RAIO-0818-61388

August 15, 2018

Docket No. 52-048

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. 492 (eRAI No. 9551) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 492 (eRAI No. 9551)," dated June 20, 2018

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 Questions from NRC eRAI No. 9551:

- 05.02.03-18
- 05.02.03-19

This letter and the enclosed response make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Carrie Fosaaen at 541-452-7126 or at cfosaaen@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9551

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NuScale Response to NRC Request for Additional Information eRAI No. 9551

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Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 9551
Date of RAI Issue: 06/20/2018

NRC Question No.: 05.02.03-18

Regulatory basis: 10 CFR Part 50, Appendix A, GDC 1 and GDC 30 require that components in the reactor coolant pressure boundary shall be designed, fabricated, erected, and tested to the highest quality standards practicable. 10 CFR Part 50, Appendix A, GDC 4 requires SSCs to be designed and fabricated to accommodate the effects of environmental conditions during normal, off normal, and accident conditions.

On December 18, 2017 the applicant provided a response to RAI 9193 Question 05.02.03-11. The applicant states that the description of "weld filler classifications compatible with low alloy base metal" is sufficient in detail to meet NRC regulations. The applicant cites the AP1000 and the US-EPR designs as the basis for this conclusion. The staff has reviewed the applicant's response and disagrees.
The staff has requested information on the weld filler materials for the RPV from multiple DCD applicants. This includes the System 80+ (10 CFR Part 52, Appendix C) and the ESBWR (10 CFR Part 52, Appendix E). The staff has also requested this information as part of the DCD review for the US-APWR and the APR1400.
The applicant's requirement of "compatible with the base metal" does not provide sufficient detail to determine of the filler material is suitable for service in the reactor coolant system. The term "compatibility" is not term a commonly used in welding or weldment design.
Define "compatible with low allow base metal," describe how "compatibility with the base metal" ensures that the RPV welds can be made under fabrication conditions (including any process requirements), and how "compatibility with the base metal" provides a sufficient technical assurance that the probability of RPV failure is consistent with the GDC 4 requirements.
Alternatively, if the applicant utilizes the term "compatible with the base metal" because the weld filler material will be chosen at a later time (during procurement when a component fabricator determines the optimal chemical composition for the weldment) the applicant may revise the DCD Tier 2, FSAR information to identify the weld filler material as a COL Action Item.

NuScale Response:

The NuScale design requires conformance to the American Society of Mechanical Engineers (ASME) Boiler Pressure Vessel Code (BPVC) 2013 edition. In addition, the NuScale design specifies that weld filler metals must meet all applicable ASME BPVC requirements and NRC regulatory requirements. Examples of ASME BPVC requirements and NRC regulatory requirements include: ASME BPVC Section II Part C, NB-2000 of ASME BPVC Section III, Subsection NB, 10CFR50 Appendix G & Appendix H, Regulatory Guide (RG) 1.34, RG 1.50, RG 1.71, and RG 1.99. RPV fabricators will be required to use compatible weld filler metals to meet the NuScale RPV design specifications including the same weld metal mechanical and chemical composition requirements. When NuScale states that the weld filler material is compatible with the base metal, this statement means that the NuScale design will conform with applicable portions of the 2013 edition of the ASME BPVC and will meet applicable regulatory requirements.

As a practical matter, each reactor pressure vessel (RPV) fabricator uses slightly different low alloy steel filler metal specifications due to its unique experience and equipment. Thus, NuScale cannot identify a specific weld filler material that will be used for each RPV fabrication. In addition, NuScale cannot defer the identification of a specific weld filler material to the combined license applicant (COLA), because the same issue will still exist. NuScale may not have selected the RPV fabricators prior to the initial COL application. Each time NuScale changes RPV fabricators or adds new RPV fabricators, the NuScale DCA or COLA would potentially need to be updated. This would increase NRC staff and NuScale burden for no technical or regulatory reason. Finally, as stated previously, the NRC staff found this practice acceptable for RPV weld metal filler metals in the AP1000 DCD and AP1000 COLA.

In this NRC request for additional information (RAI) the NRC staff did not provide specific technical or regulatory bases why the NRC disagrees with NuScale's Design Certification Application (DCA) position and previous RAI responses, except to state that other DCAs (e.g. the NRC identified US-APWR and APR1400) have provided specific RPV weld filler material information. NuScale can only assume that the DCAs that the NRC identified must be RPV fabricators themselves or will have the RPV fabricated by the same fabricator that they have used previously. On this basis, these applicants can provide the exact weld filler metal specifications before RPV production. NuScale, like Westinghouse (i.e. AP 1000 DCA), is not an RPV fabricator, and therefore cannot identify the specific RPV weld filler metal specifications prior to selecting an RPV fabricator.

Finally, the NRC will have an opportunity to review the NuScale ASME Design report provided by the COL applicant. This requirement is tracked in Part 2, Tier 1, Table 2.1-4, items 1 and 2 and Part 2, Tier 2, Table 14.3-1 as ITAAC No.s 02.01.01, and 02.01.02. The ASME Design report ensures that applicable ASME BPVC requirements have been met for the NuScale Power Module (NPM), this would include the weld filler material compatibility with RPV.

Based on the above, NuScale has determined that selecting weld filler material that is compatible with the base metal, that is, meets ASME BPVC requirements and NRC regulatory requirements, is sufficient to demonstrate a safety finding and meets GDC 4 and GDC 30 requirements. Specifically, by meeting these requirements, structures, systems, and components important to safety will be designed to the highest quality standards to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. NuScale does not believe that there is a regulatory or technical basis for needing to list the exact filler material in the DCA, and that doing so would be unnecessarily limiting. Finally, the ASME Design report (an ITAAC item) will certify to the NRC that the NPM as constructed meets applicable ASME BPVC requirements.

Impact on DCA:

There are no impacts to the DCA as a result of this response.

Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 9551
Date of RAI Issue: 06/20/2018

NRC Question No.: 05.02.03-19

Regulatory basis: 10 CFR Part 50, Appendix A, GDC 1 and GDC 30 require that components in the reactor coolant pressure boundary shall be designed, fabricated, erected, and tested to the highest quality standards practicable. GDC 30 also requires the means for detecting and identifying, to the extent practical, the location of the source of RCS leakage.

On December 18, 2017, the applicant provided a response to RAI 9193 Question 05.02.03-14. The staff has reviewed the applicant's response and agrees that the applicant's approach is acceptable. However, the staff notes that the containment environment monitoring element described by the applicant in the RAI response is not reflected in the Tier 2 DCD information. One acceptable approach to revising the information in the DCD would be:

> COL Item 5.2-5
> A COL applicant that references the NuScale Power Plant design certification will develop and implement a Boric Acid Control Program that includes: inspection elements to ensure the integrity of the reactor coolant pressure boundary components for subsequent service, monitoring of the containment atmosphere for evidence of RCS leakage, the type of visual or other nondestructive inspections to be performed, and the required inspection frequency.

NuScale Response:
COL Item 5.2-5 has been revised as the NRC requested. See the enclosed markup of the NuScale Final Safety Analysis Report.

Impact on DCA:

FSAR Table 1.8-2 and COL Item 5.2.-5 have been revised as described in the response above and as shown in the markup provided in this response.

RAI 01-61, RAI 02.04.13-1, RAI 03.04.01-4, RAI 03.04.02-1, RAI 03.04.02-2, RAI 03.04.02-3, RAI 03.05.01.04-1, RAI 03.05.02-2, RAI 03.06.02-15, RAI 03.06.03-11, RAI 03.07.01-2, RAI 03.07.01-3, RAI 03.07.02-8, RAI 03.07.02-12, RAI 03.08.04-23S1, RAI 03.08.05-14S1, RAI 03.09.02-15, RAI 03.09.02-48, RAI 03.09.02-67, RAI 03.09.03-12, RAI 03.09.06-5, RAI 03.09.06-6, RAI 03.09.06-16, RAI 03.09.06-16S1, RAI 03.09.06-27, RAI 03.11-8, RAI 03.11-14, RAI 03.11-14S1, RAI 03.11-18, RAI 03.13-3, RAI 04.02-1S2, RAI 05.02.03-19, RAI 05.02.05-8, RAI 05.04.02.01-13, RAI 05.04.02.01-14, RAI 06.04-1, RAI 09.01.02-4, RAI 09.01.05-3, RAI 09.01.05-6, RAI 09.03.02-3, RAI 09.03.02-4, RAI 09.03.02-5, RAI 09.03.02-6, RAI 09.03.02-8, RAI 10.02-1, RAI 10.02-2, RAI 10.02-3, RAI 10.02.03-1, RAI 10.02.03-2, RAI 10.03.06-1, RAI 10.03.06-5, RAI 10.04.06-1, RAI 10.04.06-2, RAI 10.04.06-3, RAI 10.04.10-2, RAI 13.01.01-1, RAI 13.01.01-1S1, RAI 13.02.02-1, RAI 13.03-4, RAI 13.05.02.01-2, RAI 13.05.02.01-2S1, RAI 13.05.02.01-3, RAI 13.05.02.01-3S1, RAI 13.05.02.01-4, RAI 13.05.02.01-4S1, RAI 14.02-7, RAI 19-31, RAI 19-31S1, RAI 19-38, RAI 20.01-13

Table 1.8-2: Combined License Information Items

Item No.	Description of COL Information Item	Section
COL Item 1.1-1:	A COL applicant that references the NuScale Power Plant design certification will identify the site-specific plant location.	1.1
COL Item 1.1-2:	A COL applicant that references the NuScale Power Plant design certification will provide the schedules for completion of construction and commercial operation of each power module.	1.1
COL Item 1.4-1:	A COL applicant that references the NuScale Power Plant design certification will identify the prime agents or contractors for the construction and operation of the nuclear power plant.	1.4
COL Item 1.7-1:	A COL applicant that references the NuScale Power Plant design certification will provide site-specific diagrams and legends, as applicable.	1.7
COL Item 1.7-2:	A COL applicant that references the NuScale Power Plant design certification will list additional site-specific piping and instrumentation diagrams and legends as applicable.	1.7
COL Item 1.8-1:	A COL applicant that references the NuScale Power Plant design certification will provide a list of departures from the certified design.	1.8
COL Item 1.9-1:	A COL applicant that references the NuScale Power Plant design certification will review and address the conformance with regulatory criteria in effect six months before the docket date of the COL application for the site-specific portions and operational aspects of the facility design.	1.9
COL Item 1.10-1:	A COL applicant that references the NuScale Power Plant design certification will evaluate the potential hazards resulting from construction activities of the new NuScale facility to the safety-related and risk significant structures, systems, and components of existing operating unit(s) and newly constructed operating unit(s) at the co-located site per 10 CFR 52.79(a)(31). The evaluation will include identification of management and administrative controls necessary to eliminate or mitigate the consequences of potential hazards and demonstration that the limiting conditions for operation of an operating unit would not be exceeded. This COL item is not applicable for construction activities (build-out of the facility) at an individual NuScale Power Plant with operating NuScale Power Modules.	1.10
COL Item 2.0-1:	A COL applicant that references the NuScale Power Plant design certification will demonstrate that site-specific characteristics are bounded by the design parameters specified in Table 2.0-1. If site-specific values are not bounded by the values in Table 2.0-1, the COL applicant will demonstrate the acceptability of the site-specific values in the appropriate sections of its combined license application.	2.0
COL Item 2.1-1:	A COL applicant that references the NuScale Power Plant design certification will describe the site geographic and demographic characteristics.	2.1
COL Item 2.2-1:	A COL applicant that references the NuScale Power Plant design certification will describe nearby industrial, transportation, and military facilities. The COL applicant will demonstrate that the design is acceptable for each potential accident, or provide site-specific design alternatives.	2.2
COL Item 2.3-1:	A COL applicant that references the NuScale Power Plant design certification will describe the site-specific meteorological characteristics for Section 2.3.1 through Section 2.3.5, as applicable.	2.3
COL Item 2.4-1:	A COL applicant that references the NuScale Power Plant design certification will investigate and describe the site-specific hydrologic characteristics for Section 2.4.1 through Section 2.4.14, ~~as applicable~~except Section 2.4.8 and Section 2.4.10.	2.4
COL Item 2.5-1:	A COL applicant that references the NuScale Power Plant design certification will describe the site-specific geology, seismology, and geotechnical characteristics for Section 2.5.1 through Section 2.5.5, below.	2.5

Table 1.8-2: Combined License Information Items (Continued)

Item No.	Description of COL Information Item	Section
COL Item 5.2-5:	A COL applicant that references the NuScale Power Plant design certification will develop and implement a Boric Acid Control Program that includes: inspection elements to ensure the integrity of the reactor coolant pressure boundary components for subsequent service, monitoring of the containment atmosphere for evidence of RCS leakage, the type of visual or other nondestructive inspections to be performed, and the required inspection frequency.	5.2
COL Item 5.2-6:	A COL applicant that references the NuScale Power Plant design certification will develop site-specific preservice examination, inservice inspection, and inservice testing program plans in accordance with Section XI of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code and will establish implementation milestones. If applicable, a COL applicant that references the NuScale Power Plant design certification will identify the implementation milestone for the augmented inservice inspection program. The COL applicant will identify the applicable edition of the American Society of Mechanical Engineers Code utilized in the program plans consistent with the requirements of 10 CFR 50.55a.	5.2
COL Item 5.2-7:	A COL applicant that references the NuScale Power Plant design certification will establish plant-specific procedures that specify operator actions for identifying, monitoring, and trending~~, and locating~~ reactor coolant system leakage in response to prolonged low leakage conditions that exist above normal leakage rates and below the technical specification limits. The objective of the methods of detecting and ~~locating~~trending the reactor coolant pressure boundary leak will be to provide the operator sufficient time to take actions before the plant technical specification limits are reached.	5.2
COL Item 5.3-1:	A COL applicant that references the NuScale Power Plant design certification will establish measures to control the onsite cleaning of the reactor pressure vessel during construction in accordance with Regulatory Guide 1.28.	5.3
COL Item 5.3-2:	A COL applicant that references the NuScale Power Plant design certification will develop operating procedures to ensure that transients will not be more severe than those for which the reactor design adequacy had been demonstrated.	5.3
COL Item 5.3-3	A COL applicant that references the NuScale Power Plant design certification will describe their reactor vessel material surveillance program consistent with NUREG 0800, Section 5.3.1.	5.3
COL Item 5.4-1:	A COL applicant that references the NuScale Power Plant design certification will develop and implement a Steam Generator Program for periodic monitoring of the degradation of steam generator components to ensure that steam generator tube integrity is maintained. The Steam Generator Program will be based on the latest revision of Nuclear Energy Institute (NEI) 97-06, "Steam Generator Program Guidelines," and applicable Electric Power Research Institute steam generator guidelines at the time of the COL application. The elements of the program will include: assessment of degradation, tube inspection requirements, tube integrity assessment, tube plugging, primary-to-secondary leakage monitoring, shell side integrity and accessibility assessment, steam plant corrosion product deposition assessment, primary and secondary side water chemistry control, foreign material exclusion, loose parts management, contractor oversight, self-assessment, and reporting.	5.4
COL Item 6.2-1:	A COL applicant that references the NuScale Power Plant design certification will develop a containment leakage rate testing program that will identify which option is to be implemented under 10 CFR 50, Appendix J. Option A defines a prescriptive-based testing approach whereas Option B defines a performance-based testing program.	6.2
COL Item 6.3-1:	A COL applicant that references the NuScale Power Plant design certification will describe a containment cleanliness program that limits debris within containment. The program should contain the following elements: • Foreign material exclusion controls to limit the introduction of foreign material and debris sources into containment. • Maintenance activity controls, including temporary changes, that confirm the emergency core cooling system function is not reduced by changes to analytical inputs or assumptions or other activities that could introduce debris or potential debris sources into containment. • Controls that limit the introduction of coating materials into containment. • An inspection program to confirm containment vessel cleanliness prior to closing for normal power operation.	6.3

guidelines. Whenever corrective actions are taken to address an abnormal chemistry condition, increased sampling is utilized to verify the effectiveness of these actions. When measured water chemistry parameters are outside the specified range, corrective actions are taken to bring the parameter back within the acceptable range and within the time period specified in the EPRI water chemistry guidelines. Following corrective actions, additional samples are taken and analyzed to verify that the corrective actions were effective in returning the concentrations of contaminants to within the specified range. Chemistry procedures will provide guidance for the sampling and monitoring of primary coolant properties.

Refueling operations will require the NuScale Power Module to be isolated, disconnected from the attached systems, and transported to the refueling pool for disassembly and refueling. The pool water will be purified by the pool cleanup system to ensure impurity levels in the pool water meet the impurity levels (i.e. chloride, fluoride, and sulfate) specified for reactor coolant system cold shutdown in the EPRI PWR Primary Water Chemistry Guidelines (Reference 5.2-3).

COL Item 5.2-4: A COL applicant that references the NuScale Power Plant design certification will develop and implement a Strategic Water Chemistry Plan. The Strategic Water Chemistry Plan will provide the optimization strategy for maintaining primary coolant chemistry and provide the basis for requirements for sampling and analysis frequencies, and corrective actions for control of primary water chemistry consistent with the latest version of the Electric Power Research Institute Pressurized Water Reactor Primary Water Chemistry Guidelines.

RAI 05.02.03-19

COL Item 5.2-5: A COL applicant that references the NuScale Power Plant design certification will develop and implement a Boric Acid Control Program that includes: inspection elements to ensure the integrity of the reactor coolant pressure boundary components for subsequent service, monitoring of the containment atmosphere for evidence of RCS leakage, the type of visual or other nondestructive inspections to be performed, and the required inspection frequency.

5.2.3.2.2 Compatibility of Construction Materials with Reactor Coolant

RAI 05.02.03-5, RAI 05.02.03-6

The RCPB ferritic low alloy steels used in pressure retaining applications have austenitic stainless steel cladding or Ni-Cr-Fe cladding on surfaces that are exposed to the reactor coolant. Low alloy steel forgings have an average grain size of five or finer in accordance with American Society for Testing and Materials standards. The cladding of ferritic type base material receives a post-weld heat treatment as required by ASME BPVC, Section III, Subsubarticle NB-4622.

RAI 05.02.03-4, RAI 05.02.03-5, RAI 05.02.03-6

The inside and outside surfaces of the RPV low alloy steels including RPV attachments and appurtenances in contact with reactor coolant, secondary water or pool water are clad with austenitic stainless steel or Ni-Cr-Fe. The austenitic stainless steel cladding on the inside surfaces is deposited with at least two layers;