Response to SDAA Audit Question

Question Number: A-16-1

Receipt Date: 07/17/2023

Question:

Each Bases subsection should label its section that discusses accident analysis as "APPLICABLE SAFETY ANALYSES" not "APPLICABLE SAFETY ANALYSIS"; several locations in SDAA part 4, "Bases," need this correction to conform to the STS Bases and TSTF-GG-05-01.

Response:

NuScale revises SDAA Part 4 Technical Specification Bases Section B 3.5, replacing instances of "APPLICABLE SAFETY ANALYSIS" with "APPLICABLE SAFETY ANALYSES."

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

BASES

BACKGROUND (continued)

The closed feedwater and main steam isolation valves form part of the DHRS loop pressure boundary, these valves are described in FSAR Section 5.4 (Ref. 1), FSAR Section 6.2 (Ref. 2), and FSAR Chapter 10 (Ref. 3).

APPLICABLE SAFETY ANALYSEIS

The DHRS is designed to ensure that adequate decay heat removal is provided to ensure core integrity. The system function is bounded by loss of normal AC power event, as described in FSAR Chapter 15 (Ref. 4). A loss of normal AC power will result in a loss of feedwater and a loss of condenser vacuum. Both of these anticipated operational occurrences (AOOs) require actuation of the DHRS.

DHRS is actuated by MPS upon receipt of any of the following:

a. High Pressurizer Pressure

b. High RCS Hot Temperature

c. Low AC Voltage

d. High Main Steam Pressure

e. High Containment Pressure when RCS Hot Temperature is above the T-3 interlock (about 340 °F)

f. Low Pressurizer Level when RCS Hot Temperature is above the T-4 interlock (about 500 °F)

g. High Under-the-Bioshield Temperature

These actuations cover the range of events that indicate inadequate heat removal from the Reactor Coolant System.

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

LCO

This LCO ensures that sufficient DHRS equipment is OPERABLE to meet the initial conditions assumed in the safety analyses. One loop of DHRS is required to function to meet the safety function of the system. Each loop of DHRS includes one SG, one heat exchanger, and redundant valves that actuate for the system to meet its safety function. Inoperability of individual redundant valves do not affect the overall redundancy of the DHRS. However, both redundant valves are needed to ensure that the DHRS loop is capable of meeting its safety function if a single active failure occurs.

BASES

BACKGROUND (continued)

During transients and shutdowns which are not associated with design basis events in which DHRS or ECCS is actuated, water from the RP is added to the containment vessel by the Containment Flooding and Drain System (CFDS). After reaching an appropriate level in the containment, the reactor vent valves (RVVs) and reactor recirculation valves (RRVs) are opened to permit improved heat transfer from the reactor coolant system (RCS) to the containment vessel walls.

During normal operations, the RP limits temperatures of the module because the containment vessel is partially immersed in water. The water also provides shielding above and around the region of the core during reactor operations, limiting exposure to personnel and equipment in the area.

In MODE 4, the module is transported from the operating position to the RFP area of the UHS.

APPLICABLE SAFETY ANALYSEIS

During all MODES of operation and storage of irradiated fuel, the UHS supports multiple safety functions.

The UHS level is assumed and credited in a number of transient analyses. A UHS level of 52 ft provides margin above the minimum level required to support DHRS and ECCS operation in response to LOCA and non-LOCA design basis events. The 52 ft level also assures the containment vessel wall temperature initial condition assumed in the peak containment pressure analysis. The upper limit of 54 ft for the maximum pool level is an initial condition that ensures long term cooling analyses assumptions.

The UHS bulk average temperature is assumed and credited, directly or indirectly in design basis accidents including those that require DHRS and ECCS operation such as LOCA and non-LOCA design basis events. The bulk average temperature is also assumed as an initial condition of the peak containment pressure analysis, and the minimum pool temperature is an assumption used in long-term cooling analyses.

BASES

APPLICABLE SAFETY ANALYSEIS (continued)

The UHS bulk average boron concentration lower limit is established to ensure adequate shutdown margin during unit shutdowns that are not associated with events resulting in DHRS or ECCS actuation, when the module is filled with RP inventory using the CFDS and the RRVs are opened. It also ensures adequate shutdown margin when the module is configured with the UHS inventory in contact with the reactor core, specifically in MODE 4 when the containment vessel is disassembled for removal, and in MODE 5.

The upper limit on boron concentration is established to limit the effect of moderator temperature coefficient (MTC) during localized or UHS bulk average temperature changes while the module and core are in contact with UHS water.

The ultimate heat sink level, temperature, and boron concentration parameters satisfy Criteria 2 and 3 of 10 CFR 50.36(c)(2)(ii).

LCO

The UHS must provide an adequate heat sink to perform its UHS function. This is accomplished by providing limits on submersion of the module and the mass of water that can be heated, and vaporized to steam if necessary, to remove decay heat via the decay heat removal system or conduction through the containment vessel walls and heat from irradiated fuel in the pool. The UHS level limits ensure that the assumed and required level of module submersion and mass of water is available.

The UHS bulk average temperature is an initial assumption of safety analyses. The limits on temperature preserve the analyses assumptions and permit crediting the pool to mitigate these events. The UHS level and temperature limits ensure CNV heat transfer is consistent with conditions assumed in the safety analyses for containment pressurization and long-term cooling. Determination of the UHS bulk average temperature is in accordance with approved procedures.

The boron concentration must be within limits when the UHS contents are in communication with the RCS to preserve core reactivity assumptions and analyses. Determination of the bulk average boron concentration is in accordance with approved plant procedures.

BASES

APPLICABLE SAFETY ANALYSE~~I~~S

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 limits are appropriately preserved during post-event recovery actions, including consideration of the highest reactivity control rod assembly, 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 that is within the limits specified in the COLR. This ensures that the quantity of boron assumed in the accident analyses will be available to dissolve and ensure subcriticality as the module cools. The contents of both ESB dissolvers are credited and each ESB dissolver must contain the 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.

~~A Note to the Applicability provides an exception to the LCO when analyses demonstrate subcriticality with the RCS Tavg ≤ 100 °F and the single CRA of highest reactivity worth assumed to be fully withdrawn. This allowance is appropriate because the reactor will remain subcritical during portions of a fuel cycle under these conditions and the ESB function is not required to ensure the reactor remains safely shutdown during cooldown after design basis events.~~ 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.