October 12, 2017 Docket: 52-048

U.S. Nuclear Regulatory Commission
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SUBJECT: NuScale Power, LLC Request for Public Meeting to Address Proposed Limitation and Condition 4.5 in the Safety Evaluation for Topical Report TR-0815-16497, Revision 1.

REFERENCE: S. Lee, U.S. Nuclear Regulatory Commission, letter to J. Wike, NuScale Power, LLC, "Staff's Revision 2 to the Safety Evaluation Report for Revision 1 of the NuScale Topical Report, 'Safety Classification of Passive Nuclear Power Plant Electrical Systems,'" dated August 22, 2017 (ML17233A246)

In the referenced letter, NRC indicated plans to modify Limitation and Condition 4.5 in Revision 2 of the staff's Safety Evaluation for Topical Report TR-0815-16497, Revision 1, to respond to comments from the Advisory Committee on Reactor Safeguards (ACRS). The letter requested NuScale notify NRC if it wished to engage in a public meeting to discuss the impacts of the planned changes.

The purpose of this letter is to request a public meeting on the staff's plans to respond to ACRS comments, and to identify the impacts to NuScale of these plans. Attachment 1 of this submittal provides a summary of the concerns and impacts identified by NuScale for use during the requested public meeting. Attachment 1 has been determined to be nonproprietary.

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

If you have any questions on this response, please feel free to contact Darrell Gardner at 980-349-4829 or at dgardner@nuscalepower.com.

Sincerely,

Zackary W, Rad
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Attachment 1: NuScale Comments on Proposed Limitation and Condition 4.5 of the Safety Evaluation for NuScale Topical Report TR-0815-16497

NuScale Comments on Proposed Limitation and Condition 4.5 of the Safety Evaluation for NuScale Topical Report TR-0815-16497

I. Introduction

In a letter dated August 22, 2017, the NRC indicated plans to modify Limitation and Condition 4.5 in *Safety Evaluation for Topical Report TR-0815-16497*, Revision 1, by deleting the second sentence, which states "Alternatively, an applicant or licensee referencing the TR may provide justification, for NRC review, that this condition is not applicable to their design." The resulting Condition 4.5 would read:

> *Demonstrate that system(s) necessary to retain reactor coolant within the RCPB are designed with sufficient reliability such that a DBE that removes the RCPB as a fission product barrier does not occur with the frequency of an AOO.*

The basis for the change is that the deleted sentence was "for the benefit of future applicants with passive designs that may be different from the NuScale's design," and thus, by implication, not intended for use by NuScale.

NuScale and NRC have had several discussions regarding concerns with Condition 4.5. As discussed further herein, NuScale disagrees with the stated basis for the Condition and believes demonstrating compliance with the first sentence of Condition 4.5 is problematic for the NuScale design. Because of these concerns, NuScale intended to pursue the now-deleted second sentence of Condition 4.5 as a viable path to allow reference to the Topical Report in the Design Certification Application. NuScale was previously unaware that this alternative was being made unavailable for NuScale use.

In light of this new information provided in the referenced letter, NuScale wishes to engage the staff in a public meeting to discuss the impacts resulting from the proposed change to Condition 4.5. The following discussion more fully articulates the ongoing concerns with the proposed Condition 4.5, as complicated by the proposed change, and proposes an alternative Condition 4.5 for further discussion. NuScale believes it understands Staff's safety concern, and desires to address it in a mutually acceptable manner.

II. The Staff's Safety Concern

NuScale understands NRC Staff's fundamental concern is whether adequate defense-in-depth is maintained by the NuScale design in its potential use of the ECCS cooling flow path under AOO conditions. The SER notes, "The AOO scenario in Appendix D to the TR appears to rely on the containment to retain the reactor coolant necessary to ensure fuel cladding integrity during an AOO. Because an AOO, by definition, is expected to occur one or more times during the life of the nuclear power plant, the NRC staff is concerned that such reliance upon the containment may not be consistent with the underlying defense-in-depth purpose of Criterion 15."

Thus, NuScale believes Staff's concern restated more specifically for the NuScale design is: Upon loss of all electric power, the ECCS valves open and containment fulfills a reactor coolant inventory retention function in addition to the heat removal and fission product retention functions of typical containments. If the containment cannot fulfill the reactor coolant inventory retention function—due to a failure of the containment function—the loss of reactor coolant from containment may concurrently challenge fuel integrity, leading to a subsequent release of fission products to the environment. In terms of defense-in-depth, reliance on containment appears to be exclusive reliance on a single fission product barrier.

NuScale agrees with the defense-in-depth premise of this concern—defense-in-depth is foundational to the NuScale design philosophy. However, NuScale does not agree that relying on containment to perform a coolant inventory retention function is a reduction in safety or inadequate defense-in-depth for the NuScale design. This concern is evaluated in the subsequent discussion.

III. Summary of NuScale's Concerns with Condition 4.5 and Considerations for Resolution

NuScale considers the general basis cited for establishing Condition 4.5 to be problematic. Inherent in Staff's SER discussion and Condition 4.5 is the notion that a "direct coolant flowpath between the reactor core and the containment" constitutes "removing a fission product barrier," which "may not be consistent" with the Commission's defense-in-depth policy and associated NRC regulations. NuScale disagrees with the implications of these statements. NuScale acknowledges that for existing LWRs the RCPB functions as a physical fission product barrier under circumstances where an accident could damage fuel without failure of the RCPB itself. However, the RCPB's role as a "fission product barrier" is primarily that of preventing accidents from occurring, through maintaining its integrity and thus normal core cooling capability. Unexpected "opening" of the RCPB (i.e., a failure) for those designs would be expected to challenge fuel integrity; in turn, one fission product barrier, containment, would remain.

NuScale's design fully adheres to the primary objective of defense-in-depth (DID): "to avert damage to the plant thereby ensuring the protection of public health and safety while maintaining an acceptably low probability of accidents."[1] The fundamental design features of DID are "(1) prevention of accidents, (2) protective systems are provided to take corrective actions, and (3) engineered safety features to mitigate the consequences of postulated serious accidents."[2] Just as RCPB integrity prevents accidents in a traditional LWR, RCPB integrity is maintained as the primary line of defense in the NuScale design to prevent accidents—in accordance with 10 CFR 50.55a and GDCs 14, 15, 30, and 31. Under a range of transient conditions, including AOOs, NuScale relies on the containment vessel as a safe, passive, long-term residual heat removal flow path, which *prevents* accidents by ensuring fuel integrity. This safe, stable, analyzed condition is a feature of the design, not a shortcoming. Just as traditional designs take extraordinary measures to prevent failures of the RCPB that could cause accidents and provide features to mitigate such accidents should they occur, NuScale's design also entails such measures. The opening of the ECCS valves under AOO conditions (other than an *inadvertent* opening of the valves) is not an unexpected failure. Experiences in existing PWRs with stuck-open RCPB valves and subsequent challenges to emergency core cooling systems do not translate to this feature of NuScale's design.

Thus, while NuScale fully agrees with Staff's underlying defense-in-depth expectations, NuScale disagrees that the only acceptable view of defense-in-depth would mandate the same "barriers" be utilized in the same manner for advanced, passive reactors like NuScale's versus traditional LWRs. Under AOO conditions, the NuScale design maintains at least two safety-related fission product barriers: the fuel cladding and the containment vessel. Moreover, the reactor coolant system continues, in conjunction with the containment vessel after RVV and RRV opening, to provide a stable core coolant flow path to prevent an accident (core damage) from occurring.

As described in Section II, above, NuScale understands the staff's concern regarding reliance on containment that forms the basis for Condition 4.5. However, the NuScale design offers significant improvements in defense-in-depth by enabling the RCS to safely depressurize. Accordingly, NuScale believes the Condition should be narrowed to specifically address the following more specific safety concern, which is discussed in the basis for Condition 4.5: *Containment should not be pressurized to its design pressure during the normal course of plant operation, including events anticipated to occur (AOOs) within the life of a reactor module.* Even though containment is designed to be pressurized to its design pressure, similar to the RCPB, it differs from the RCPB in that it is not normally used in that condition. Similar to a traditional LWR's use of ECCS, pressurization of the NuScale containment near design pressure is intended only to offer protection when the RCS is inadvertently and rapidly depressurized. And as a traditional LWR limits its use of ECCS to prevent "challenges" to it, the NuScale

[1] SECY-13-0132, U.S. Nuclear Regulatory Commission Staff Recommendation For The Disposition Of Recommendation 1 Of The Near-Term Task Force Report, Enclosure 3, Defense in Depth Observations and Detailed History, p. 6.
[2] *Id.* at 3.

power module has been designed to limit the anticipated frequency for inadvertently pressurizing containment near design pressure such that it is not expected to occur in the life of a reactor module.

If staff agrees that the defense-in-depth concern underlying Condition 4.5 is limited to the frequency that containment will be *inadvertently* pressurized to near design pressure, then Condition 4.5 could be rewritten as follows:

> *Demonstrate that inadvertent actuation of the RCS depressurization system (i.e., NuScale ECCS) leading to containment pressures approaching the containment design pressure is not expected to occur during the lifetime of the module.*

NuScale believes such a Condition is appropriately tailored to address Staff's concern without imposing burdens on NuScale's design that are potentially contrary to its fundamental approach to safety.

As currently written, Condition 4.5 may broadly limit the use of the ECCS valves in conflict to the intended use of these valves in the NuScale design. The condition requires that "a DBE [design basis event] that removes the RCPB as a fission product barrier does not occur with the frequency of an AOO." While DBE is not formally defined in NRC regulations, its understood meaning—consistent with Standard Review Plan Section 15.0—includes "Conditions of normal operation, including AOOs, design-basis accidents, external events, and natural phenomena." NuScale's design basis includes opening of the ECCS valves under a range of normal and off-normal conditions to perform a residual heat removal function, in addition to the emergency core cooling function under certain design-basis accident conditions. The NRC SER, as currently written, indicates that staff would consider the intentional use of the containment vessel as part of the residual heat removal flow path as "removing a fission product barrier." While NuScale disagrees with Staff's interpretation, assuming it to be correct NuScale's design basis therefore necessarily means "removing the RCPB as a fission product barrier" occurs with the frequency of an AOO. In addition to normal conditions like cooldown for refueling, by design AOOs for the NuScale design ultimately result in opening of the RVVs and RRVs at less than containment design pressures — a safe, long-term cooling condition — irrespective of DC power reliability. Therefore, there is no reliability of the DC power system that could achieve Condition 4.5 as currently worded. However, the reliability of electric power systems is of interest to limit the frequency of containment pressurization to its design pressure due to inadvertent ECCS actuation. NuScale believes the proposed alternative Condition 4.5 provides reasonable assurance of adequate safety, consistent with NuScale's understanding of the Staff's safety concern and NuScale's design basis.

If Staff agrees with an alternative Condition 4.5, limited to addressing the frequency under which the Containment will be *inadvertently* pressurized to design pressures rather than a broader concern with the opening of the ECCS valves being considered a loss of a fission product barrier, then NuScale further requests the SER discussion associated with Condition 4.5 be revised accordingly. Specifically, NuScale is concerned with the staff's regulatory link to GDC 15. NuScale agrees with NRC staff that GDC 15 serves an underlying DID purpose, namely ensuring the structural integrity of the RCPB in order to prevent its unexpected failure and potential accidents that would result. However, NuScale believes that GDC 15 is fully satisfied by assuring that design conditions of the RCPB are not exceeded during conditions of normal operations, including AOOs. NuScale's reliance on the containment, via the RRVs and RVVs, to perform a residual heat removal function under normal and AOO conditions is unlike a failure of RCPB integrity. Such use of the containment flow path is a design function, conservatively evaluated to safely perform that function assuming limiting failures.

NRC's invocation of GDC 15, however, implies that it is violated by failing to maintain coolant within the RCPB during AOOs, or, at the least, by depressurizing the RCPB in response to AOOs. Whereas preventing the exceedance of RCPB design conditions during AOOs is a well-understood acceptance criterion, NuScale is unclear of the bounds of such a new GDC 15 test. Therefore, NuScale is concerned about the implications of this discussion within the SER for future NuScale licensees. While NuScale acknowledges the "direct coolant flowpath" to containment differs from the traditional LWR use of safety and power-operated relief valves in response to AOOs, we believe the appropriate test for satisfying GDC

15 is not whether the event "*can* result in significant pressurization of containment" or "*can* result in a significant tensile stress on the fuel cladding." Rather, the issue for GDC 15 has been and should remain whether AOO conditions can cause failure of the RCPB. Intentional opening of the ECCS valves is not such a failure because it has been demonstrated safe (containment and fuel integrity is safely maintained) for the NuScale design. NuScale believes instead that GDC 50 more appropriately underlies Staff's concern as discussed herein, and would form the basis for the Condition proposed.

IV. Conclusion

NuScale intended to conform with the second sentence of Condition 4.5 by justifying that the Condition is not applicable to the NuScale design. Since the Staff does not intend this alternate provision to be available to NuScale, a public meeting is requested to attempt to reach alignment on Staff's and NuScale's concerns and an alternative Condition. NuScale has provided for NRC consideration an alternative Condition 4.5 that should resolve the concerns discussed herein by specifically addressing the frequency of containment pressurization to near containment design pressure.

The NuScale design offers improvements in defense-in-depth by enabling the RCS to safely depressurize. NuScale's ECCS design provides safe, stable long-term cooling under normal and AOO conditions, in addition to its emergency cooling function under DBA conditions. This approach provides protection against radiological release even if subsequent independent failures lead to a loss of either the core cooling or the containment function. Further, for beyond design basis containment bypass events, intentional RCS depressurization is beneficial in terms of safety. The alternative Condition 4.5 proposed here would appropriately tailor the defense-in-depth principle to NuScale's approach to accident prevention and preservation of sufficient fission product barriers, without limiting use of the ECCS to perform its design basis functions.