UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

October 19, 2018

MEMORANDUM TO: Samuel S. Lee, Chief
Licensing Branch 1
Division of Licensing, Siting,
and Environmental Analysis
Office of New Reactors

FROM: Marieliz Vera, Project Manager ***/RA/***
Licensing Branch 1
Division of Licensing, Siting,
and Environmental Analysis
Office of New Reactors

SUBJECT: SUMMARY OF THE AUGUST 22, 2018, CATEGORY 1 PUBLIC TELECONFERENCE WITH NUSCALE POWER, LLC TO DISCUSS THE INADVERTENT ACTUATION BLOCK OF THE DESIGN CERTIFICATION APPLICATION

The U.S. Nuclear Regulatory Commission (NRC) held a Category 1 public teleconference on August 22, 2018, to discuss the Inadvertent Actuation Block (IAB) of the NuScale Power, LLC (NuScale) Design Certification Application. Participants included personnel from NuScale and members of the public.

The public meeting notice can be found in the Agencywide Documents Access and Management Systems under Accession No. ML18234A021. This meeting notice was also posted on the NRC public website.

The meeting agenda and list of participants can be found in Enclosures 1 and 2, respectively.

CONTACT: Marieliz Vera, NRO/ DLSE
301-415-5861

Summary:

On August 22, 2018, the NRC staff held a public meeting to discuss the assumptions in the accident analyses described in the NuScale Final Safety Analysis Report (FSAR) regarding the functions of the IAB valve in the NuScale Emergency Core Cooling System (ECCS). NuScale provided a set of proprietary slides for discussion during the closed portion of the meeting.

Highlights of the meeting include the following:

In Slide 4, NuScale provided an operational overview of the IAB valve. Although the slide specified that the IAB valve is a passive device, NuScale representatives agreed with the NRC staff during the meeting that the IAB valve is an active component. NuScale clarified that it is requesting that the specific closing function of the IAB valve to prevent an inadvertent opening of the main valve be treated as a passive function in the accident analyses with respect to the single failure criterion. All other functions of the IAB valve will be treated as active functions in the accident analyses.

In Slides 5 and 6, NuScale suggested that the IAB valve is similar to a spring-loaded check valve and described the IAB valve function in the NuScale design. As stated during the meeting, the NRC staff considers the IAB valve to be a spring-loaded differential pressure valve rather than a simple check valve. During normal conditions, the IAB valve is open with zero differential pressure across its preset spring. Upon release of pressure in the trip valve line, the high temperature borated water in the trip valve tubing and upper portion of IAB valve will flash to steam as the pressure drops toward the containment vessel vacuum conditions. When the reactor is at high pressure conditions, the IAB valve must close in a timely manner to maintain pressure in the main valve control chamber to prevent the main valve disc from opening prematurely and releasing high reactor pressure reactor coolant into the containment vessel. The NRC staff considers the design, application, and operation of the IAB valve to be significantly different from a check valve.

In valve diagrams attached to Slide 7, NuScale presented the normal position, blocking function, and ECCS operation of the IAB valve. NuScale stated that the IAB valve will remain open for all loss of coolant accident (LOCA) scenarios because the ECCS automatic actuation signals do not occur until the reactor pressure has dropped below the IAB spring capability holding the IAB valve open. With respect to manual ECCS actuation, NuScale stated that reactor operators are trained to not actuate the ECCS until the automatic actuation signals are present. During this time, the reactor operators would be performing other LOCA response tasks, such as initiating shutdown procedures and supplying make-up water to the extent possible. NuScale stated that the IAB valve will be designed and demonstrated to be capable of re-opening following its initial closure. NuScale also stated that the blocking function of the IAB valve will be demonstrated to support the reliability assumption with follow-up discussion during a future meeting. NuScale was not clear if this demonstration would be a qualitative or quantitative demonstration.

In Slide 8, NuScale referenced SECY-77-439 (August 17, 1977), “Single Failure Criterion,” regarding the failure of components that can be treated as passive with respect to the single failure criterion. In particular, NuScale notes the example in SECY-77-439 of a passive failure in a fluid system as the failure of a simple check valve to move to its correct position. The NRC staff noted that SECY-77-439 is referring to “simple check valves” while the NRC staff considers the IAB valve to be a differential pressure spring-loaded valve.

In Slides 9 and 10, NuScale referenced SECY-94-084 (March 28, 1994), “Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems in Passive Plant

Designs." NuScale believes that SECY-94-084 is only addressing check valves in passive systems with low differential pressure. NuScale does not consider SECY-94-084 to be applicable to the IAB valve because of its high differential pressure conditions. NuScale interprets SECY-77-439 as applicable to the IAB valve without the need for the quantitative reliability demonstration specified in SECY-94-084. The NRC staff did not agree with this distinction between the provisions for justifying the assumption of a passive failure of a component in these two Commission papers.

In Slides 11 and 12, NuScale referenced the AP1000, U.S. APWR, and U.S. EPR reactor designs regarding assumptions for passive functions of other components, such as spring-loaded safety or relief valves. The NRC staff noted that the specific functions of the referenced valves do not match the design, application, and function of the IAB valve. The NRC staff also noted that Slide 11 specifies the high reliability of other valve types as a condition for the passive assumption.

In Slides 13 and 14, NuScale referenced two International Atomic Energy Agency (IAEA) documents to support its interpretation of passive components. For example, IAEA-TECDOC-626 (1991), "Safety Related Terms for Advanced Nuclear Plants," defines a passive component as a component which does not need any external input to operate. NuScale states that IAEA-TECDOC-1624 (2009), "Passive Safety Systems and Natural Circulation in Water Cooled Nuclear Power Plants," includes the same classification for passive devices as IAEA-TECDOC-626. The NRC staff noted that the NuScale reference to IAEA-TECDOC-626 did not include the detailed discussion in its Appendix A of passive to active possibilities, including reliability and the need for evaluation and justification. The NRC staff also noted that the NuScale reference to IAEA-TECDOC-1624 did not indicate that the aim of the publication is to describe passive safety systems in advanced water-cooled reactor designs, or the full discussion of reliability and need for evaluation and justification for passive components in IAEA-TECDOC-626. The NRC staff also noted that SECY-94-084 references IAEA 50-P-1, "Application of the Single Failure Criterion," which indicates that some IAEA Member States consider self-operating components (e.g., check valves) to be active if the state is changed. IAEA 50-P-1 reports that the reason for accepting that an opening failure of a simple non-powered valve need not be considered as a single failure is that failure probability is assumed to be very low and comparable to passive mechanical components. The IAEA document also indicates that, based on the mean failure rate for the closing function of a check valve, the closing function would be considered to be an active function. The NRC staff also noted that IAEA Safety Standard SSR-2/1, "Safety of Nuclear Power Plants: Design," states that the design shall take due account of the failure of a passive component, unless it has been justified in the single failure analysis with a high level of confidence that a failure of that component is very unlikely and that its function would remain unaffected by the postulated initiating event.

In addition to IAEA documents, the NRC staff discussed other documents that address the consideration of components as either active or passive. For example, NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," states that the NRC staff considers check valves, and other automatic valves designed to close without operator action following an accident considered to be "active" valves that would be classified as such in the inservice testing (IST) program. Similar criteria are said to be applied to the opening function of a check valve. NUREG-1482 also indicates that the discussion in SECY-77-439 of a check valve to move to its correct position as a passive failure does not correspond to the issue of "active" versus "passive" for the purpose of inservice testing. The staff also referred to ANSI/ANS 51.1, "Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants," and ANSI/ANS 52.1, "Nuclear Safety Criteria for the Design of Stationary Boiling Water Reactor

Plants," which state that an active component is a component in which mechanical movement must occur to accomplish the nuclear safety function of the component. Also referenced in SECY-94-084, the staff indicated that ANSI/ANS 58.9, "Single Failure Criteria for Light Water Reactor Safety-Related Fluid Systems," states that an active failure is a malfunction, excluding passive failures, of a component that relies on mechanical movement to complete its intended function upon demand. ANS 58.9 provides examples of active failures including the failure of a powered valve or a check valve to move to its correct position. ANS 58.9 later states that where the proper active function of a component can be demonstrated despite any credible condition, then that component may be considered exempt from active failure. ANS 58.9 provides examples of component functions that could be exempt from the active failure assumption including opening of code safety valves and certain swing check valves. ANS 58.9 notes that where such exemption is taken, the basis for the exemption shall be documented in the single failure analysis. The NRC staff also referred to ANSI/ANS 58.14, "Safety and Pressure Integrity Classification Criteria for Light Water Reactors," which includes the definition of an active function as a function where mechanical motion, actuation, or a change of state occurs (e.g., the closing of a valve); and passive function as a function that is not an active function (e.g., the pressure-retaining function of a valve that is not required to change its position).

Based on the IAEA, NRC, and ANS documents, the NRC staff noted that while the discussion may be different among the various documents, the common provision is that the assumption that the function of a specific component is a passive function with respect to the single failure criterion needs to be justified by an evaluation of the reliability of the component to perform that function.

In Slide 15, NuScale states that the IAB valve is credited as a passive component in the accident analysis in FSAR Tier 2, Section 15.6.6. As noted earlier, NuScale stated during the meeting that the IAB valve is considered to be an active component with only the closing function proposed to be assumed to be a passive function with respect to the single failure criterion. The NRC staff noted that the operation of the IAB valve is also assumed in other accident analyses in the FSAR. NuScale agreed that the IAB valve is assumed to operate in several scenarios in the accident analyses.

In Slide 16, NuScale describes the function of the IAB valve as a simple plunger between a large differential pressure and a spring force. The NRC staff noted that the operation of the IAB valve includes a normal open position, a close position, and then a re-open position based on differential pressure and spring force. In addition, the staff indicated the IAB valve operation will include high temperature borated water flashing to steam in the small clearance tubing to support sealing of the IAB valve seat to prevent pressure loss in the main valve control chamber. Based on this information, the staff stated its view that the design, application, and function of the IAB valve is not the same as a check valve operating with piping flow.

In Slide 17, NuScale states that the IAB valve meets the NRC requirements with references to SECY-77-439 and SECY-94-084. The NRC staff noted that NuScale has not addressed the reliability of the component discussed in the SECY papers for the assumption that a specific function can be treated as passive with respect to the single failure criterion.

In Slide 18, NuScale states that the IAB valve is similar to other design certification applications that treat components as passive. The NRC staff did not consider the passive assumptions related to other components to be applicable to the IAB valve. In addition, an assumption that a specific function of a component can be considered to be passive with respect to the single failure criterion needs to be justified.

During the closing remarks, the NRC staff stated it appreciated the detailed discussion regarding the design, application, and function of the IAB valve to support the NRC staff review of the NuScale assumptions for the IAB valve in the FSAR accident analyses. The NRC staff summarized the meeting discussion with the following points:

(1) NuScale and the NRC staff agree that the IAB valve is an active component;

(2) NuScale proposes that the closing function of the IAB valve to prevent inadvertent opening of the main valve be considered as a passive function with respect to the single failure criterion; and

(3) The NRC staff considers the IAB valve to be a spring-loaded differential pressure valve rather than a check valve.

At the end of the meeting, the NRC staff stated that it would consider the information provided by NuScale and prepare its position on the specific discussion items. The NRC staff will notify NuScale when a follow-up meeting can be scheduled. Based on NRC staff questions, NuScale stated that its force calculation for the IAB valve, including the bellows surface area, will be placed in the NuScale electronic reading room.

Docket No. 52-048

Enclosures:
1. Meeting Agenda
2. List of Attendees

cc w/encls.: DC NuScale Power, LLC Listserv

SUBJECT: SUMMARY OF THE AUGUST 22, 2018, CATEGORY 1 PUBLIC TELECONFERENCE WITH NUSCALE POWER, LLC DESIGN TO DISCUSS THE INADVERTENT ACTUATION BLOCK OF THE CERTIFICATION APPLICATION
DATE: October 19, 2018

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DATE	10/11/2018	10/15/2018	10/19/2018

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U.S. NUCLEAR REGULATORY COMMISSION

CATEGORY 1 PUBLIC TELECONFERENCE WITH NUSCALE POWER, LLC TO DISCUSS

THE INADVERTENT ACTUATION BLOCK OF THE CERTIFICATION APPLICATION

August 22, 2018

12:30 p.m. – 2:00 p.m.

AGENDA

Public Meeting	
12:30 - 2:35 p.m.	Welcome and Introductions
12:35 - 1:30 p.m.	Technical discussion
1:30 - 1:45 p.m.	Public – Questions and Comments
1:45 - 2:00 p.m.	Closed portion

U.S. NUCLEAR REGULATORY COMMISSION

CATEGORY 1 PUBLIC TELECONFERENCE WITH NUSCALE POWER, LLC TO DISCUSS

THE INADVERTENT ACTUATION BLOCK OF THE CERTIFICATION APPLICATION

LIST OF ATTENDEES

August 22, 2018

NAME	AFFILIATION
Marieliz Vera	U.S. Nuclear regulatory Commission (NRC)
Timothy Lupold	NRC
Thomas Scarbrough	NRC
Ryan Nolan	NRC
Rani Franovich	NRC
Jeffrey Schmidt	NRC
Rebecca Karas	NRC
Kevin Coyne	NRC
John Monninger	NRC
Shana Helton	NRC
Gregory Cranston	NRC
Timothy Drzewiecki	NRC
Robert Taylor	NRC
Paul Infanger	NuScale Power, LLC (NuScale)
John Fields	NuScale
Scott Harris	NuScale
Greg Meyers	NuScale
Gary Becker	NuScale
Marty Bryan	NuScale
Colin Sexton	NuScale
Dan Lassiter	NuScale
Zack Houghton	NuScale
Jennie Wike	NuScale
Robert Gamble	NuScale