Response to SDAA Audit Question

Question Number: A-16.3.5.4-1

Receipt Date: 06/17/2024

Question:

Staff believes LCO 3.5.4 should explicitly address the form of ECCS supplemental boron (ESB) pellets, including cycle-specific requirements on boron cylindrical pellet diameter and size , which are expected to be specified in the COLR along with the quantity of boron in the ESB dissolvers. Suggested edits to Specification 3.5.4 and Bases are as follows:

LCO statement

“The form and quantity of boron in the ESB dissolvers shall be within the limits specified in the COLR.”

SR 3.5.4.1

“Verify the form and quantity of boron in the ESB dissolvers ~~is~~ are within the limits specified in the COLR. | Once prior to entering MODE 1 after any operation that could affect the form or quantity of boron in the ESB dissolvers”

First paragraph, second sentence of Applicable Safety Analyses section of Bases for Specification 3.5.4

“The additional negative reactivity is credited with ensuring ~~shutdown margin~~ SDM remains within limits ~~are appropriately preserved~~ during post-event recovery actions, including consideration of the ~~highest reactivity~~ control rod assembly (CRA) of highest reactivity worth, which is assumed to be fully withdrawn.”

First paragraph of LCO section of the Bases for Specification 3.5.4

"LCO 3.5.4 requires the ESB dissolvers to contain boron in a form and quantity within the limits specified in the COLR. This ensures the quantity of boron assumed in the accident analyses will be available ~~to~~ and that the boron pellets will dissolve at the assumed pellet dissolution rate ~~and~~ to ensure subcriticality as the module cools. The pellet dissolution rate is cycle specific and depends on the diameter (which equals the length) of the cylindrical boron pellets, as specified in the COLR. The contents of both ESB dissolvers are credited and each ESB dissolver must contain ~~the~~ boron in the form and quantity specified in the COLR."

Bases for SR 3.5.4.1

"This SR verifies ~~Verification~~ that the form and quantity of boron in the ESB dissolvers ~~is~~ are within limits specified in the COLR. The specified minimum quantity of boron ensures that ~~the~~ a sufficient mass of boron will be available for dissolution by ECCS condensate flow to maintain the required SDM if the ~~system~~ ECCS is actuated. The specified maximum quantity of boron ensures no boron precipitation will occur during the extended passive cooling period. The Frequency requires verification after any operation that could affect the form or quantity of boron available."

The applicant is requested to clarify Subsections 3.5.4 and B 3.5.4 consistent with the suggested changes as shown in the above ESB-related markups of passages from Subsections 3.5.4 and B 3.5.4 in SDAA Part 4, Revision 1.

Response:

NuScale revises Generic Technical Specification 3.5.4 and associated Bases to address the form of emergency core cooling system supplemental boron pellets and the associated requirements to be specified in the core operating limits report.

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

3.5 PASSIVE CORE COOLING SYSTEMS (PCCS)

3.5.4 Emergency Core Cooling System Supplemental Boron (ESB)

LCO 3.5.4 The form and quantity of boron in the ESB dissolvers shall be within the limits specified in the COLR.

APPLICABILITY: MODE 1

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. ESB inoperable.	A.1 Be in MODE 2.	24 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.4.1	Verify the form and quantity of boron in the ESB dissolvers are~~is~~ within the limits specified in the COLR.	Once prior to entering MODE 1 after ~~any~~ operations that could affect the form or quantity of boron in the ESB dissolvers

BASES

APPLICABLE SAFETY ANALYSES

As described in FSAR Chapter 15 (Ref. 2) the ESB feature is credited with adding negative reactivity to the reactor by increasing the boron concentration of the reactor coolant as the coolant returns to the reactor vessel after an ECCS actuation. The additional negative reactivity is credited with ensuring shutdown margin remains within limits ~~are appropriately preserved~~ during post-event recovery actions, including consideration of the ~~highest reactivity~~ control rod assembly of highest reactivity worth, which is assumed to be fully withdrawn.

The ESB satisfies Criterion 3 of 10 CFR 50.36(c)(2)(ii).

LCO

LCO 3.5.4 requires the ESB dissolvers to contain boron in a form and quantity within the limits specified in the COLR. This ensures the quantity of boron assumed in the accident analyses will be available and that the boron pellets will~~to~~ dissolve at the assumed pellet dissolution rate to~~and~~ ensure subcriticality as the module cools. The pellet dissolution rate depends on the geometric form (dimensions and shape) of the boron pellets, as specified in the COLR. The contents of both ESB dissolvers are credited and each ESB dissolver must contain ~~the~~boron in the form and quantity specified in the COLR. The ESB dissolvers are not accessible during operations so the quantities of boron in the dissolvers are verified by measuring the material before it is added to the containment, and ensuring it is transferred to the dissolvers.

APPLICABILITY

The ESB is relied upon to provide supplemental boron to ensure the reactor will remain subcritical after ECCS actuation from critical operating conditions. Critical conditions only exist in MODE 1. In other operating MODES and conditions the reactor is already subcritical, shut down, and the supplemental boron is not needed because the shutdown margin limits in LCO 3.1.1 provide assurance the module will remain subcritical.

The quantity of supplemental boron required is dependent on core design and time in life. If supplemental boron is not required in the ESB dissolvers to ensure subcriticality with the RCS Tavg ≤ 100 °F and the single CRA of highest reactivity worth assumed to be fully withdrawn, the LCO is considered met with no boron additions to the ESB dissolvers.

BASES

ACTIONS

A.1

If it is determined that the ESB is unable to perform its required function, the condition must be resolved by restoring the quantity of boron in the dissolvers. To do this the reactor must be shut down. This results in placing the reactor in a condition where the function is no longer required. Therefore, the Required Action is to place the reactor in MODE 2 within 24 hours.

The required Completion Time of 24 hours is a reasonable period to assess the condition and reach MODE 2 from full power conditions in an orderly manner based on operating experience.

SURVEILLANCE REQUIREMENTS

SR 3.5.4.1

~~Verification~~This SR verifies that the form and quantity of boron in the ESB dissolvers are~~is~~ within limits specified in the COLR. The specified minimum quantity of boron ensures that a sufficient mass of~~the~~ boron will be available for dissolution by ECCS condensate flow to maintain the required shutdown margin if the ECCS~~system~~ is actuated. The specified maximum quantity of boron ensures no boron precipitation will occur during the extended passive cooling period. The Frequency requires verification after ~~any~~ operations that could affect the form or quantity of boron available. Operations that could affect the form or quantity of boron in the ESB dissolvers are specified in the COLR. The Frequency is appropriate because ESB dissolvers are physically isolated from changes by their location in the containment vessel. This ensures they are unaffected during normal operations and the form and quantity of boron will remain unchanged once established.

REFERENCES

1. FSAR, Section 6.3.
2. FSAR, Chapter 15.