODE 4 conditions.

With the assurance that sufficient SDM is established in the reactor vessel to prevent criticality in MODE 4, prior to entry into MODE 4 from MODE 3 and also from MODE 5, and the statement in Revision 1 of DCA Part 2, Tier 2, Section 12.3.4.1, that the area radiation monitors in the reactor building pool area satisfy 10 CFR 50.68(b)(6), which provides assurance that excessive radiation during module movement in the pool can be detected, the staff concludes that the proposed changes to the Bases for SR 3.1.1.1 are acceptable, provided: (1) the above clarifying edits are incorporated in the Bases for SR 3.1.1.1, (2) that after filling the CNV using the CFDS in MODE 3 in preparation for entering MODE 4, the CNV water boric acid concentration will be verified by sampling (in consideration of the potential communication of reactor coolant and borated water in the CNV through the open RRVs), and (3) the initial response to RAI 228-9034, Question 16-30, Subquestion a1, is revised to be consistent with the above described staff interpretation of the response.

In a November 6, 2018, public meeting teleconference (ML18337A019), the applicant stated it will provide a supplemental response to RAI 228-9034, Question 16-30, Subquestion a1, to address the above issues; in addition, the applicant stated it will include in this supplemental response, its response to RAI 512-9634, Question 16-60, Subquestion 9, concerning the proposed definition of SDM, as described in SER Section 16.4.2.2. In its supplemental response (ML19045A350) to RAI 228-9034, Question 16-30, Subquestion a1, the applicant made the requested clarification of the Bases for SR 3.1.1.1. The applicant also stated that procedures required by COL Item 13.5-1 will adequately control operational Mode transitions and will address sampling of the containment contents or alternative means of assuring the reactivity condition will remain within limits. The applicant stated that the requested clarification to the previous response to RAI 228-9034, Question 16-30, Subquestion a1, is addressed by its response (ML19029B572) to RAI 512-9634, Question 16-60, Subquestion 9. In this response, the applicant revised the SDM definition as requested. The staff finds the above changes acceptable because they clarify the SDM definition and will ensure that reactivity in Mode 4 is maintained within limits. Therefore, RAI 228-9034, Question 16-30, Subquestion a1, and RAI 512-9634, Question 16-60, Subquestion 9, are resolved. **The staff is tracking these changes as a confirmatory item under RAI 512-9634, Question 16-60, Subquestion 9.**

The staff therefore concludes that the above additional issues stemming from unique NuScale operations are resolved.

16.4.8.7 Conclusion for Surveillance Requirements

The staff will complete the review of Surveillance statements and Frequencies of Section 3.1 though Section 3.8 following resolution of the identified open items.

16.4.9 Design Features (Chapter 4, Sections 4.1 through 4.3)

In 10 CFR 50.36(c)(4), the NRC requires that TS include design features, which it states are "those features of the facility such as materials of construction and geometric arrangements, which, if altered or modified, would have a significant effect on safety that are not covered in [the] categories" of safety limits, limiting conditions for operation, or surveillance requirements.

GTS Chapter 4 addresses the requirement to include design features not covered in the LCOs of Chapter 3. Chapter 4 contains information about site location, core design, and fuel storage design.

16.4.9.1 Section 4.1, Site Location

Section 4.1 contains bracketed information regarding site-specific information about the facility's location, site and exclusion boundaries, and the facility's low population zone, which must be provided by applicants for a COL referencing the NuScale certified design. Section 16.5 of this SER summarizes the COL information items included in the NuScale DCA Part 4.

16.4.9.2 Section 4.2, Reactor Core

Section 4.2 contains reactor core design requirements. Subsection 4.2.1, 'Fuel Assemblies," specifies the design number of fuel assemblies and allowed composition of fuel rod cladding and fuel material, and requires that fuel assemblies be limited to fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with fuel safety design bases. It also permits a limited number of lead test assemblies that have not completed representative testing to be placed in non-limiting core regions.

Subsection 4.2.2, "Control Rod Assemblies," specifies the number of CRAs and the permitted control materials used in the CRAs.

16.4.9.3 Section 4.3, Fuel Storage

Subsection 4.3.1, "Criticality," contains design requirements of the spent fuel storage racks to prevent criticality of the stored fuel assemblies. The spent fuel storage racks are designed and maintained with stored fuel assemblies with a maximum U-235 enrichment of 5.0 weight percent; a $k_{eff} \leq 0.95$ with the fuel storage pool fully flooded with borated water at a minimum soluble boron concentration of 800 ppm; a $k_{eff} < 1.00$ with the fuel storage pool fully flooded with unborated water; and a nominal center-to-center distance between fuel assemblies placed in the spent fuel storage racks. To meet GDC 61, NuScale is incorporating neutron absorbing material into the design of the spent fuel racks to maintain the specified subcriticality and ensure safe operation. Subsection 5.5.12, "Spent Fuel Rack Neutron Absorber Monitoring Program," is included in Section 5.5 to ensure safe operation by requiring periodic physical examination and neutron attenuation testing, and performance-based examinations. SER Section 16.4.10.3

further discusses Subsection 5.5.12. Subsection 4.3.2, “Drainage,” requires the spent fuel pool to be designed and maintained to prevent inadvertent draining of the pool below 20 ft above the spent fuel pool floor. Subsection 4.3.3, “Capacity,” contains information regarding how the spent fuel pool shall be designed and maintained to hold a specified maximum number of fuel assemblies.

16.4.9.4 Conclusion for Chapter 4

The staff found Chapter 4 to be consistent with the W-STS and the NuScale design as described in the Revision 2 of DCA Part 2, Tier 2. The staff concludes that Chapter 4 satisfies 10 CFR 50.36(c)(4) and is therefore acceptable.

16.4.10 Administrative Controls (Chapter 5, Sections 5.1 through 5.7)

16.4.10.1 Sections 5.1, Responsibility; 5.2, Organization; and 5.3, Facility Staff Qualifications

Staff reviewed these sections and found that they are consistent with W-STS and are therefore acceptable. For Subsection 5.2.2, “Facility Staff,” SER Chapter 18 evaluates NuScale’s minimum licensed staffing requirements while one to twelve NPMs are operating in Mode 1, 2, or 3.

16.4.10.2 Section 5.4, Procedures

<u>Subsection 5.4.1, Procedures</u>

Because the Subsection 5.4.1 opening paragraph, and paragraphs a, b, c, d, and e are consistent with the W-STS, the staff concludes these paragraphs are acceptable.

In RAI 197-9051 (ML17237C008), Question 16-27, the staff requested that the applicant augment RCDR, Revision 0 (ML17005A136), by stating how the availability and testing of NuScale nonsafety-related SSCs, which NuScale has determined do not meet any of the four LCO selection criteria of 10 CFR 50.36(c)(2)(ii), are intended to be controlled by a NuScale Nuclear Power Plant COL holder, with reference to the regulatory basis for the controls. In its response (ML17291A299) to Question 16-27, the applicant indicated it did not plan to revise the RCDR as requested, and stated the following:

> Controls over availability and testing of equipment that does not satisfy the criteria of 10 CFR 50.36 for inclusion within the scope of the Technical Specifications are implemented in accordance with the descriptions in the FSAR (as defined in 10 CFR 50.59(a)(3)) by 10 CFR 50.59, 10 CFR 52 subparts B and C, and the "Processes for Changes and Departures" requirements expected to be incorporated in the NuScale design certification rulemaking.

The response indicated that “specific programs and procedures” for implementing the controls “are described in the FSAR,” and cited the examples of Section 13.4, "Operational Programs,” and Section 17.4, “Reliability Assurance Program (RAP).” The response also referred to the maintenance rule, 10 CFR 50.65, and to proposed COL action item 13.5-1, which states

> A COL applicant that references the NuScale Power Plant design certification will describe the site-specific procedures that provide administrative control for activities that are important for the safe operation of the facility consistent with the guidance provided in [Regulatory Guide] 1.33, Revision 3.

The staff determined that the nonsafety-related SSCs in question are unlikely to be within the scope of the above controls precisely because they are designated as not important to the safe operation of the facility. Consequently, the staff needed additional information about the intended controls for nonsafety-related SSCs.

In a February 21, 2018, public meeting teleconference, the staff and the applicant discussed the intended controls for the availability, maintenance, and operation of SSCs that are nonsafety related in the NuScale design. Equivalent SSCs in previous reactor designs are safety related and typically the subject of TS LCOs. The staff questioned whether the scope of GTS 5.4.1.a, which requires a COL holder for a NPM to establish, implement, and maintain applicable procedures recommended in RG 1.33, “Quality Assurance Program Requirements (Operation),” Revision 3, issued June 2013, will include procedures for these nonsafety-related SSCs. The staff suggested that a list of nonsafety-related SSCs may include the following:

- Control room and reactor building filtered ventilation systems
- Control room and reactor building ventilation system filters
- Control room ventilation system and emergency air bottle breathing air and passive temperature control system (control room habitability system)
- Control room envelope boundary integrity control and unfiltered inleakage testing
- Reactor building and radwaste building ventilation system isolation on high radiation signal from 00-RBV-RE-0510, 00-RBV-RE-0511, and 00-RBV-RE-0512 to mitigate a release of radioactivity
- Accident monitoring instrumentation for Type B and C variables, as defined by Revision 4 of Regulatory Guide 1.97, and supported by the safety display and indication system (SDIS)
- Offsite ac electrical power sources
- Onsite standby ac electrical power sources and support systems
- Onsite backup low voltage ac source and support systems
- Offsite and onsite ac electrical power distribution system
- Onsite dc electrical power sources, battery parameters, battery chargers, and dc to ac inverters
- Onsite dc electrical power distribution system
- Containment system instrumentation sensors not included in design reliability assurance program (D-RAP) (see FSAR Table 17.4-1)
- RCS instrumentation sensors not included in D-RAP (see FSAR Table 17.4-1)
- Diesel generator starting air, lube oil, and fuel oil storage and transfer
- Containment Flood and Drain System

- Containment Evacuation System
- Reactor Building Crane controls to preclude dropping a NPM in Mode 4
- Reactor Building Ventilation System for battery room hydrogen control
- CVCS, DWS, and BAS

The applicant agreed that procedures recommended in RG 1.33 would not address nonsafety-related SSCs. In a letter dated March 19, 2018 (ML18078B311), and in a supplemental response (ML18158A530) to RAI 197-9051, Question 16-27, the applicant revised GTS Section 5.4 by adding a requirement for procedures for such nonsafety-related SSCs in paragraph 5.4.1.f, which states the following:

> 5.4.1 Written procedures shall be established, implemented, and maintained covering the following activities:
>
> f. Procedures that implement the availability and reliability controls applicable to structures, systems, or components as described in the owner-controlled requirements manual.

This added provision provides reasonable assurance that appropriate written procedures will be established, implemented, and maintained to satisfy the availability and reliability requirements for SSCs within the scope of the owner-controlled requirements manual.

Establishment of an owner-controlled requirements manual by a COL holder is assured by COL action item 16.1-2, which Revision 2 of DCA Part 2, Tier 2, Section 16.1.1, describes as follows:

> 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.

However, for the staff to complete the evaluation of Section 5.4, the applicant needs to submit a description of the contents, including the covered SSCs, of the owner-controlled requirements manual, and add a statement to DCA Part 2 that incorporates the owner-controlled requirements manual into DCA Part 2, so that changes to it will clearly be subject to the requirements of 10 CFR 50.59. In a November 6, 2018, public meeting teleconference (ML18337A019), the applicant stated it would informally communicate to the staff the DCA Part 2 locations of passages that describe the owner-controlled requirements manual. Pending verification of these references in DCA Part 2, **the staff is tracking the adequacy of the owner-controlled requirements manual descriptions therein, as an open item under RAI 197-9051, Question 16-27.**

16.4.10.3 Section 5.5, Programs and Manuals

<u>Subsection 5.5.1, Offsite Dose Calculation Manual (ODCM);</u>
<u>Subsection 5.5.2, Radioactive Effluent Control Program; and</u>
<u>Subsection 5.5.3, Component Cyclic or Transient Limit</u>

These three Specifications are consistent with W-STS, and are therefore acceptable.

Subsection 5.5.4, Steam Generator (SG) Program

Together with Subsection 3.4.9, “SG Tube Integrity,” and Subsection 5.6.5, “SG Tube Inspection Report,” the SG Program ensures that SG tube integrity is maintained. The staff compared these subsections against the corresponding requirements in W-STS as modified by STS change traveler TSTF-510-A, Revision 2. The staff also took into consideration the unique design of the NPM SGs to evaluate the proposed: (1) criteria for assessing the as found condition of a SG tube following a tube inspection, (2) SG tube integrity performance criteria (tube structural integrity, accident induced primary to secondary Leakage limits, and operational primary to secondary Leakage limits), (3) SG tube plugging criteria, (4) criteria for selection of SG tube inspection intervals and the tubes to be inspected, and (5) provisions for monitoring operational primary-to-secondary Leakage. SER Section 5.4.2, “SG Program,” further discusses the staff’s technical evaluation of SG-related GTS requirements.

After reviewing the applicant’s response (ML18032A391) to RAI 306-9234 (ML17353A373), the staff concluded that portions of Questions 16-38, 16-39, 16-40, and 16-41 remained unresolved. Therefore, the staff issued RAI 490-9556 (ML18166A372) with followup Questions 16-45, 16-46, 16-47, and 16-49. For each followup question, a brief description of the issue, the applicant’s response (ML18215A261), and the basis for resolution and closure of the issue are given below.

Followup Question or Subquestion	Unresolved Question or Subquestion	Description of Issue and its Resolution
16-45	16-38	The applicant’s response explained that in FSAR Section 15.1.5, “Steam Piping Failures Inside and Outside of Containment,” the Main Steam Line Break (MSLB) accident analyses conservatively assume 300 gallons per day primary-to-secondary leakage. This explanation is responsive to staff’s question in RAI 16-45, and,therefore, the first part of Question 16-45 is closed.
16-45	16-41.a5	The staff asked applicant to justify accident induced SG tube leakage limit. The postulated steam generator tube failure (SGTF) accident analysis assumes 150 gallons per day primary-to-secondary leakage and is described in DCA Part 2, Tier 2, Section 15.6.3, "Steam Generator Tube Failure (Thermal Hydraulic)." The SGTF evaluation assumes only one intact SG is eligible for leakage and thus assumes only 150 gallons per day leakage. This limit is equal to the primary-to-secondary leakage limit in LCO 3.4.5. The applicant’s response to Question 16-45 stated, “As described in the response to RAI question 16-38, no accident-induced leakage (AIL) performance criterion in addition to the operational leakage criterion is required for the NuScale SG design based on structural integrity performance evaluations.” Finding the provided justification sufficient, the staff concludes that the assumed 150 gallons per day primary-to-secondary leakage is

		acceptable for both AIL and normal leakage. Therefore, the second part of Question 16-45 is also closed.
16-49.b	16-38	Revision 1 of Subsection B 3.4.9, LCO section, corrected the reference to LCO 3.4.5, “RCS Operational LEAKAGE.” Therefore, Question 16-49, Subquestion b, is closed.
16-46.a.1	16-39	The staff asked applicant to justify the statement, “because of the substantial design differences, any list of exceptions [in the GTS and Bases to TSTF-510-A] is not appropriate for comparison.” The response to Question 16-46, Subquestion a.1, states in part, “The proposed TS and the associated Bases, in combination with the balance of the DCA and RAI responses and other docketed interactions with the staff describe the basis for review of the TS as submitted.” The staff finds that this statement accurately describes the basis for reviewing the SG tube integrity requirements in the GTS. Therefore, Question 16-46, Subquestion a.1, is closed.
16-46.a.2	16-39.a	The staff asked applicant to justify and describe differences with TSTF-510-A, Rev. 2, in TR-1116-52011-NP. Since this report was never intended to discuss departures from approved TSTF travelers, which were already incorporated into STS Rev. 4, the staff concludes that the applicant’s responses to RAI-questions concerning NuScale GTS departures from TSTF-510-A provide sufficient justification for the proposed GTS requirements for maintaining SG tube integrity. Therefore, Question 16-46, Subquestion a.2, is closed.
16-46.b	16-39.i	The staff asked applicant to justify using “or” in the phrase “affected **or** potentially affected” in Subsection 5.5.4, paragraph d.3; the corresponding phrase in the W-STS Subsection 5.5.9 uses “and.” The applicant’s response changed “or” to “and” in the quoted phrase of paragraph d.3, which is consistent with the STS, and acceptable. Therefore, Subquestion 16-46.b is closed.
16-47	16-40	The staff asked applicant to justify the longer SG tube inspection interval without inspection, degradation, and flaw growth experience with NuScale SG tubes, or propose more frequent inspections for the first few cycles of the initial NPMs put into operation, in GTS Subsection 5.5.4, paragraph d.2. The applicant’s response to Question 16-47 adequately described the basis for the proposed SG tube inspection interval. The staff finds the SG tube inspection interval in NuScale’s proposed GTS acceptable based on operating experience for SGs with Alloy 690 TT tubes, the use of industry best practices in water

		chemistry, and the overall requirements of the SG program. Therefore, Question 16-47 is closed.
16-49.a	16-41.b3	As requested, the applicant revised Subsection B 3.4.9, LCO section, second paragraph, by replacing "repair criteria" with "plugging criteria." Therefore, Subquestion 16-49.a is closed.
16-49.c	16-41.b7	As requested, the applicant revised Subsection B 3.4.9, Actions section, second paragraph, by replacing "repair criteria" with "plugging criteria." Therefore, Subquestion 16-49.c is closed.
16-49.d	16-41.b9	In Subsection B 3.4.9, SRs section, as requested, the applicant revised the Bases for SR 3.4.9.1 and SR 3.4.9.2 by replacing "repair criteria" with "plugging criteria." Therefore, Subquestion 16-49.d is closed.
16-49.e	16-41.b10	In Subquestion 16-41.b10, the staff asked the applicant to address an omitted closing sentence about crack indications in the fourth paragraph of the Bases for SR 3.4.9.1. This sentence is included in TSTF-510-A, and states: "If crack indications are found in any SG tube, the maximum inspection interval for all affected and potentially affected unit SGs is restricted by Specification 5.5.4 until subsequent inspections support extending the inspection interval." The applicant's response restored the omitted sentence. Therefore, Subquestion 16-49.e is closed.

The staff included new Question 16-48 in RAI 490-9556 (ML18166A372) to request that the applicant change a reference to 10 CFR Part 100 in the ASA section of Subsection B 3.4.9 to the correct citation of 10 CFR 50.34(a)(1). This is the applicable regulation specifying the allowed radiological dose consequence criteria, according to 10 CFR 100.21. The applicant's response (ML18215A261) made the requested change by replacing 10 CFR 100 with 10 CFR 50.34 in Subsection B 3.4.9, in both the ASA section and the References section. In addition, the response made the conforming changes of (1) removing an unnecessary reference to 10 CFR 100 in the References section of Subsection B 3.1.1; and (2) replacing 10 CFR 100 with 10 CFR 50.34 in two places in the Background section, and in the References section of Subsection B 3.3.1. Therefore, RAI 490-9556, Question 16-48, is closed.

The NRC staff determined that the GTS incorporate TSTF-510 as intended, consistent with the NuScale design, and conclude that GTS Subsections 3.4.5, 3.4.9, 5.5.4, and 5.6.5 together satisfy 10 CFR 50.36(c), Subsections (2), (3), and (5), and that Subsections B 3.4.5 and B 3.4.9 satisfy 10 CFR 50.36(a) and are therefore acceptable.

Subsection 5.5.5, Secondary Water Chemistry Program;
Subsection 5.5.6, Explosive Gas and Storage Tank Radioactivity Monitoring Program;
Subsection 5.5.7, TS Bases Control Program; and
Subsection 5.5.8, Safety Function Determination Program (SFDP)

These four program Specifications are consistent with the W-STS, and are therefore acceptable.

Subsection 5.5.9, Containment Leakage Rate Testing Program

The staff verified that this subsection is consistent with the W-STS and satisfies the requirements of 10 CFR 50.54(o) and 10 CFR 50, Appendix J. This program is referenced by SR 3.6.1.1 ("Perform required visual examinations and leakage rate testing in accordance with the Containment Leakage Rate Testing Program.") and SR 3.6.2.5 ("Verify the combined leakage rate for all containment bypass leakage paths is ≤ 0.6 L_a when pressurized to ≥ 951 psia.") In Subsection B 3.6.1, the ASA section defines P_a as "the calculated peak containment internal pressure 951 psia (P_a) resulting from the limiting DBA"; the LCO section states, "Leakage integrity is assured by performing local leak rate testing (LLRT) and containment inservice inspection. Total LLRT leakage is maintained < 0.60 L_a in accordance with 10 CFR 50, Appendix J (Ref. 1). Satisfactory LLRT and ISI examination are required for containment OPERABILITY." SER Section 16.4.8.1 discusses the disposition of SR 3.6.2.5, which is the subject of RAI 506-9614, Question 16-55.

Subsection 5.5.10, Setpoint Program

In RAI 196-9050 (ML17237C007), Question 16-16, Subquestion c, the staff requested that the applicant clarify its decision to designate the LTSP as the NSSS. In its response (ML17291A482), the applicant affirmed its choice of the LTSP as the NSSS. In a February 21, 2018, public meeting teleconference with the applicant, the staff pointed out that because of this choice, and to satisfy 10 CFR 50.36(c)(1)(ii)(A), the SP needed to specify the value of the LTSP for each required automatic protection instrumentation function, in addition to the values of the NTSP, AFT, and ALT. In a supplemental response (ML18352B166) to Question 16-16, Subquestion c, the applicant added LTSP to Specification 5.5.10, paragraphs b and e. Pending verification that this change is included in DCA Revision 3, the staff is tracking RAI 196-9050, Question 16-16, Subquestion c, as resolved confirmatory.

SER Chapter 7 gives the staff's evaluation of TR-0616-49121-P, "NuScale Instrument Setpoint Methodology." **Verification that Specification 5.5.10, paragraph b, of Revision 3 of DCA Part 4, includes the document date or revision number of the staff approved version of TR-0616-49121-P is considered a part of the confirmatory item for Question 16-16, Subquestion c, of RAI 196-9050**.

Subsection 5.5.11, Surveillance Frequency Control Program

SER Section 16.4.8.3 gives the staff's evaluation of this program.

Subsection 5.5.12, Spent Fuel Storage Rack Neutron Absorber Monitoring Program

Because the GTS adopt the content of the improved version of this program, as stated in STS change traveler TSTF-557, Revision 1, which the staff recently approved, this Subsection is acceptable. SER Section 9.1.1 gives the staff's evaluation of the response to RAI 316-9222, Question 9.1.1-19.

Conclusion for Section 5.5

Based on the above evaluation, the staff concludes that Section 5.5 is consistent with the W-AP1000-STS and acceptable.

16.4.10.4 Section 5.6, Reporting Requirements

Subsection 5.6.1, Annual Radiological Environmental Operating Report, and
Subsection 5.6.2, Radioactive Effluent Release Report

These report Specifications are consistent with the W-AP1000-STS report Specifications, and are therefore acceptable.

Subsection 5.6.3, CORE OPERATING LIMITS REPORT (COLR)

In RAI 472-9445 (ML18130A984), Question 16-43, the staff requested that the applicant revise Subsection 5.6.3, paragraph b, by listing the documents describing analytical methods previously reviewed and approved by the NRC and used to determine the core operating limits. In its response (ML18163A417) to RAI 472-9445, Question 16-43, the applicant inserted this list in paragraph b with brackets to indicate the list is a COL action item. Along with this bracketed list, the applicant also inserted the following bracketed reviewer's note:

> b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:
>
> [----------------------------------REVIEWER'S NOTE---------------------------------
> The COL applicant shall confirm the validity of each listed document and the listed Specifications for the associated core operating limits, or state the valid NRC approved analytical method document and list of associated Specifications.
>
> The COL applicant shall state the valid core reload analysis methodology document and list of associated Specifications.
> --]

Each document is listed by title, revision number, and date along with the LCOs supported by the analytical methods described in the document. The proposed change to paragraph b is consistent with the W-AP1000-STS presentation regarding level of detail and format. SER Section 4.3 gives the staff's evaluation of the listed methodologies. The staff verified that the response's listed methodologies and associated LCOs accurately cite the FSAR sections and topical reports provided in DCA Part 2. And Specification 5.6.3 encloses these methodology references and associated LCOs within brackets to indicate their designation as COL action items. The staff confirmed that the cited topical reports and FSAR references match Revision 2 of the DCA. The staff also confirmed incorporation of this list in Specification 5.6.3 of Revision 2 of DCA Part 4. SER Section 4.3 gives the staff's evaluation of the cited methodologies on the reactor core design and operating limits. Based on the applicant's response and incorporation of the methodology list in Specification 5.6.3, RAI 472-9445, Question 16-43 is resolved and closed.

Subsection 5.6.4, RCS PRESSURE AND TEMPERATURE LIMITS REPORT (PTLR)

This report is consistent with the W-STS PTLR Specification, and is therefore acceptable. SER Section 5.3 gives the staff's evaluation of TR-1015-18177, "Pressure and Temperature Limits Methodology," Revision 1.

Subsection 5.6.5, Steam Generator Tube Inspection Report

This report is consistent with the W-STS SG tube inspection report and NRC staff approved improvements described in TSTF-510-A, and is, therefore, acceptable.

Omitted reports which are included in STS Section 5.6

As described in SER Section 16.4.1.6, the GTS do not include an LCO for PAM instrumentation; accordingly, Section 5.6 omits the PAM Report.

16.4.10.5 Section 5.7, High Radiation Area

Because Section 5.7 is identical to the W-STS Section 5.7, it is acceptable.

16.4.10.6 Conclusion for Chapter 5

The staff will complete its review of Chapter 5 following resolution of the identified open items.

16.4.11 TSTF Traveler Disposition

The applicant presented its evaluation of TSTF travelers in Table C-1 of Appendix C of Revision 1 of the RCDR. Appendix C states the following:

> The NuScale power plant design is different from previously licensed nuclear power plants. Plant operations are also different from previously operating nuclear power plants. Experience and lessons learned from the improved technical specifications were extensively considered during development of the proposed GTS.
>
> Consideration of the contents of travelers does not imply direct correspondence or functional equivalent unless described as such. The NuScale design is not addressed in the traveler process, so none of the travelers are explicitly applicable to the NuScale GTS. Rather the intent of the traveler was considered based on available information related to the changes made or proposed to the STS. The term 'implemented' as used below indicates the traveler changes were made to the extent practicable and appropriate for the NuScale design.
>
> The table provides details of the extent of consideration of features from the listed STS travelers that correspond with specifications included in the proposed NuScale GTS.

The staff reviewed the applicant's rationale for choosing or declining to incorporate applicable changes of each TSTF traveler that the applicant had evaluated. Travelers that were not yet approved by the staff when Revision 2 of the NuScale DCA was submitted may be recognized by having no "-A" appended to the traveler number. In Table 16.4.11-1 to Table 16.4.11-6 below, italics denotes material quoted from RCDR Table C-1. Table 16.4.11-7 lists commitments that a licensee must make as a condition of NRC approval of plant-specific TS changes based on TSTF traveler changes already incorporated into Revision 4 of the STS. The status of each traveler listed in the tables below is based on its approval status when Revision 2 of DCA Part 4 was submitted to the NRC on October 30, 2018 (ML18311A006, ML18310A284), or on a subsequent approval through December 31, 2018. In this SER section, the phrase "TSTF travelers proposed for incorporation" means TSTF traveler changes or intent that the applicant has considered and found to be appropriate for the NuScale design, and has proposed for the GTS to the extent practicable.

- Table 16.4.11-1 — *Approved TSTF travelers proposed for incorporation:* 490-A, 493-A, 510-A, 513-A, 523-A, 529-A, 545-A, 546-A, 557-A, 563-A, 565-A

- Table 16.4.11-2 — *Approved TSTF travelers not proposed for incorporation:* 426-A, 432-A, 501-A, 505-A, 514-A, 522-A, 542-A, 547-A

- Table 16.4.11-3 — *Unapproved TSTF travelers under NRC staff review and proposed for incorporation:* 541

- Table 16.4.11-4 — *Unapproved TSTF travelers under NRC staff review but not proposed for incorporation:* 521, 530, 531, 535, 536, 537, 538, 540, 551

- Table 16.4.11-5 — *Withdrawn previously approved or pending TSTF travelers:*
  Proposed for incorporation: 534
  Not proposed for incorporation: 454, 515, 525, 553

- Table 16.4.11-6 — *Disposition of T-travelers:*
  Proposed for incorporation:
  502-T, 548-T, 555-T
  Not proposed for incorporation:
  494-T, 504-T, 520-T, 524-T, 526-T, 527-T, 528-T, 532-T, 533-T, 539-T, 543-T, 549-T, 550-T, 556-T, 558-T, 559-T, 560-T, 561-T

- Table 16.4.11-7 — *Conditions for adoption of TSTF changes, which are included in STS Revision 4, and*
  Included in GTS: 359-A, 366-A, 425-A, 427-A
  Not included in GTS: 409-A, 422-A, 425-A

(For the tables in this SER section, shading in the first column denotes that the listed traveler is incorporated, as described.)

16.4.11.1 Approved TSTF travelers proposed for incorporation

The RCDR Table C-1 indicated the following approved travelers were proposed for incorporation, consistent with the NuScale design.

Table 16.4.11-1

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Incorporation
490-A, Revision 1	*Deletion of E-Bar Definition and Revision to RCS Specific Activity Tech Spec*	*The proposed NuScale TS implement the TSTF changes modified to reflect the NuScale specific limits.* Changes are reflected in GTS Section 1.1, "Definitions," and Subsection 3.4.8, "RCS Specific Activity"

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Incorporation
493-A, Revision 4	*Clarify Application of Setpoint Methodology for LSSS Functions* in STS Section 3.3 and offer the option to implement an STS Section 5.5 setpoint program (SP)	*The proposed NuScale TS Sections 3.3 and 5.5 implement Option B of the traveler through inclusion of a Setpoint Program in Section 5.5* (GTS 5.5.10).
510-A, Revision 2 (not addressed in RCDR Table C-1)	"Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection."	GTS 1.1, 3.4.5, 3.4.9, 5.5.4, and 5.6.5 incorporate TSTF-510
513-A, Revision 3	*Revise PWR Operability Requirements and Actions for RCS Leakage* Detection *Instrumentation*, which affects W-STS 3.4.15.	*The contents of* this *traveler were considered during construction of proposed* GTS Subsection *3.4.7, "RCS Leakage Detection Instrumentation." The NuScale leakage detection methods are significantly different from those used in PWRs* accounted for in W-STS, CE-STS, and W-AP1000-STS.
523-A, Revision 2	*Generic Letter 2008-01, Managing Gas Accumulation*	*Affects GTS 3.5.2, "Decay Heat removal System"* *The NuScale DHRS was conservatively determined to have the potential for accumulation of non-condensible gases. Instrumentation is provided to permit monitoring of the volume where gases could accumulate, and safety analyses are performed assuming the presence of gases in the volume above the instrumentation.* *NuScale design incorporates design features to detect postulated accumulation of noncondensible gases and safety analyses are conservatively performed assuming gases are present in the quantity that could exist before indication of their presence.*
529-A, Revision 4	*Clarify Use and Application Rules. Affects Section 1.3, "Completion Times," and Section B 3.0, "SR Applicability,"* of the B&W-STS, W-STS, and CE-STS.	*The changes to W-STS by this traveler are included as appropriate in the GTS, in* • *Section 1.3, See response (ML17269A210) to RAI 156-9031, Question 16-3* • *LCO 3.0.2 and Bases* • *LCO 3.0.3 Bases* • *LCO 3.0.4 Bases* • *LCO 3.0.5 Bases, See discussion of response to RAI 157-9033, Question 16-12 (open item) in SER Section 16.4.4.1.* • *SR 3.0.2 Bases* • *SR 3.0.3 Bases, See discussion of response to RAI 157-9033, Question 16-15 in SER Section 16.4.4.2*
545-A, Revision 3	*TS Inservice Testing (IST) Program Removal & Clarify SR*	*The changes described in the TSTF were implemented in appropriate locations*

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Incorporation
	Usage Rule Application to Section 5.5 Testing	*throughout the proposed NuScale GTS (Section 1.1, "Definitions," Subsections 3.1.9, "Boron Dilution Control," 3.4.4, "Reactor Safety Valves (RSVs)," 3.4.6, "CVCS Isolation Valves," 3.5.1, "ECCS," 3.5.2, "Decay Heat Removal System," 3.6.2, "CIVs," 3.7.1, "MSIVs," 3.7.2, "Feedwater Isolation.")* *The IST program was incorporated into the* GTS *Definitions section. SRs applicable to similar components associated with functions or SSCs in the GTS were revised to be consistent with the traveler. Consistent with the TSTF traveler, the IST program description is not provided in 5.5 Programs. The following statement is included after the first paragraph of Subsection B 3.0 SR Applicability: "SR 3.0.2 and SR 3.0.3 apply in Chapter 5 only when invoked by a Chapter 5 Specification."* See response (ML17257A450) to RAI 157-9033, Question 16-14. Also see response (ML19010A409) to RAI 512-9634, Question 16-60, Subquestion 49.
546, Revision 0	*Revise* average power range [neutron flux] monitor *(APRM) Channel Adjustment SR;* affects *BWR* STS reactor protection system *(RPS) instrumentation.*	*The NuScale design does not incorporate APRMs, however the excore neutron monitoring system that provides a similar function incudes requirements for calibration by comparison with a heat balance. The limits on acceptable deviation between the neutron flux monitor indication and the value measured by heat balance distinguishes between conservative and non-conservative differences, and establishes a limit and required actions to make adjustments if the difference is not in the conservative direction.* *The allowances provided by the TSTF traveler are incorporated in the proposed NuScale* Subsection *3.3.1, "Module Protection System Instrumentation,"* SR 3.3.1.2, surveillance column Note 3b, which applies to Functions: 1a, "Reactor Trip Signal (RTS)" on "High Power Range Linear Power"; and 1b, "Demineralized Water System Isolation (DWSI)" on "High Power Range Linear Power."

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Incorporation
557-A, Revision 1	*Spent fuel storage rack neutron absorber monitoring program*	See response to RAI 316-9222, Question 9.1.1-19 regarding Specification 5.5.12 conformance to this traveler's proposed program language.
563-A, Revision 0	*Revise definition of Channel Calibration and Channel Operational Test to permit each segment of an instrument loop to have its own Frequency controlled by the SFCP.*	*The proposed modification of the COT definition, and other instrumentation surveillance definitions, implements STS change traveler TSTF-563-A;* See discussion of resolution of RAI 156-9031, Subquestion 16-2c in SER Section 16.4.2.2.
565-A, Revision 1	*Clarify the Term Operational Convenience in the LCO 3.0.2 Bases to correct an inconsistency between the LCO 3.0.2 and LCO 3.0.3 Bases, and to restore the original intent of the phrase described in Generic Letter (GL) 87-09.*	Dated May 9, 2017 The traveler makes no change to the Technical Specifications and is consistent with LCO 3.0.2. Licensees may adopt this traveler using the Technical Specifications Bases Control Program. In Revision 2 of DCA Part 4, the Bases for LCO 3.0.2 and LCO 3.0.3 incorporate the changes of this traveler.

16.4.11.2 Approved TSTF travelers <u>not</u> proposed for incorporation

The RCDR Table C-1 indicated the following approved travelers were not proposed for incorporation

Table 16.4.11-2

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Non-incorporation
426-A, Revision 5	*Revise or Add Actions to Preclude Entry into LCO 3.0.3 - RITSTF Initiatives 6b & 6c*	*The topical report does not apply to NuScale. The TS have been written to minimize the potential for conditions leading to explicit or default entry into LCO 3.0.3*
432-A, Revision 1	*Change in TS End States (WCAP-16294)*, which affects W-STS action requirements	*The topical report does not apply to NuScale. The proposed NuScale TS including operational paradigm is significantly different from that addressed in the TSTF.*
501-A, Revision 1	*Relocate Stored Fuel Oil and Lube Oil Volume Values to Licensee Control*, which affects W-STS 3.8.3, "Diesel Fuel Oil, Lube Oil, and Starting Air"	*The NuScale design does not require or include safety-related onsite diesel generators. Therefore, no corresponding specification is proposed, and the TSTF traveler is not applicable.*
505-A, Revision 1	*Provide Risk-Informed Extended Completion Times - RITSTF Initiative 4b, which affects W-STS and CE-STS*	*NuScale has deferred a final decision to incorporate this* traveler in a future version of the DCA (Revision 1 or later).

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Non-incorporation
514-A, Revision 3	*Revise BWR* STS *Operability Requirements and Actions for RCS Leakage* Detection *Instrumentation*	*NuScale leakage detection instrumentation and methods are not similar to those used in* General Electric (GE) *BWRs.* Therefore, changes related to this traveler are not applicable to the NuScale design.
522-A, Revision 0	*Revise Ventilation System SRs to Operate for 10 hours per Month*	*The NuScale design does not include credited ventilation systems and no TS are proposed.*
542-A, Revision 1	*Reactor Pressure Vessel Water Inventory Control*	*The NuScale design and operating paradigm does not include operations at reduced inventories or water levels.* *The NuScale design and operations, including refueling activities, will not result in a potential for water inventory in the reactor vessel to be reduced to the level of the fuel. All refueling operations are conducted with the reactor vessel and fuel remaining submerged in the reactor pool.*
547-A, Revision 1	*Clarification of Rod Position Requirements;* affects W-STS Section *3.1 reactivity control specifications related to rod position requirements.*	*The NuScale core design is significantly different from that of large PWRs. The traveler was not incorporated* in Subsections 3.1.4, "Rod Group Alignment Limits," 3.1.5, "Shutdown Group Insertion Limits," and 3.1.6, "Regulating Group Insertion limits," *because the proposed changes are not necessary.*

16.4.11.3 Unapproved TSTF travelers under NRC staff review and proposed for incorporation

The RCDR Table C-1 indicated the following unapproved traveler is under NRC staff review but was still proposed for incorporation.

Table 16.4.11-3

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Disposition
541, Revision 0 Draft Revision 1 provided on June 6, 2018 for NRC staff feedback	*Add Exceptions to SRs When the Safety Function is Being Performed*	*The passive NuScale design includes a limited number of valves with potential for the addressed condition to exist. Exceptions consistent with the traveler were incorporated into the SRs of Subsection 3.6.2, "Containment Isolation Valves."* Since the staff has not yet approved TSTF-541, Revision 0, and considering the above observations, the staff could not determine whether the proposed application of the intent of the traveler is needed for the NuScale GTS. See evaluation of response (ML17291A299) to RAI 197-9051 (ML17237C008),

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Disposition
		Question 16-28 in SER Section 16.4.8.5; in the response to this question, the applicant applied the "conceptual basis" of this traveler and added notes and phrases to SRs not only for valves, but for Class 1E isolation devices associated with electrical power to the MPS, reactor trip breakers, and pressurizer heater trip breakers. Pending completion of the review of this response, and the above proposed requirements, the staff is tracking RAI 197-9051, Question 16-28 as an open item.

16.4.11.4 Unapproved TSTF travelers under NRC staff review but not proposed for incorporation

The RCDR Table C-1 indicated the following unapproved travelers were under NRC staff review but were not proposed for incorporation.

Table 16.4.11-4

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Disposition
521, Revision 0	*Exclusion of Time Constants from Channel Operational Tests in* W-STS *Specifications 3.3.1,* "Reactor Protection System (RPS) Instrumentation," *and 3.3.2*, "Engineered Safety Features Actuation System (ESFAS) Instrumentation."	*The credited NuScale instrumentation* specified by GTS Subsection 3.3.1, "Module Protection System Instrumentation," *does not include corresponding time constants or dynamic compensation.* Therefore, the changes made by this traveler are not applicable for incorporation in GTS Subsections 3.3.1 and B 3.3.1.
530, Revision 0	*Clarify SR 3.0.3* and Section B 3.0, Bases for SR 3.0.3 *to be Consistent with Generic Letter 87-09*	The initial version of NuScale SR 3.0.3 had incorporated the content of this traveler, but that content was removed in the response (ML17257A450) to RAI 157-9033, Question 16-15, because in 2012 the staff had declined to review this traveler. See Section 16.4.4.2 of this SER.
531, Revision 0	*Revision of Specification 3.8.1*, "AC Sources – Operating," *Required Actions B.3.1 and B.3.2.*	*The NuScale design does not depend on emergency AC power sources and there are no corresponding requirements in the proposed NuScale TS.*
535, Revision 0	*Revise Shutdown Margin Definition to Address Advanced Fuel Designs – Only affects BWR STS definition of SDM.*	*Not applicable* to NuScale SDM definition.
536, Revision 0	*Resolve CE Digital TS Inconsistencies Regarding CPCs and CEACs* – affects	*The NuScale digital control system does not include CE core protection calculators (CPCs) or control element assembly calculators (CEACs), however the underlying purpose of*

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Disposition
	CE-STS *instrumentation and control specifications*	*the traveler was considered in the development of the Actions and SRs applicable to the corresponding NuScale specifications (3.3.1, "Module Protection System,".3.3.2, "Reactor Trip System Logic and Actuation," 3.3.3, "ESFAS Logic and Actuation," and 3.3.4, "Manual Actuation Functions.")* *The NuScale TS considered the reason for* the proposed changes *to the STS by the TSTF traveler. The specification Actions and SRs do not include conditions unrelated to system Operability.* The staff concludes that this traveler is not adopted because it is not applicable.
537, Revision 0	*Increase containment isolation valve (CIV) Completion Times; update of TSTF-373;* affects CE-STS Subsection 3.6.3	*TSTF traveler is based on a risk-informed technical basis applicable to CE designed plants.* *The NuScale design is not consistent with the CE design and the technical basis for the traveler is not applicable to the NuScale design.*
538, Revision 0	*Add Actions to preclude entry into LCO 3.0.3 – Risk-Informed TSTF (RITSTF) Initiatives 6b & 6c.* Affects B&W-STS Specifications for *containment spray and cooling systems, and emergency ventilation systems.*	*The NuScale design does not include a containment spray system or emergency ventilation systems. Containment cooling is a passive function utilizing heat transfer through the [containment vessel] walls to the reactor pool. There are no credited ventilation systems in the design that need TS.*
540, Revision 0	*Add Exceptions to SRs When the Safety Function is Being Performed;* affects *BWR specifications for secondary containment and control room ventilation and filtration systems.*	*The NuScale design does not incorporate a containment gas treatment system similar to that used by the secondary containment design of BWRs. Nor does the NuScale design credit the control room ventilation systems with performing a function that is required to be performed in response to a DBA.* The staff concludes that this traveler is not adopted because it is not applicable.
551, Revision 3	*Revise Secondary Containment SRs; affects Bases for BWR STS Subsection 3.6.4, "Secondary Containment."*	This traveler is no*t applicable because the NuScale design does not include or credit a secondary containment or similar functional boundary and does not include a corresponding specification.*

16.4.11.5 Withdrawn previously approved or pending TSTF travelers

The RCDR Table C-1 indicated the following previously approved or pending travelers had been withdrawn by the TSTF.

Table 16.4.11-5

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Disposition
454, Revision 3	Staggered Integrated ESFAS Testing (WCAP-15830); affects CE-STS ESFAS and ESF surveillance tests	*The topical report does not apply to NuScale design, which uses ESFAS and ESF systems that are not similar to those accounted for in the CE-STS.*
515, Revision 0	*Revise Post-Accident Monitoring Instrumentation based on Regulatory Guide 1.97, Rev. 4 and NEDO-33349*, which affects GE-BWR4-STS (NUREG-1433) and GE-BWR6-STS (NUREG-1434) Section 3.3.3.	*Withdrawn by TSTF. Also, the NuScale design does not include any PAM instrumentation that meets the threshold for inclusion in the TS,* as described in the evaluation of the response (ML17291A482) to RAI 196-9050 (ML17237C007), Question 16-22 in Subsection 16.4.1.6 of this SER.
525, Revision 0	*Post Accident Monitoring instrumentation Requirements (WCAP-15981-NP-A).* The NRC declined to review this traveler in a letter dated March 7, 2011 (ML103420584).	Since this *TSTF Traveler is specific to PAM instrumentation selection for Westinghouse designs*, it would not apply to NuScale PAM instrumentation for Type B and C variables. The applicant found no *PAM instrumentation* for Type B and C variables meeting *the threshold for inclusion in GTS* as described in the evaluation of the response (ML17291A482) to RAI 196-9050 (ML17237C007), Question 16-22 in Subsection 16.4.1.6 of this SER.
534, Revision 0	*Clarify Application of Pressure Boundary Leakage Definition.* Affects W-STS Subsections 3.4.5 and B 3.4.5, "RCS Operational LEAKAGE."	The initial version of GTS Section 1.1 (added a sentence to LEAKAGE definition), Subsection 3.4.5, "RCS Operational LEAKAGE," and Subsection B 3.4.5 had incorporated this traveler, even though the TSTF had previously withdrawn it following receipt of NRC staff comments. See discussion of response (ML17269A210) to RAI 156-9031, Subquestion 16-2f in Section 16.4.2 of this SER. The staff is tracking RAI 156-9031, Subquestion 16-2f, as an open item.
553, Revision 1	*Add Action for Two Inoperable Control Room Emergency Air Temperature Control System (CREATCS) Trains; affects B&W-STS, W-STS, and CE-STS.*	*The TSTF withdrew this traveler.* In addition, since the *NuScale design does not credit a CREATCS or a similar* function*, the GTS [do] not include a corresponding specification.*

16.4.11.6 Disposition of T-travelers

Some industry-proposed minor improvements to STS have been documented in TSTF travelers that the TSTF chose not to submit for NRC staff review. These travelers are identified with a "T" appended to the sequential TSTF number, (e.g., TSTF-494-T). Such a T-traveler may become an approved traveler following staff approval of a license amendment request to incorporate the associated changes into an individual licensee's plant-specific TS. Following are the T-travelers evaluated by the applicant as described in RCDR Table C-1.

Table 16.4.11-6

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Disposition
494-T, Revision 2	*Correct Bases Discussion of Figure B 3.0-1*, which is related to Bases for W-STS LCO 3.0.6	*NuScale has not incorporated the expanded explanation provided by the TSTF, consistent with NUREG-2194, Rev. 0 and the ESBWR GTS that did not incorporate the TSTF.*
502-T, Revision 1	*Correct Containment Isolation Valve Bases Regarding Closed Systems*, which affects W-STS B 3.6.3, "Containment Isolation Valves"	*The proposed NuScale Bases* for GTS Subsection 3.6.2, "Containment Isolation Valves," *incorporate the corrected wording.*
504-T, Revision 0	*Revised the Main Steam Isolation Valve (MSIV) and Main Feedwater Isolation Valve (MFIV) Specifications to Provide Actions for Actuator Trains*, which affects W-STS 3.7.1, "MSIVs" and 3.7.2, "MFIVs"	The NuScale MSIV and feedwater isolation valve (FWIV) designs do not incorporate dual actuators such that the TSTF traveler changes should be incorporated. Therefore, changes related to this traveler were not incorporated in GTS 3.7.1 "MSIVs" and GTS 3.7.2, "Feedwater Isolation."
520-T, Revision 0	*Correct* conflicting statements in CE-STS Subsection B *3.1.4,* "Control Element Assembly (CEA) Alignment," Actions section of Bases for *Required Action A.1.*	The proposed NuScale TS Bases do not include the conflicting statements. Therefore, this traveler is not applicable for incorporation in GTS Subsection B 3.1.4, "Rod Group Alignment Limits."
524-T, Revision 0	*Clarify the Application of SR 3.0.2 to SR 3.1.3.2, MTC;* affects Bases for W-STS *SR 3.1.3.2*	*The NuScale moderator temperature coefficient (MTC) specification SR does not include Notes that correspond directly with those in* W-STS Subsection 3.1.3 and Subsection B 3.1.3, Surveillance Requirements section, *and the NuScale Bases are consistent with the proposed specifications.* Therefore, this traveler is not applicable for incorporation in GTS Subsection B 3.1.3, "Moderator Temperature Coefficient."
526-T, Revision 0	*Clarify* SR section of Bases for STS Subsection concerning surveillance column *Notes regarding momentary transients outside the load band.* Affects	*The NuScale design does not depend on emergency AC power sources and there are no corresponding requirements in the proposed NuScale TS.* Therefore, this

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Disposition
	W-STS Subsection B 3.8.1, SRs section, discussion of emergency diesel generator load tests required by SR 3.8.1.3 Note 2, SR 3.8.1.14 Note 1, and SR 3.8.1.15 Note 1.	traveler is not applicable for incorporation in GTS.
527-T, Revision 0	*Incorporate* Commitments *in Model Applications* for TSTF travelers *as Reviewer's Notes* in Bases of affected STS.	*This traveler describes the use of Reviewer's Notes in the Bases of the published STS. The TSTF traveler describes the management and identification of commitments into travelers and Bases. The proposed NuScale TS are based on the licensing basis provided in the DCA.* See Subsection 16.4.11.7 below.
528-T, Revision 0	*Bracket Accident Analysis Discussion in LCO 3.4.4.* Affects B&W-STS (NUREG-1430) Bases Subsection B 3.4.4, "RCS Loops – MODES 1 and 2."	*The NuScale plant does not include 'loops' or associated TS. The proposed NuScale Bases reflect the safety analyses applicable to the design and the use of brackets for non-COLA items is contrary to DC/COL-ISG-8.* Therefore, this traveler is not applicable for incorporation in GTS Bases.
532-T, Revision 0	*Eliminate Incorrect Reference to Appendix R in the Remote Shutdown System* (RSS) *Bases*; affects CE-STS Bases Subsection B 3.3.5	*The incorrect reference in the CE-*STS *Bases* Subsection B 3.3.5 References section *is not included in the NuScale Bases for the RSS,* G*TS* Subsection B *3.3.5. Therefore, this traveler is not applicable for incorporation in the GTS Bases.*
533-T, Revision 0	*Remove COLR and PTLR Revision and Date Relocation Provisions Added by TSTF-363, -408, and -419; affects B&W-STS, W-STS, and CE-STS*	*The NuScale administrative specifications in* GTS Section 5.6 *that describe the COLR and PTLR will include the number, title, date, and NRC staff approval document for the methodology by NRC letter and date. Pending an update to Specification 5.6.4 for the revision and date of the RCS pressure and* ***temperature limits methodology technical report and NRC approval document and date, TSTF-533-T is being tracked as a confirmatory item.***
539-T, Revision 0	*Correction of Post-Accident Monitoring (PAM) Instrumentation Bases;* affects B&W-STS, W-STS and CE-STS PAM instrumentation Bases.	*The NuScale PAM design does not include any variables that result in inclusion of a PAM technical specification.* See discussion of response (ML17291A482) to RAI 196-9050 (ML17237C007), Question 16-22 in Section 16.4.1.6 of this SER.
543-T, Revision 0	*Clarify Verification of Time Constants; affects W-STS Section 3.3*	*Not applicable. The credited NuScale instrumentation does not include corresponding time constants or dynamic compensation.*

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Disposition
548-T, Revision 0	*Safety Function Determination Program (SFDP) Changes for Consistency;* affects W-STS *Subsection 5.5.8 program description.*	*The NuScale SFDP description provided in* GTS Subsection *5.5.8 is consistent with the intended content as previously described in* B&W-STS, CE-STS, and W-AP1000-STS.
549-T, Revision 0	*Correct* Actions section of Bases for W-STS Subsection 3.2.4, *"Quadrant Power Tilt Ratio (QPTR)."*	*The NuScale design does not include monitoring of a QPTR or QPTR-like variable. The TSTF is specific to an inappropriate wording that existed in the W-STS Bases.* This traveler is not incorporated because it does not apply to NuScale GTS Section 3.2 requirements for core operating limits.
550-T, Revision 1	*Correct Misleading Bases Statements in Systems not Required to be Operable in Shutdown Modes; affects* B&W-STS, W-STS, and CE-STS *Bases for* TS *systems that perform a support function for other* TS *systems required to be operable when the facility is shutdown. Specifically, cooling water systems.*	*The NuScale design uses a large reactor pool as the* Ultimate Heat Sink *(UHS) during operational modes and during transition and refueling operations.* The applicability of *Specification 3.5.3,* "UHS," *is "At all times" and the Bases reflect this. There are no other corresponding systems in the NuScale design that are required to be operable during* operational modes, which also *provide support functions during shutdown conditions.* Therefore, this traveler is not applicable to the NuScale design, and the GTS and Bases.
555-T, Revision 0	*Clarify the Nuclear Instrumentation Bases Regarding the Detection of an Improperly Loaded Fuel Assembly;* affects B&W-STS, W-STS, and CE-STS *Section 3.9 nuclear instrumentation specifications*.	*The NuScale design includes neutron flux instrumentation at the refueling tool that corresponds to and performs a function similar to that of the source range neutron flux monitors used at PWRs. Therefore, the GTS includes Specification 3.8.1, "Nuclear Instrumentation."* In that GTS Subsection B 3.8.1 does not include a description of an ability to detect an improperly loaded fuel assembly, this traveler is incorporated.
556-T, Revision 1	*Modify TS 3.8.1 and TS 3.8.2 Bases to Address an Open Phase Condition*	This traveler is not applicable to the GTS because the GTS have no LCOs for AC sources, since *the NuScale design does not credit offsite electrical power.*
558-T, Revision 0	*Clarify SR Bases added by TSTF-523; affects PWR and BWR specifications related to ECCS, decay heat removal, RHR, SDC and Containment Spray systems.*	*Affects GTS 3.5.2, "Decay Heat Removal System (DHRS)"* *The NuScale DHRS was conservatively determined to have the potential for accumulation of non-condensible gases. Instrumentation is provided to permit monitoring of the volume where gases could accumulate, and safety analyses are performed assuming the presence of gases in the volume above the instrumentation.*

TSTF Traveler No.	Purpose of Traveler	Applicant's Rationale for Disposition
		NuScale design incorporates design features to detect postulated accumulation of noncondensible gases and safety analyses are conservatively performed assuming gases are present in the quantity that could exist before indication of their presence. The staff concludes that clarification of the Bases for the SRs to check for gas accumulation is not applicable to the GTS Bases for SR 3.5.2.2.
559-T, Revision 0	*Revise Bases to Reflect Revised SL Pressure Limit; affects BWR STS Bases for Subsections 2.1.1, 3.3.1, and 3.3.6.*	*This traveler resolves an issue specific to the GE design that does not correspond to a NuScale SSC or function. Therefore, this traveler is not applicable to NuScale GTS.*
560-T, Revision 0	*Addition of SRs Note for Turbine Bypass System, LCO 3.7.7 (BWR4 STS) and LCO 3.7.6 (BWR6 STS.)*	*This traveler is not applicable because no corresponding SSC or function in the NuScale design is credited or otherwise would result in inclusion in the GTS. There is no LCO for a Turbine Bypass System.*
561-T, Revision 0	*Bracket LCO 3.5.1 LCO Note in the ISTS;* affects BWR-STS Subsection 3.5.1, "ECCS," LCO Note	*Addition of optional content or reviewer's notes to STS are not applicable or appropriate for DCA GTS submittal. Only COL-specific content is presented as bracketed content to be modified by applicants referencing the certified design.*

16.4.11.7 Conditions for adoption of TSTF changes, which are included in STS Revision 4

The staff reviewed the previously approved TSTF travelers, which are included in the W-STS CE-STS, or both, and which the applicant determined contain changes appropriate for the NuScale design and GTS, to verify that the applicant had satisfied the conditions stated in the traveler for including the changes. These travelers, some of which are marked with an asterisk (*) because they are addressed by TSTF-527-T, are given below:

Table 16.4.11-7

TSTF Traveler No.	Purpose of Traveler	Conditions for Adoption / Reviewer's Note(s)
359-A, Revision 9	The STS Revision 2 version of LCO 3.0.4 is revised to allow entry into a MODE or other specified condition in the Applicability while relying on the associated ACTIONS, provided (a) the ACTIONS to be entered permit continued operation in the MODE or other specified condition in the Applicability for an unlimited period of time,	"Need to perform qualitative risk assessment for NuScale; the scope of the PWR risk assessment should focus on the transition from MODE 5 to 4, MODE 4 to 3, MODE 3 to 2, and MODE 2 to 1. Also consider unique events to the MODE of interest, such as LTOP protection. Should address "initiating events of interest" in each Mode of operation, and determine if any systems, if inoperable, or any parameters outside its limits, should

TSTF Traveler No.	Purpose of Traveler	Conditions for Adoption / Reviewer's Note(s)
	(b) a risk assessment has been performed which justifies the use of LCO 3.0.4, or (c) an NRC approved allowance (i.e., a Required Actions Note) is provided in the Specification to be entered ("LCO 3.0.4.c is applicable"). The STS Revision 2 version of LCO 3.0.4 allows entry into a MODE or a specified condition in the Applicability, while relying on the associated ACTIONS, only if (a) the ACTIONS permit continued operation in the MODE or other specified condition in the Applicability for a unlimited period of time, or (b) if an NRC approved allowance is provided in the Specification to be entered (LCO 3.0.4 is not applicable"). SR 3.0.4 is also revised to reflect the concepts of the changes to LCO 3.0.4. The applicability of LCO 3.0.4 and SR 3.0.4 is expanded to include transition into all MODES or other specified conditions in the Applicability, except when required to comply with ACTIONS or that are part of a shutdown of the unit.	preclude entering its Mode of Applicability as allowed by LCO 3.0.4.b." SER Section 16.4.4.1 discusses making a NuScale design-related change to the Bases for LCO 3.0.4. "...In this context, a unit shutdown is defined as a change in MODE or other specified condition in the Applicability associated with transitioning from MODE 1 to MODE 2, and MODE 2 to MODE 3 and not PASSIVELY COOLED, and not PASSIVELY COOLED to PASSIVELY COOLED." Pending resolution of this suggested clarification, the staff is tracking the Subsection B 3.0 Bases for LCO 3.0.4 as an open item under RAI 9642, Question 16-63.
*366-A, Revision 0	Elimination of Requirements for a Post Accident Sampling System (PASS); inserts Reviewer's Note in W-STS 5.5.3, PASS CE-STS 5.5.3, PASS	(W-STS) "This program may be eliminated based on the implementation of WCAP-14986, Rev. 1, "Post Accident Sampling System Requirements: A Technical Basis," and the associated NRC Safety Evaluation dated June 14, 2000, and implementation of the following commitments: 1. [LICENSEE] has developed contingency plans for obtaining and analyzing highly radioactive samples of reactor coolant, containment sump, and containment atmosphere. The contingency plans will be contained in [emergency plan implementing procedures] and [implemented with the implementation of the License amendment]. Establishment of contingency plans is considered a regulatory commitment.

<table>
<tr><th>TSTF Traveler No.</th><th>Purpose of Traveler</th><th>Conditions for Adoption / Reviewer’s Note(s)</th></tr>
<tr><td></td><td></td><td>2. The capability for classifying fuel damage events at the Alert level threshold has been established for [PLANT] at radioactivity levels of 300 mCi/cc dose equivalent iodine. This capability will be described in emergency plan implementing procedures and implemented with the implementation of the License amendment. The capability for classifying fuel damage events is considered a regulatory commitment.
3. [LICENSE] has established the capability to monitor radioactive iodines that have been released to offsite environs. This capability is described in our emergency plan implementing procedures. The capability to monitor radioactive iodines is considered a regulatory commitment.”
In its response (ML19010A409) to RAI 512-9634 (ML18333A021), Question 16-60, Subquestion 44, the applicant stated the following, in part:
NuScale has addressed this issue in the responses to eRAI listed below:
8837 dated May 18, 2018 (ML18138A383)
9044 dated Oct 31, 2017 (ML17304B483)
9278 dated May 16, 2018 (ML18136A870)
Additionally, NuScale is pursuing an explicit exemption to address the NuScale design and need for a PASS. That exemption request is schedule for submittal in the first quarter of 2019.
The exemption provides a regulatory basis for concluding that a PASS does not significantly contribute to NuScale plant safety or accident recovery. Therefore no technical specification program is required.
The staff is tracking the disposition of the planned exemption request as a confirmatory item under RAI 512-9634, Question 16-60, Subquestion 44.</td></tr>
<tr><td>*409-A, Revision 2</td><td>Containment Spray System Completion Time Extension (CE NPSD-1045-A); inserts Reviewer’s Note in CE-STS Bases Subsection B 3.6.6.A, “Containment Spray and</td><td><u>Required Action A.1</u>
“Utilization of the 7 day Completion Time for Required Action A.1 is dependent on the licensee adopting CE NPSD-1045-A (Ref. 6) and meeting the requirements of the Topical Report and the associated Safety Evaluation including the following commitment:</td></tr>
</table>

TSTF Traveler No.	Purpose of Traveler	Conditions for Adoption / Reviewer's Note(s)
	Cooling Systems (Atmospheric and Dual)," Actions section.	'[LICENSEE] has enhanced its Configuration Risk Management Program, [as implemented under 10 CFR 50.65(a)(4), the Maintenance Rule,] to include a Large Early Release Fraction assessment to support this application.' Otherwise, a 72 hour Completion Time applies." *This traveler does not apply to NuScale which has no containment spray system.*
*422-A, Revision 1	Change in Technical Specifications End States (CE NPSD-1186); inserts Reviewer's Note in CE-STS Bases Subsections: 1) B 3.3.6, "ESFAS Logic and Manual Trip (Digital)," Actions section. The Bases discussion of Required Actions E.1 and E.2 is also expanded and clarified. 2) B 3.3.8, "Containment Purge Isolation Signal (CPIS) (Digital)," Actions section. The Bases discussion of Required Actions B.1 and B.2 is also expanded and clarified. 3) B 3.3.9, "Control Room Isolation Signal (CRIS) (Digital)," Actions section. 4) B 3.4.6,"RCS Loops – MODE 4," Actions section. The Bases discussion of Required Action A.2 is also expanded and clarified. 5) B 3.5.4, "Refueling Water Tank (RWT)," Actions section. The Bases discussion of Required Action B.1 is also expanded and clarified. 6) B 3.6.2, "Containment Air Locks (Atmospheric and Dual)," Actions section. The Bases discussion of Required Actions B.1 and B.2 is also expanded and clarified. 7) B 3.6.3, "Containment Isolation Valves	CE-STS (Digital) Subsections B 3.3.6 Required Actions E.1 and E.2; B 3.3.8 Required Actions B.1 and B.2; B 3.3.9 Required Actions A.1, B.1, B.2, C.1, C.2.1, and C.2.2 B 3.4.7 Required Action A.2; B 3.5.4 Required Action B.1; B 3.6.2 Required Actions D.1 and D.2; B 3.6.3 Required Actions G.1 and G.2; B 3.6.4 Required Actions B.1 and B.2 B 3.6.5 Required Actions B.1 and B.2 B 3.6.6A Required Actions B.1 and B.2; and F.1 and F.2; B 3.7.7 Required Actions B.1 and B.2; B 3.7.8 Required Actions B.1 and B.2; B 3.7.9 Required Actions B.1 and B.2; B 3.7.10 Required Actions B.1 and B.2; B 3.7.11 Required Actions C.1 and C.2; B 3.7.12 Required Actions B.1 and B.2; B 3.7.13 Required Actions C.1 and C.2; B 3.7.15 Required Actions C.1 and C.2; B 3.8.1 Required Actions G.1 and G.2; B 3.8.4 Required Actions D.1 and D.2; and B 3.8.7 Required Actions B.1 and B.2 contain the following Reviewer's Note: Adoption of a MODE 4 end state requires the licensee to make the following commitments: 1. [LICENSEE] will follow the guidance established in Section 11 of NUMARC 93-01, "Industry Guidance for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," Nuclear Management and Resource Council, Revision 3, July 2000. 2. [LICENSEE] will follow the guidance established in Revision 2 of WCAP-16364-NP, "Implementation Guidance for Risk Informed Modification to Selected Required Action End States at Combustion Engineering NSSS Plants (TSTF-422)," Westinghouse, May 2010.

TSTF Traveler No.	Purpose of Traveler	Conditions for Adoption / Reviewer's Note(s)
	(Atmospheric and Dual)," Actions section. The Bases discussion of Required Actions G.1 and G.2 is also expanded and clarified. 8) B 3.6.4A, "Containment Pressure (Atmospheric)," Actions section. The Bases discussion of Required Actions B.1 and B.2 is also expanded and clarified. 9) B 3.6.5, "Containment Air Temperature (Atmospheric and Dual)," Actions section. The Bases discussion of Required Actions B.1 and B.2 is also expanded and clarified. 10) B 3.6.6A, "Containment Spray and Cooling Systems (Atmospheric and Dual)," Actions section. 11) B 3.7.7, "Component Cooling Water (CCW) System," Actions section. The Bases discussion of Required Actions B.1 and B.2 is also expanded and clarified. 12) B 3.7.8, "Service Water System (SWS)," Actions section. The Bases discussion of Required Actions B.1 and B.2 is also expanded and clarified. 13) B 3.7.9, "Ultimate Heat Sink (UHS)," Actions section. The Bases discussion of Required Actions B.1 and B.2 is also expanded and clarified. 14) B 3.7.10, "Essential Chilled Water (ECW) System," Actions section. The Bases discussion of Required Actions B.1 and B.2 is also expanded and clarified. 15) B 3.7.11, "Control Room Emergency Air Condition-ing System (CREACS),"	*The staff determined that the generic TS Chapter 3 default Actions for shutting down a unit after the time allowed for restoring compliance with the LCO has expired, and the final state of the unit, are acceptable. SER Table 16.4.7-1 summarizes these Actions.*

TSTF Traveler No.	Purpose of Traveler	Conditions for Adoption / Reviewer's Note(s)
	Actions section. The Bases discussion of Required Actions C.1 and C.2 is also expanded and clarified. 16) B 3.7.12, "Control Room Emergency Air Temperature Control System (CREATCS)," Actions section. 17) B 3.7.13, "Emergency Core Cooling System (ECCS) Penetration Room Emergency Air Control System (PREACS)," Actions section. The Bases discussion of Required Actions C.1 and C.2 is also expanded and clarified. 18) B 3.7.15, "PREACS," Actions section. The Bases discussion of Required Actions C.1 and C.2 is also expanded and clarified. 19) B 3.8.1, "AC Sources – Operating," Actions section. 20) B 3.8.4, "DC Sources – Operating," Actions section. The Bases discussion of Required Actions D.1 and D.2 is also expanded and clarified. 21) B 3.8.7, "Inverters – Operating," Actions section.	
425-A, Revision 3	Relocate Surveillance Frequencies to Licensee Control - RITSTF Initiative 5b." Affects B&W-STS, W-STS, and CE-STS. Relocates most periodic surveillance frequencies and associated Bases to documentation required by a new program specified in STS Section 5.5. "Administrative Controls – Programs and Manuals," Subsection 5.5.18, "Surveillance Frequency Control Program."	SER Section 16.4.8.2 gives the staff's evaluation of the applicant's response (ML17317B552) to RAI 228-9034 (ML17257A227), Question 16-30, Subquestion d, concerning how GTS and Bases should reflect incorporation of a SFCP. The staff observed that Revision 1 of DCA Part 4 included new GTS Subsection 3.4.10, "LTOP Valves." However, the applicant did not list the base Frequencies and associated Bases of new SR 3.4.10.1 and SR 3.4.10.3 and associated Bases in Revision 2 of DCA Part 2, Table 16.1-1. **The staff is tracking the 24-month Frequency and its Bases under RAI 512-9634, Question 16-60, Subquestion 1, as a confirmatory item** pending verification that

TSTF Traveler No.	Purpose of Traveler	Conditions for Adoption / Reviewer's Note(s)
		DCA Part 2, Table 16.1-1, has been updated to include the Frequency and Bases of new SR 3.4.10.1 and SR 3.4.10.3. In the supplementary response (ML19010A409) to RAI 375-9201, Question 5.2.5-7, the applicant added new SR 3.7.3.1. **The staff is tracking the update of Table 16.1-1 to include SR 3.7.3.1 as a part of the above confirmatory item.**
*427-A, Revision 2	Allowance for Non Technical Specification Barrier Degradation on Supported System OPERABILITY. Addition of LCO 3.0.9 and associated Bases includes a Reviewer's Note regarding commitments. Affects Section B 3.0, "LCO Applicability," of B&W-STS, W-STS, and CE-STS.	Adoption of LCO 3.0.9 requires the licensee to make the following commitments: 1. [LICENSEE] commits to the guidance of NUMARC 93-01, Revision 2, Section 11, which provides guidance and details on the assessment and management of risk during maintenance. 2. [LICENSEE] commits to the guidance of NEI 04-08, "Allowance for Non Technical Specification Barrier Degradation on Supported System OPERABILITY (TSTF-427) Industry Implementation Guidance," March 2006. Because NRC approval of this traveler relied upon a design specific general risk assessment, NuScale must provide an equivalent assessment to include this traveler in GTS Section 3.0. SER Section 16.4.3 discusses the applicant's response (ML17257A450) to RAI 157-9033, Questions 16-8 and 16-13.

16.4.11.8 Conclusion for TSTF traveler disposition

The staff will complete the review of NuScale's disposition of TSTF travelers following resolution of the identified open items.

16.5 <u>Combined License (COL) Information Items</u>

Table 16.5-1 lists and describes COL information sub-items, as enumerated by the staff, related to bracketed information in Revision 2 of DCA Part 4, GTS and Bases. In Revision 2 of DCA Part 2, Section 16.1.1, "Introduction to Technical Specifications," describes COL Information Item 16.1-1, as follows:

> 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.

Table 16.5-1 NuScale COL Information Item 16.1-1

Sub-Item Number	COL 16.1-1 Sub-Item Description	GTS or Bases Location
	Confirm or update each listed critical heat flux ratio [reactor core Safety Limit correlation CHFR value]	2.1.1.1
	Insert statement describing Site Location .... Insert statement describing Site and Exclusion Boundaries .... Insert statement describing Low Population Zone	4.1 4.1.1 4.1.2
	Replace "[Plant Manager]" with equivalent site-specific title .... Replace "[Shift Manager (SM)]" with equivalent site-specific title .... Replace "[Plant Manager]" with equivalent site-specific title .... Replace "[specified corporate officer]" with equivalent site-specific title .... Replace "[Plant Manager]" with equivalent site-specific title .... Replace "[shift manager]" with equivalent site-specific title...........................	5.1.1 5.1.2 5.2.1 5.2.1 5.5.1.c.2 5.7.2.a.1
	Replace "[FSAR/QA Plan]" with equivalent site-specific title	5.2.1
	Confirm or update each listed [document describing the NRC reviewed and approved analytical methods used to determine the core operating limits, and the supported LCOs that reference the limits in the COLR]..........................	5.6.3.b
	Replace "[2013 Edition]" with the site specific edition of Section III of the ASME, Boiler and Pressure Vessel Code in the Applicable Safety Analyses section of the Bases for RCS Pressure SL, and in reference 2 in the References section of the Bases...	B 2.1.2
	Replace "[2013 Edition]" with the site specific edition of Section XI, Article IWA-5000 of the ASME, Boiler and Pressure Vessel Code in reference 3 in the References section of the Bases..	B 2.1.2
	Confirm or update each listed [document describing the NRC reviewed and approved analytical methods used to determine the core operating limits, and the supported LCOs that reference the limits in the COLR]..........................	5.6.3.b

The staff is tracking the completion of the COL information sub-item list as an open item.

In Revision 2 of DCA Part 2, Section 16.1.1 describes COL Information Item 16.1-2 as follows:

> 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.

SER Section 16.4.10.2 discusses GTS 5.4.1.f, which requires that written procedures be established, implemented, and maintained covering the following activity:

> Procedures that implement the availability and reliability controls applicable to structures, systems, or components as described in the owner-controlled requirements manual.

The staff is tracking the adequacy of the DCA Part 2 descriptions of the contents of the owner-controlled requirements manual as an open item under RAI 197-9051, Question 16-27.

The staff will complete its review of the COL information items following resolution of the above open items, and completion of the review of the GTS and Bases, as described in SER Section 16.4.

16.6 Conclusion

The staff will complete its review of whether the proposed NuScale GTS and Bases comply with 10 CFR 50.34, 10 CFR 50.36, and 10 CFR 50.36a upon resolution of the [RAI-Questions] described above.