

Response to SDAA Audit Question

Question Number: A-16.3.3.1-6

Receipt Date: 11/06/2023

Question:

The Applicability of NuScale US460 SDAA generic TS LCO 3.3.1 Function 19.b, SSI Actuation on Low Low Main Steam Pressure, is MODE 1, MODE 2(k), and MODE 3(k) where footnote (k) states,

“With containment [water] level below the L-1 interlock
with reactor narrow range temperature above the T-3 interlock,
or
with containment water level below the L-1 interlock
with V-1 not active (both FWIVs open).”

Bases page B 3.3.1-15 states, “The WR RCS Thot T-3 interlock is active when WR [wide range] RCS Thot is less than approximately 340 °F.”

ACTIONS Condition I applies after 6 hours of discovery that Function 19.b has one or two channels inoperable, if the channels are still inoperable and one channel is not placed in trip or/and the other channel is not placed in bypass), or immediately upon discovery that three or more channels are inoperable, and requires placing the unit in MODE 2 within 6 hours and in MODE 3 and PASSIVELY COOLED within 36 hours.

(a) Explain why the T-3 interlock, which is based on RCS Thot wide range indication, either blocks or enables Function 19.a, which is applicable based on reactor [coolant system] narrow range [indicated] temperature being > T-3 interlock WR RCS Thot temperature setpoint?

(b) Which RCS narrow range temperature instrument channels (hot or cold?) are used to determine when the unit is within the Applicability of Function 19.b? How many of these narrow range temperature channels must indicate > T-3 interlock to be within the Applicability?

Response:

The T-3 interlock is based on wide range RCS hot temperature as stated in the bases for GTS 3.3.1. The reference to reactor narrow range temperature in GTS Table 3.3.1-1 footnote (k) is incorrect. NuScale revises GTS Table 3.3.1-1 footnote (k) to read:

(k) With containment water level below the L-1 interlock with RCS temperature above the T-3 interlock, or with containment water level below the L-1 interlock with V-1 not active (both FWIVs open).

Markups of the affected changes, as described in the response, are provided below:

Table 3.3.1-1 (page 5 of 8)
Module Protection System Instrumentation

FUNCTION	APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS	REQUIRED CHANNELS	CONDITIONS
19. Low Low Main Steam Pressure			
a. RTS	1, 2 ^(a) , 3 ^(a)	4 per SG	D
b. SSI	1, 2 ^(k) , 3 ^(k)	4 per SG	I
c. DWSI	1, 2 ^(b) , 3 ^(b)	4 per SG	H
20. High Steam Superheat			
a. RTS	1	4 per SG	D
b. SSI	1	4 per SG	I
c. DWSI	1	4 per SG	H
21. Low Steam Superheat			
a. RTS	1 ^(l)	4 per SG	D
b. SSI	1 ^(l) , 2 ^(m) , 3 ^(m)	4 per SG	I
c. DWSI	1 ^(l)	4 per SG	H

- (a) When capable of withdrawal of more than one CRA.
- (b) When capable of withdrawal of more than one CRA and the RCS temperature above the T-3 interlock.
- (k) With containment level below the L-1 interlock with ~~reactor narrow range~~RCS temperature above the T-3 interlock, or with containment water level below the L-1 interlock with V-1 not active (both FWIVs open).
- (l) With V-1 not active (both FWIVs open).
- (m) With containment water level below the L-1 interlock and with V-1 not active (both FWIVs open).

Table 3.3.1-1 (page 5 of 8)
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19. Low Low Main Steam Pressure			
a. RTS	1, 2 ^(a) , 3 ^(a)	4 per SG	D
b. SSI	1, 2 ^(k) , 3 ^(k)	4 per SG	I
c. DWSI	1, 2 ^(b) , 3 ^(b)	4 per SG	H
20. High Steam Superheat			
a. RTS	1	4 per SG	D
b. SSI	1	4 per SG	I
c. DWSI	1	4 per SG	H
21. Low Steam Superheat			
a. RTS	1 ^(l)	4 per SG	D
b. SSI	1 ^(l) , 2 ^(m) , 3 ^(m)	4 per SG	I
c. DWSI	1 ^(l)	4 per SG	H

- (a) When capable of withdrawal of more than one CRA.
- (b) When capable of withdrawal of more than one CRA and the RCS temperature above the T-3 interlock.
- (k) With containment water level below the L-1 interlock with reactor narrow range temperature above the T-3 interlock, or with containment water level below the L-1 interlock with V-1 not active (both FWIVs open).
- (l) With V-1 not active (both FWIVs open).
- (m) With containment water level below the L-1 interlock and with V-1 not active (both FWIVs open).

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

5. When the N-2H interlock is not active, the operating bypass is automatically removed for the following:
 - the High Power Range Positive Rate reactor trip;
 - the High Power Range Positive Rate DWSI actuation;
 - the High Power Range Negative Rate reactor trip; and
 - the High Power Range Negative Rate DWSI actuation.

Reactor Tripped Interlock, RT-1

The Reactor Tripped Interlock, RT-1 is active when both divisional reactor trip breakers indicate open. The RT-1 interlock is required to be active for the ESFAS interlocks T-2, T-3, and L-1.

FWIV Closed Interlock, V-1

The FWIV Closed interlock, V-1 is active when one FWIV indicates closed.

1. When the V-1 interlock is active, an automatic operating bypass is established for the Low Main Steam Superheat reactor trip.
2. When the V-1 interlock and the T-3 interlock are active, or the containment water level interlock, L-1, is active, an automatic operating bypass is established for the Low_Low Main Steam Pressure Secondary System Isolation actuation.
3. When the V-1 interlock or the L-1 interlock are active, the operating bypass is established for the Low Main Steam Superheat Secondary System Isolation actuation.
4. When the V-1 interlock is not active, the operating bypass is automatically removed for the Low Main Steam Superheat reactor trip.
5. When the V-1 interlock or the T-3 interlock are not active, and L-1 is not active, the operating bypass is automatically removed for the Low_Low Main Steam Pressure Secondary System Isolation actuation.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Wide Range RCS Tcold Interlock, T-1

The Wide Range (WR) RCS Cold Temperature (Tcold) T-1 interlock is active when Wide Range Tcold is greater than approximately 290 °F.

When the T-1 interlock is active, an automatic operating bypass is established for the Low Temperature Overpressure Protection actuation.

When the T-1 interlock is not active, the operating bypass is automatically removed for the Low Temperature Overpressure Protection actuation.

Wide Range RCS That Interlock, T-2

The WR RCS Hot Temperature (That) T-2 interlock is active when WR RCS That is less than approximately 200 °F and RT-1 is active.

1. When the T-2 interlock is active, an automatic operating bypass is established for the Low Pressurizer Level trip for Secondary System Isolation actuation
2. When the T-2 interlock is active, an automatic operating bypass is established for the Low₋Low Pressurizer Level trip for the following:
 - CVCS Isolation actuation; and
 - Containment System Isolation actuation.
3. When the T-2 interlock and containment water level interlock, L-1, are not active, the operating bypass is automatically removed for the Low Pressurizer Level trip Secondary System Isolation actuation
4. When the T-2 interlock and containment water level interlock, L-1, are not active, the operating bypass is automatically removed for the Low₋Low Pressurizer Level trip for the following:
 - CVCS Isolation actuation; and
 - Containment System Isolation actuation.

Wide Range RCS That Interlock, T-3

The WR RCS That T-3 interlock is active when WR RCS That is less than approximately 340 °F.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Containment Water Level Interlock, L-1

The Containment Water Level Interlock L-1 is active when Containment Water Level is greater than approximately 45 ft. and RT-1 is active.

1. When L-1 is active, an automatic operating bypass is established for the following:
 - Low_-Low Main Steam Pressure Secondary System Isolation actuation;
 - Low Main Steam Superheat Secondary System Isolation actuation;
 - Low Pressurizer Level Secondary System Isolation actuation;
 - Low_-Low Pressurizer Level Chemical and Volume Control System Isolation actuation; and
 - Low_-Low Pressurizer Level Containment System Isolation actuation.
2. When the L-1 interlock and the WR RCS Thot interlock, T-2, are not active, the operating bypass is automatically removed for the following:
 - Low Pressurizer Level Secondary System Isolation actuation;
 - Low_-Low Pressurizer Level Containment System Isolation actuation; and
 - Low_-Low Pressurizer Level Chemical and Volume Control System Isolation actuation.
3. When the L-1 interlock and the WR RCS Thot interlock, T-3, or the FWIV Closed interlock, V-1, are not active, the operating bypass is automatically removed for the Low_-Low Main Steam Pressure Secondary System Isolation actuation.
4. When the L-1 interlock and the FWIV Closed interlock, V-1, are not active, the operating bypass is automatically removed for the Low Main Steam Superheat Secondary System Isolation actuation.

BASES

APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY (continued)

Four Low Steam Superheat reactor trip, SSI, and DWSI channels are required to be OPERABLE when operating in MODE 1 with both feedwater isolation valves (FWIVs) open. With one or more FWIV closed, the reactor trip, SSI, and DWSI are not needed to mitigate any events.

Four Low Steam Superheat SSI channels are required to be OPERABLE in MODES 2 and 3 with the containment water level below the L-1 interlock, or with both FWIVs open.

In MODES 2, 3, 4, and 5 the reactor is subcritical.

Four channels are provided to permit one channel in trip or bypass indefinitely and still ensure no single random failure will disable this trip Function. Reactor trip and DWSI are automatically bypassed when V-1 is active (one or more FWIV closed). SSI is automatically bypassed when the V-1 is active (one or more FWIV closed). SSI is also automatically bypassed if containment water level is above the L-1 interlock. The bypass logic is necessary to permit unit startup without resulting in a Low Main Steam Superheat actuation.

9. Containment Pressure

Narrow Range Containment pressure is measured by four sensors (one per separation group) located near the top of the containment vessel.

- a. High Narrow Range Containment Pressure – Reactor Trip, Demineralized Water System Isolation, Containment Isolation, Secondary System Isolation, Decay Heat Removal System Actuation, Pressurizer Heater Trip, and CVCS Isolation (Table 3.3.1-1 Functions 22.a, b, c, d, e, f, g)

The High Containment Pressure trip provides protection for:

- System malfunctions that increase the RCS inventory;
- Inadvertent operation of the ECCS;
- Loss of containment vacuum;
- Steam system piping failures inside the containment vessel;