

August 27, 2024

Docket No. 52-050

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 16 (RAI-10134 R1) on the NuScale Standard Design Approval Application

REFERENCE: 1. NRC Letter to NuScale, "Request for Additional Information No. 16 (RAI-10134 R1)," dated March 2, 2024

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) response to the referenced NRC Request for Additional Information (RAI).

The enclosure to this letter contains NuScale's response to the following RAI question from NRC RAI-10134 R1:

- 3.6.3-1

Enclosure 1 is the proprietary version of the NuScale response to NRC RAI No. 16 (RAI-10134 R1). NuScale requests that the proprietary version be withheld from public disclosure in accordance with the requirements of 10 CFR § 2.390. The enclosed affidavit (Enclosure 3) supports this request. Enclosure 2 is the nonproprietary version of the NuScale response.

This letter makes no regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions, please contact Elisa Fairbanks at 541-452-7872 or at efairbanks@nuscalepower.com.

I declare under penalty of perjury that the foregoing is true and correct. Executed on August 27, 2024.

Sincerely,



Mark W. Shaver
Director, Regulatory Affairs
NuScale Power, LLC

Distribution: Mahmoud Jardaneh, Chief New Reactor Licensing Branch, NRC
Getachew Tesfaye, Senior Project Manager, NRC
Prosanta Chowdhury, Senior Project Manager, NRC

Enclosure 1: NuScale Response to NRC Request for Additional Information RAI-10134 R1,
proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information RAI-10134 R1,
nonproprietary

Enclosure 3: Affidavit of Mark W. Shaver, AF-173493

Enclosure 1:

NuScale Response to NRC Request for Additional Information RAI-10134 R1, proprietary

Enclosure 2:

NuScale Response to NRC Request for Additional Information RAI-10134 R1, nonproprietary

Response to Request for Additional Information Docket: 052000050

RAI No.: 10134

Date of RAI Issue: 03/02/2024

NRC Question No.: 3.6.3-1

Regulatory Basis

10 CFR Part 50 Appendix-A GDC 4 states that structures, systems, and components shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit. However, dynamic effects associated with postulated pipe ruptures in nuclear power units may be excluded from the design basis when analyses reviewed and approved by the Commission demonstrate that the probability of fluid system piping rupture is extremely low under conditions consistent with the design basis for the piping.

Issue

FSAR Section 3.6.3 states that Leak-Before-Break (LBB) is not used for SDAA. This is a change from the DCA approach where LBB methodology was used. Specifically, for DCA, Pipe Rupture Hazards Analysis Technical Report, TR-0818-61384-P, Revision 2, utilized LBB methodology while the SDAA Pipe Rupture Hazards Analysis TR-121507-P, Revision 0, does not.

In the DCA, LBB methodology was credited to justify exclusion of high energy line breaks in large-diameter secondary piping, namely main steam system (MSS) and feedwater system (FWS) piping. This was noted in section 2.2.2.1.1 of the DCA Technical Report TR-0818-61384-P, Revision 2. NuScale analyzed MSS and FWS piping for LBB and showed them to meet the criteria in the Section 2.2.5 discussion related to SRP 3.6.3. This was also reflected in Section 3.6.3.2 of the DCA Safety Evaluation. However, in the SDAA NuScale does not use LBB methodology for MSS and FWS piping inside containment. This is a significant change in NuScale's approach.

Information Requested

Provide the basis for break exclusion for the high energy piping (and particularly the MSS and FWS piping) inside containment that account for the change in methodology from DCA to

SDAA. Discuss changes in design parameters such as pressure, temperature, and flow rate as a result of the power increase from DCA to SDAA, and whether there are any changes in MSS and FWS piping routing inside containment, and how the above are considered in the justification for break exclusion. Provide a summary of maximum stress and its location for MSS and FWS systems for BTP 3-4 stress combination as well as for ASME service levels A, B, C, and D. Discuss whether the leak detection system based on previous LBB approach from DCA remains due to a change in methodology in SDAA.

NuScale Response:*Executive Summary*

Leak before break (LBB) methodology was applied to the main steam system (MSS) and feedwater system (FWS) in the US600 design certification (DCA). The US460 standard design approval application (SDAA) implements an alternate approach under Branch Technical Position (BTP) 3-4, and extends the “break exclusion zone” in certain instances as long as the additional design criteria of BTP 3-4 B.1.(ii) are satisfied. Criteria for break exclusion under BTP 3-4 B.1.(ii) include the following:

- application of more conservative stress and fatigue limits than those required by ASME Code
- 100 percent volumetric inservice examination of all pipe welds during each inspection interval

BTP 3-4 B.1.(ii) imposes conservative stress limits and inspection requirements to reduce the probability of flaw initiation and growth. In contrast, LBB relies on detecting leakage from a crack that has already propagated through the pressure boundary, allows higher operating stresses, and requires no additional inspections.

Basis for break exclusion for high energy piping inside containment

The basis and methodologies for break exclusion are described in “Pipe Rupture Hazards Analysis”, TR-121507, Revision 0, Appendix A.

Inside containment, BTP 3-4 B.1.(ii) is applied to the following:

- the steam generator system (SGS), main steam (MS), and feedwater (FW) piping
- the terminal end welds between the decay heat removal system (DHRS) piping and the containment vessel (CNV) safe ends
- the bolted connections between the emergency core cooling system (ECCS) valves and the reactor pressure vessel (RPV)

Changes in design parameters as a result of the power increase from DCA to SDAA

TR-121507 Table 3-3 defines the characteristics of the high energy piping (including temperature and pressure) inside the Reactor Building for the SDAA, and is comparable to the pipe rupture hazards analysis TR-0818-61384 Table 3-3 for the DCA. A comparison between these values is shown below in Table 1.

Table 1: SGS MS and FW Parameter Comparison

System	Parameter	US600 DCA	US460 SDAA
SGS MS	Operating Temperature	585 °F	575 °F
	Design Temperature	650 °F	650 °F
	Operating Pressure	500 psia	700 psia
	Design Pressure	2100 psia	2200 psia
	Full Power Steam Flow	5.321E5 lbm/hr	8.14E5 lbm/hr
SGS FW	Operating Temperature	300 °F	250 °F
	Design Temperature	650 °F	650 °F
	Operating Pressure	550 psia	701 psia
	Design Pressure	2100 psia	2200 psia

The increase in secondary side operating pressures between the DCA and SDAA is due to operating conditions throughout an operating range of 20 percent to 102 percent power.

Changes to the SGS MS and FW pipe routing are addressed in the current SDAA design. TR-121507 Section A.1.1 describes the application of BTP 3-4 B.1.(ii) and includes considerations for pipe routing.

Summary of maximum stress for MSS and FWS systems

Preliminary stress analyses are performed for the Class 1, 2, & 3 high-energy piping larger than nominal pipe size (NPS) 1 both inside and outside containment in order to confirm the adequacy of the piping layout and support locations, and to support high energy line break evaluations as described in SDAA Section 3.12. Current stress analysis results for the portions of SGS MS and FW lines inside containment are summarized in Table 2 and Table 3 below. High stress locations are shown in Figure 1 and Figure 2.

Table 2: Steam Generator System Feedwater & Decay Heat Removal Piping Stress Analysis Results

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}}^{2(a),(c)}

Figure 1: Steam Generator System Feedwater & Decay Heat Removal Piping Stress Analysis Result Locations

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}^{2(a),(c)}

Table 3: Steam Generator System Main Steam Piping Stress Analysis Results

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}^{2(a),(c)}

Figure 2: Steam Generator System Main Steam Piping Stress Analysis Result Locations

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}}^{2(a),(c)}

Leakage detection system changes between DCA and SDAA

The DCA leakage detection system sensitivity requirement is 0.001 gpm for the application of the LBB methodology. The SDAA leakage detection system sensitivity requirement is 0.05 gpm to meet the “Leakage-Monitoring-Related Positions” specified in RG 1.45. These requirement changes are discussed further in the response to RAI Question 3.6.2.7-2.

Conclusion

The SDAA reflects the updated design and analysis of the US460 standard plant and applies the break exclusion methodologies described in “Pipe Rupture Hazards Analysis”, TR-121507, Revision 0, Appendix A, ensuring 10 CFR Part 50 Appendix-A GDC 4 is met.

Impact on US460 SDAA:

There are no impacts to US460 SDAA as a result of this response.

Enclosure 3:

Affidavit of Mark W. Shaver, AF-173493

NuScale Power, LLC

AFFIDAVIT of Mark W. Shaver

I, Mark W. Shaver, state as follows:

- (1) I am the Director of Regulatory Affairs of NuScale Power, LLC (NuScale), and as such, I have been specifically delegated the function of reviewing the information described in this Affidavit that NuScale seeks to have withheld from public disclosure, and am authorized to apply for its withholding on behalf of NuScale.
- (2) I am knowledgeable of the criteria and procedures used by NuScale in designating information as a trade secret, privileged, or as confidential commercial or financial information. This request to withhold information from public disclosure is driven by one or more of the following:
 - (a) The information requested to be withheld reveals distinguishing aspects of a process (or component, structure, tool, method, etc.) whose use by NuScale competitors, without a license from NuScale, would constitute a competitive economic disadvantage to NuScale.
 - (b) The information requested to be withheld consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), and the application of the data secures a competitive economic advantage, as described more fully in paragraph 3 of this Affidavit.
 - (c) Use by a competitor of the information requested to be withheld would reduce the competitor's expenditure of resources, or improve its competitive position, in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.
 - (d) The information requested to be withheld reveals cost or price information, production capabilities, budget levels, or commercial strategies of NuScale.
 - (e) The information requested to be withheld consists of patentable ideas.
- (3) Public disclosure of the information sought to be withheld is likely to cause substantial harm to NuScale's competitive position and foreclose or reduce the availability of profit-making opportunities. The accompanying Request for Additional Information response reveals distinguishing aspects about the response by which NuScale develops its NuScale Power, LLC Response to NRC Request for Additional Information (RAI-10134 R1) on the NuScale Standard Design Approval Application.

NuScale has performed significant research and evaluation to develop a basis for this response and has invested significant resources, including the expenditure of a considerable sum of money.


The precise financial value of the information is difficult to quantify, but it is a key element of the design basis for a NuScale plant and, therefore, has substantial value to NuScale.

If the information were disclosed to the public, NuScale's competitors would have access to the information without purchasing the right to use it or having been required to undertake a similar expenditure of resources. Such disclosure would constitute a misappropriation of NuScale's intellectual property, and would deprive NuScale of the opportunity to exercise its competitive advantage to seek an adequate return on its investment.

- (4) The information sought to be withheld is in the enclosed response to NRC Request for Additional Information RAI-10134 R1 Chapter 3.6.3-1. The enclosure contains the designation "Proprietary" at the top of each page containing proprietary information. The information considered by NuScale to be proprietary is identified within double braces, "{{ }}" in the document.

- (5) The basis for proposing that the information be withheld is that NuScale treats the information as a trade secret, privileged, or as confidential commercial or financial information. NuScale relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC § 552(b)(4), as well as exemptions applicable to the NRC under 10 CFR §§ 2.390(a)(4) and 9.17(a)(4).
- (6) Pursuant to the provisions set forth in 10 CFR § 2.390(b)(4), the following is provided for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld:
- (a) The information sought to be withheld is owned and has been held in confidence by NuScale.
 - (b) The information is of a sort customarily held in confidence by NuScale and, to the best of my knowledge and belief, consistently has been held in confidence by NuScale. The procedure for approval of external release of such information typically requires review by the staff manager, project manager, chief technology officer or other equivalent authority, or the manager of the cognizant marketing function (or his delegate), for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside NuScale are limited to regulatory bodies, customers and potential customers and their agents, suppliers, licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or contractual agreements to maintain confidentiality.
 - (c) The information is being transmitted to and received by the NRC in confidence.
 - (d) No public disclosure of the information has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or contractual agreements that provide for maintenance of the information in confidence.
 - (e) Public disclosure of the information is likely to cause substantial harm to the competitive position of NuScale, taking into account the value of the information to NuScale, the amount of effort and money expended by NuScale in developing the information, and the difficulty others would have in acquiring or duplicating the information. The information sought to be withheld is part of NuScale's technology that provides NuScale with a competitive advantage over other firms in the industry. NuScale has invested significant human and financial capital in developing this technology and NuScale believes it would be difficult for others to duplicate the technology without access to the information sought to be withheld.

I declare under penalty of perjury that the foregoing is true and correct. Executed on August 27, 2024.



Mark W. Shaver