FINAL ENVIRONMENTAL ASSESSMENT BY THE U.S. NUCLEAR REGULATORY COMMISSION RELATING TO THE CERTIFICATION OF THE NUSCALE STANDARD DESIGN DOCKET NO. 52-048

DATE

TABLE OF CONTENTS

UNITED STATES NUCLEAR REGULATORY COMMISSION

FINAL ENVIRONMENTAL ASSESSMENT AND FINDING OF

NO SIGNIFICANT IMPACT

RELATING TO THE CERTIFICATION OF THE

NUSCALE STANDARD DESIGN

DOCKET NO. 52-048

The U.S. Nuclear Regulatory Commission (NRC) is issuing a design certification for the NuScale standard design (NuScale) in response to an application submitted in December 2016 by NuScale Power, LLC (NuScale Power). The NRC adopts design certification rules as appendices to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

The NRC has performed the following environmental assessment of the environmental impacts of the new rule and has documented its finding of no significant impact in accordance with the requirements of 10 CFR 51.21, "Criteria for and identification of licensing and regulatory actions requiring environmental assessments"; 10 CFR 51.31, "Determinations based on environmental assessment"; and the National Environmental Policy Act of 1969, as amended. This environmental assessment addresses the severe accident mitigation design alternatives (SAMDAs) that the NRC has considered for NuScale. This environmental assessment does not address the site-specific environmental impacts of constructing and operating any facility that references the NuScale design certification rule at a particular site; the NRC will evaluate those

impacts as part of its review of any application(s) for the siting, construction, or operation of such a facility.

The NRC has determined that issuing this design certification does not constitute a major Federal action significantly affecting the quality of the human environment. This finding is based on the generic finding made in 10 CFR 51.32(b)(1) that there is no significant environmental impact associated with the certification of a standard design under 10 CFR Part 52, Subpart B, “Standard Design Certifications.” The proposed action does not authorize the siting, construction, or operation of a facility using NuScale. Rather, it codifies the NuScale standard design in a rule that could be referenced in a future licensing application. Furthermore, because the certification is a rule rather than a physical action, it does not involve the commitment of any resources that have alternative uses. The 10 CFR 51.32(b)(1) generic finding of no significant impact is, essentially, the legal equivalent of a categorical exclusion (72 FR 49427; August 28, 2007). Therefore, the NRC has not prepared an environmental impact statement for the proposed action.

Under 10 CFR 51.30(d), an environmental assessment for a standard design certification must identify the proposed action and is limited to consideration of the costs and benefits of SAMDAs and the bases for not incorporating SAMDAs in the design certification. As discussed in Section 4.0 of this environmental assessment, the NRC also reviewed NuScale Power’s assessment of SAMDAs that generically apply to the NuScale design. The NRC finds that NuScale Power’s assessment, as presented in its environmental report (ER), considered a reasonable set of SAMDAs at the design certification stage and adequately demonstrated that none of the evaluated SAMDAs would provide cost-beneficial risk improvements. This finding is applicable only to the SAMDAs considered at the time of the certification and may be referenced in a future licensing action, provided that the applicant referencing the NuScale DC rule is sited at a location with site characteristics that are encompassed by the site parameters of the design

certification representative site specified in the NuScale ER submitted as design certification application Part 3, “Applicant’s Environmental Report—Standard Design Certification,” Revision 5, issued July 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20224A512), and in the supporting documents.

NuScale Power identified 199 potential SAMDAs in the NuScale ER, Table A-1, “Screening of Proposed SAMDAs.” NuScale Power evaluated the SAMDAs and binned them into categories. NuScale Power determined 45 of the potential SAMDAs did not to apply to the NuScale design and others were already incorporated into the design. NuScale also determined 37 SAMDAs were related to a procedural or surveillance action, to a multi-unit site, or to design elements to be finalized as part of a future licensing action. Therefore, NuScale Power determined that these SAMDAs were not applicable at the design certification stage. NuScale Power evaluated the remaining SAMDAs to determine if any provided cost-beneficial risk improvements. NuScale Power determined that none of the evaluated SAMDAs was cost beneficial.

Of the 37 SAMDAs identified by NuScale Power to be finalized as part of a future licensing action, 34 are related to a procedural or surveillance action. For the remaining three SAMDAs identified by NuScale Power, two (SAMDAs 17 and 85) are for multi-unit sites.[1] Namely, a multi-unit site considered in these SAMDA candidates had at least two complete plants, each with 12 NuScale power modules (NPMs) in their respective reactor buildings. Since the NuScale design certification is for a single-unit site, the NRC is not considering multi-unit site issues, and a future license applicant should reevaluate these two SAMDAs if the site would have multiple units. The third SAMDA candidate not evaluated at the design certification stage (SAMDA 197) involves a design element of the reactor building crane (RBC) to reduce the risk from a dropped module due to human errors of commission. This design element will be

[1] SAMDA candidates for "multi-unit sites" are evaluated in the context of multiple 12 NPM plants at the same site.

provided as part of a future licensing action and is therefore not considered part of the design certification.

Based on the above, the NRC determined that 51 SAMDA candidates evaluated in the NuScale ER are appropriate for further review in this design certification. A future license applicant's ER referencing the NuScale design certification will need to evaluate the 37 SAMDAs that NuScale Power identified as not required for design certification.

ENVIRONMENTAL ASSESSMENT

1.0 Identification of the Proposed Action

The proposed action is to certify NuScale in Appendix G to 10 CFR Part 52.

2.0 Need for the Proposed Action

The need for the proposed action is to allow an applicant to reference the NuScale design certification rule as part of a future license application. Specifically, the NuScale certified design could be referenced in a combined license (COL) application under 10 CFR Part 52, or it may be used in a construction permit application under 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." Those portions of the NuScale design included in the scope of the design certification rulemaking are not subject to further safety review or approval in a future licensing proceeding. In addition, the NuScale design certification rule resolves the SAMDAs evaluated at the design certification stage for any future COL applications that reference the NuScale design certification rule and fall within the associated site parameters for the design certification representative site specified in the NuScale ER.

3.0 Environmental Impact of the Proposed Action

As stated in 10 CFR 51.32(b)(1), the NRC has determined that there is no significant environmental impact associated with the issuance of a design certification. The design

certification codifies the NRC's approval of the NuScale standard design through its final safety evaluation report on the design (ML20023A318). Furthermore, because the certification of the design does not authorize any action, it would not involve the commitment of any resources that have alternative uses.

As described in Section 4.0 of this environmental assessment, the NRC reviewed various alternative design features for preventing and mitigating severe accidents. The National Environmental Policy Act of 1969, as amended, requires the consideration of such alternatives to show that the design certification rule is the appropriate course of action. The NRC's regulations at 10 CFR 51.55(a) ensure that the design to be certified does not exclude any cost-beneficial design changes related to the prevention and mitigation of severe accidents.

Through its own independent analysis, the NRC concludes that NuScale Power adequately considered an appropriate set of SAMDAs at the design certification stage and that none met the criteria to be considered cost beneficial. Although NuScale Power made no design changes as a result of considering SAMDAs, NuScale Power had already incorporated certain severe accident prevention and mitigation design features into the NuScale design based on probabilistic risk assessment (PRA) results. (See design certification application Part 2, Tier 2, Section 19.2.2, "Severe Accident Prevention," and Section 19.2.3, "Severe Accident Mitigation" (ML20224A508)).

Finally, the design certification rule does not authorize the siting, construction, or operation of a nuclear power plant. An applicant for a construction permit, early site permit, COL, or operating license that references the NuScale design certification rule will be required to address the environmental impacts of construction and operation for its specific site. As part of this evaluation, such an applicant would evaluate the 37 SAMDAs that NuScale Power identified as not applicable at the design certification stage, given the procedural, training, siting, or design element details that would be needed to reliably assess the costs of each

improvement. The NRC will evaluate the environmental impacts for any future applicant's particular site and issue an environmental impact statement in accordance with 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions" and the National Environmental Policy Act of 1969, as amended. The SAMDA analysis that has been completed as part of this environmental assessment can be incorporated by reference into an environmental impact statement related to an application for siting, construction, or operation of a nuclear plant that references the NuScale design certification and falls within the associated site parameters of the representative site for the design certification specified in the NuScale ER.

4.0 Severe Accident Mitigation Design Alternatives

This section summarizes the NRC's review of the NuScale ER and the related SAMDAs, as provided in the NuScale ER and supporting documents. The NRC conducted a detailed technical evaluation of SAMDAs to support this environmental assessment documented in "Staff Technical Analysis in Support of the NuScale Design Certification Environmental Assessment," dated August 4, 2020 (ML19302E819).

Consistent with the Commission's objectives of standardization and early resolution of design issues, the NRC is evaluating the SAMDAs identified as within the scope of the NuScale design certification. In "Policy Statement on Severe Reactor Accidents Regarding Future Designs and Existing Plants" (50 FR 32138; August 8, 1985), the Commission defined the term "severe accident" as an event that is beyond the substantial coverage of design-basis events,[2] including events in which substantial damage is done to the reactor core (whether or not there are serious offsite consequences).

[2] Design-basis events are analyzed and documented in the NuScale design certification application, Part 2, Tier 2, Chapter 15, "Transient and Accident Analyses."

Alternative design features for severe accidents in a design certification must be evaluated in two ways:

- 10 CFR 52.47(a)(27) requires a design certification applicant to describe the design-specific PRA and its results.
- 10 CFR 51.30(d) requires the consideration of SAMDAs in an environmental assessment for a design certification.

Although these requirements are not directly related, they share common purposes. Their purposes are to consider alternatives to the proposed design, to evaluate whether potential alternative improvements in the plant design might significantly enhance safety performance during severe accidents, and to prevent the foreclosure of reasonable alternatives.

The PRA required for a design certification application comprises two major areas of analysis: (1) the identification of sequences of events that could lead to core damage and the estimation of their frequencies of occurrence (the Level 1 PRA analysis) and (2) the evaluation of the potential response of the containment to these sequences, with emphasis on the possible modes of containment failure and the corresponding radionuclide source terms (the Level 2 PRA analysis).

NuScale Power performed a PRA, described in the NuScale design certification application Part 2, Tier 2, Chapter 19, to achieve the following objectives:

- Identify the dominant severe accident sequences that account for most of the core damage frequency and associated source terms for the design.
- Modify the design, on the basis of PRA insights, to prevent severe accidents or mitigate their consequences and thereby reduce the risk of such accidents.
- Provide a qualitative basis for concluding that all reasonable steps have been taken to reduce the chances of severe accidents occurring and to mitigate the consequences.

The NuScale PRA evaluates the risk of core damage and release of radioactive material associated with both internal and external events that can occur during plant operation at power or while shut down. The NuScale Level 1 and Level 2 PRA models quantified seven risk categories:

(1) internal events

(2) low-power shutdown

(3) internal flooding

(4) internal fires

(5) external floods

(6) high winds

(7) multimodule

NuScale Power used insights from the NuScale PRA by applying a SAMDA analysis approach as described in Nuclear Energy Institute (NEI) 05-01, "Severe Accident Mitigation Alternatives (SAMA) Analysis Guidance Document," Revision A (NEI 05-1A), dated November 2005 (ML060530203). This guidance is an acceptable methodology to the NRC for the assessment of SAMAs[3] for license renewals under 10 CFR 51.53(c)(3)(ii)(L) (see "Final License Renewal Interim Staff Guidance LR-ISG-2006-03," dated August 2, 2007 (ML071640133)) but has not been endorsed or accepted for the assessment of new reactor SAMDAs under 10 CFR 51.55(a). However, the NRC recognizes that there is useful information and guidance in NEI 05-01A for application to the SAMDA assessment for a design certification, and this guidance has been used in other design certifications (e.g., the Advanced Power Reactor 1400 (APR1400) design certification's ER, dated December 2014 (ML15006A038)). First, NEI 05-01A applies the cost formulas from NUREG/BR-0184, "Regulatory Analysis Technical Evaluation Handbook," issued January 1997 (ML050190193) for assessing the

[3] SAMAs are a subset of SAMDAs, which are attributes of design alternatives, procedural modifications, and training activities for the mitigation of severe accidents.

maximum benefit and includes guidance on applying cost formulas to a SAMA assessment. Second, NEI 05-01A provides a standard list of SAMAs for pressurized water reactors (PWRs) (NuScale is a PWR) to aid in the identification of candidate SAMDAs. Finally, NEI 05-01A provides a process for screening and assessing whether a SAMDA is potentially cost beneficial. Therefore, the NRC accepts NuScale's application of the NEI 05-01A guidance for this SAMDA assessment.

NuScale Power analyzed the various combinations of events leading to radiological releases from the NPM. NuScale Power then grouped these combinations of events into eight release categories (RCs) specifically to be applied in the SAMDA analysis based on the initiating events and mitigation system availabilities. The RCs 1 through 7 are generally based on internal initiating events such as pipe breaks, steam generator tube failures, spurious emergency core cooling system actuation, and general transients. The RC 8 is associated with a dropped NPM during refueling operations. A potential cause of a dropped NPM could be failures associated with the RBC through human errors of commission.

The NuScale design certification is for a single plant with up to 12 NPMs located on a site that falls within the associated site parameters. In its application, NuScale Power stated that certain siting and calculated offsite consequences were based on data and parameters associated with the Surry Power Station (Surry) site. NuScale Power asserts this site to be a reasonably representative site for the purposes of the SAMDA analysis. The Surry site has been used for this same purpose in other severe accident analyses, with the most recent analysis being the State-of-the-Art Reactor Consequence Analyses (SOARCA). As part of the SOARCA documentation, information was provided in a supporting report with the necessary consequence code input information developed by the NRC staff for NuScale Power to use in the consequence analysis in its SAMDA assessment. Because the detailed information on the Surry site makes it a good source of information for a SAMDA assessment, and there are no

reasons that the Surry site would otherwise be inappropriate, the NRC determined that the Surry site is an acceptable representative site for the purposes of the applicant's SAMDA analysis.

Based on the NRC's review of NuScale Power's SAMDA evaluation, the NRC determined that NuScale Power adequately identified SAMDAs for RCs 1 through 7 that could potentially reduce risk, and that these SAMDAs would not be cost beneficial based on applying the representative site parameters in the NuScale ER. Two SAMDAs for RC 8 (SAMDA 197 to automate the NPM transport process and SAMDA 199 associated with RBC training and procedures) are not applicable at the design certification stage and are to be addressed by future applicants referencing the NuScale standard design. Additionally, NuScale Power has two other SAMDA candidates, namely, SAMDA 17 (create a cross-tie for diesel fuel oil) and SAMDA 85 (provide cross-unit connection of uninterruptible compressed air supply), that address multi-unit site risks. A future applicant referencing the NuScale design certification rule and proposing a site with multi-units would need to reevaluate these two SAMDA candidates.

The NRC has determined that the generic evaluation of SAMDAs for NuScale is both practical and warranted for two reasons. First, all plants referencing the NuScale design certification rule will be constructed according to the same certified design. Second, the representative site specified in the NuScale ER and supporting documents establish the consequences for a reasonable set of SAMDAs for the NuScale design certification. The low residual risk posed by the NuScale design certification, and the limited potential for further risk reduction, provide high confidence that additional cost-beneficial SAMDAs would not be found for sites with characteristics that fit within the site parameter envelope. If an actual characteristic for a particular site does not fall within the site parameters of the representative site specified in the NuScale ER, then SAMDAs that could be affected by the value of the site characteristic must be reevaluated in the site-specific ER and the environmental impact statement prepared in

connection with the application. If the actual characteristics of a proposed site fall within the site parameters of the representative site specified in the ER, then the SAMDA analysis can be incorporated by reference in the site-specific environmental impact statement, and SAMDAs need not be reevaluated in the environmental impact statement.

4.1. Potential Design Improvements Identified by NuScale Power

In the NuScale ER and the supporting documents, NuScale Power identified 199 candidate design alternatives, or design improvements, based on a review of the standard list of design alternatives provided in Table 14 of NEI 05-01, Revision A, and several other license renewal ERs. NuScale Power eliminated certain candidate design alternatives from further consideration on the following bases:

- They were already implemented in NuScale.
- They were not applicable to NuScale or to the design certification.
- They had excessive implementation costs.
- They were of very low benefit.
- They were combined into a comprehensive SAMDA candidate.
- They were not required at the design certification stage.

NuScale Power had already incorporated 18 candidate design alternatives, such as the following:

- installing a gas turbine generator,
- providing additional direct current battery capacity, and
- creating a reactor cavity flooding system.

NuScale Power applied a SAMDA screening process based on NEI 05-01, Revision A, and presented its assessment in the NuScale ER, Section 6. In summary, NuScale Power performed three screening steps to assess whether a SAMDA candidate should be considered for a cost-benefit analysis.

As described in Section 4.3.1 of this environmental assessment, if the expected implementation costs for a SAMDA candidate would exceed the calculated maximum benefit, resulting in a negative net present value (NPV), NuScale Power did not consider the SAMDA further. NuScale Power began the screening process with 199 SAMDAs. This screening process eliminated one potential design alternative that was identified as being unfeasible due to excessive implementation costs and that provided negligible benefit. Eighteen SAMDA candidates were identified as already implemented into the NuScale design. The applicant identified another 45 SAMDA candidates as not applicable to the NuScale design. Another 37 SAMDA candidates are not required at the design certification stage due to a procedural or surveillance action, related to a multi-unit site, or related to design elements to be finalized as part of a future licensing action. The applicant combined similar SAMDA candidates to develop more comprehensive SAMDA candidates, eliminating 13. It determined 34 potential design alternatives to be of very low benefit. NuScale Power retained the remaining 51 SAMDAs for further assessment in the cost-benefit analysis.

4.2. NRC Evaluation of Potential Design Improvements

The NRC reviewed NuScale Power's SAMDA candidate screening and selection process and determined that the methods applied and their implementation are appropriate. The NRC also determined that the set of SAMDA candidates evaluated by NuScale Power addressed the major contributors to core damage. For those SAMDA candidates that continued to SAMDA screening, NuScale Power applied a systematic and comprehensive process for identifying potential plant improvements for NuScale. The set of potential plant improvements identified by NuScale Power is reasonably comprehensive and, therefore, acceptable for the NRC to evaluate. As discussed previously, NuScale Power's SAMDA candidate search included reviewing insights from the design-specific PRA study as well as assessing SAMAs based on industry guidance (see Section 4.3.1 of this environmental assessment).

4.3. Cost Impacts of Candidate Severe Accident Mitigation Design Alternatives

4.3.1. NuScale Power Evaluation

In performing the cost-benefit analysis of the SAMDAs considered, NuScale Power estimated the cost of implementing the enhancement (cost of enhancement or COE) associated with potential events based on available information related to similar events and components of other nuclear power plant designs. NuScale Power derived the COE values for the NuScale SAMDAs from the compilation of information from the SAMA analyses performed for the license renewal applications of presently operating nuclear power plants, as documented in the licensees' renewal ERs and in the final supplemental environmental impact statements under NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants." From these sources of information, NuScale Power identified a minimum COE value of approximately $100,000.

4.3.2. NRC Evaluation

The NRC reviewed the analyses performed by NuScale Power and found that the estimated potential costs for the SAMDAs (i.e., COE values) evaluated by NuScale at the design certification stage are acceptable because the sources for the information and the cost estimates reasonably apply guidance based on prior NRC-reviewed license renewal SAMAs. This approach facilitates the cost-benefit comparisons founded on a screening approach when assessing the averted costs using 7-percent and 3-percent discount rates. This approach is consistent with Section 7.2 of NEI 05-01, Revision A.

4.4. Cost-Benefit Comparison

4.4.1. NuScale Power Evaluation

The methodology used by NuScale Power is based primarily on the NRC's guidance for performing cost-benefit analysis outlined in NUREG/BR-0184 and NEI 05-01A. The guidance involves determining the NPV for each SAMDA according to the following formula:

NPV = (APE + AOC + AOE + AOSC) – COE

where:

NPV = net present value of current risk ($)

APE = present value of averted public exposure ($)

AOC = present value of averted offsite property damage costs ($)

AOE = present value of averted occupational exposure ($)

AOSC = present value of averted onsite costs ($)

COE = cost of any enhancement implemented to reduce risk ($)

If the NPV of a SAMDA is negative, the cost of implementing the SAMDA is larger than the benefit associated with the SAMDA, and the SAMDA is not cost beneficial. As noted below, the applicant screened out 51 candidate SAMDAs from further analyses for this reason. If the SAMDA's benefit exceeds the estimated cost, resulting in a positive NPV, the SAMDA is potentially cost beneficial.

The maximum benefit that could be provided is calculated to be the sum of the four averted cost categories, as follows:

Maximum Benefit = APE + AOC + AOE + AOSC

Table 1 summarizes NuScale Power's and the NRC's estimates for each of the associated maximum benefit cost elements, applying the 7-percent discount rate. NuScale performed a sensitivity case for a single NPM using the 3-percent discount rate, with a result of approximately $341,000 total maximum benefit. The averted costs in Table 1 are based on the applicant's numerical PRA results and conservatively represent the potential benefit associated with eliminating all severe accidents. Additionally, as noted in design certification application Part 2, Tier 2, Chapter 19, Section 19.1.9.1, COL Item 19.1-8 states that a COL applicant that references the NuScale design certification will confirm the validity of the key assumptions and

data used in the design certification application PRA and modify them, as necessary, for applicability to the as-built, as-operated PRA.

Table 1 Calculated Total Maximum Benefit for Severe Accident Impact

Risk Category	Single NPM		12 NPMs	
	NuScale[a]	NRC	NuScale[a]	NRC
APE	$58.6	$61.4	$196	$205
AOC	$0.755	$0.859	$8.68	$9.47
AOE	$1,340	$1,360	$4,130	$4,250
AOSC	$31,300	$31,300	$131,000	$131,000
Total Maximum Benefit	$32,700	$32,735	$136,000	$136,000

[a] From Tables 5-3 and 5-4 of the NuScale ER.

It is important to note that the monetary present value estimate for each risk attribute does not represent the expected reduction in risk resulting from a single averted accident. Rather, it is the present value of potential losses extending over the projected lifetime of the facility (in this case, 60 years, which assumes a 40-year license and one 20-year license renewal). Therefore, it reflects the expected averted annual costs resulting from eliminating all severe accidents and the effect of discounting these potential averted future costs that may occur at any time over the licensed life to present value.

In September 2004, the NRC issued NUREG/BR-0058, “Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission,” Revision 4 (ML042820192), to reflect the agency’s policy on discount rates. NUREG/BR-0058, Revision 4, states that two sets of estimates should be developed—one at 3 percent and one at 7 percent.

As previously discussed, the applicant carried 51 SAMDAs to the next screening phase for cost-benefit consideration. For each of the SAMDAs applying the 7-percent discount rate, NuScale Power evaluated the NPV and determined whether the enhancements were cost beneficial. NuScale Power performed this part of the evaluation for the NPV by subtracting the cost of incorporating the SAMDA into the design, namely the COE value, from the maximum benefit derived, based on the conservative assumption that the implementation of any SAMDA

would reduce the total plant risk to zero. Through its SAMDA analyses, NuScale Power determined that the SAMDAs it considered to be within the scope of the design certification afforded no potentially cost-beneficial enhancements at the 7-percent discount rate. In NuScale ER Section 6.4, “Screening Sensitivity,” NuScale Power analyzed several sensitivity cases and found that only a siting sensitivity case using the Peach Bottom Atomic Power Station site (also analyzed in the SOARCA study) and the 3-percent discount rate sensitivity cases have the possibility to result in a SAMDA candidate that is potentially cost beneficial. The applicant further stated in NuScale ER Section 6.4 that the SAMDA candidates associated with seismic risk (i.e., SAMDAs 140, 187, and 188 associated with improvements to the seismic ruggedness of certain plant components) were potentially cost beneficial due to the higher seismic activity at the Peach Bottom site compared to the Surry site. However, the applicant stated that the likely NuScale specific implementation costs, as opposed to the assumed SAMDA implementation cost used for screening purposes, would show that these SAMDAs are not cost beneficial. Therefore, of the SAMDAs considered within the scope of the design certification, NuScale Power concluded that no design changes would provide a positive cost benefit if included in the NuScale design.

4.4.2. NRC Evaluation

The NRC selected a subset of the NuScale sensitivity cases described in NuScale ER Section 5.8, “Maximum Benefit Sensitivity Study,” for the NRC’s independent confirmatory analysis. The NRC’s confirmatory calculational results for the Surry site and Peach Bottom site (Sensitivity Case 3) are very similar to NuScale’s results. The NuScale sensitivity analysis demonstrates how insensitive the maximum benefit is to changes in the consequence analysis that affect the APE, AOC, and AOE values as shown by the results for Sensitivity Cases 1, 2, and 4 through 13. Based on the NRC’s confirmatory calculations and the NRC’s review of the NuScale’s sensitivity analysis, the NRC sees no benefit from performing confirmatory analysis

on all of the other sensitivity cases. The NRC recognizes, based on the above offsite consequence/risk and maximum benefit sensitivity analyses, that the APE, AOC, and AOE make only a small contribution to the total maximum benefit.

As shown in Table 1, the NRC's confirmatory analyses were in general agreement with those of NuScale Power for the offsite public exposure (i.e., APE), onsite occupational dose (i.e., AOE) averted costs, and the onsite (i.e., AOSC) averted costs. The NRC evaluation resulted in higher values than NuScale Power's evaluation for offsite property damage cost (i.e., AOC).

The frequency weighted maximum benefits for RC 1 through RC 7 are very small for the risks from either a single NPM or all 12 NPMs. Thus, the NRC finds it reasonable that the costs for SAMDA candidates that would reduce the frequency of RC 1 through RC 7 will be much greater than the maximum benefits of RC 1 through RC 7 (less than $100 for the risk from a single NPM and $1,200 for the risk from 12 NPMs). Therefore, none of the SAMDA candidates for reducing the risks from RC 1 through RC 7 would be potentially cost beneficial. As discussed below, an applicant referencing the certified design will need to address potential enhancements related to RC 8 and the procedural, training, siting, or design element details of the RBC.

The NRC reviewed the SAMDA candidates associated with seismic risk (i.e., SAMDAs 140, 187, and 188) given their potential to be cost beneficial due to the higher seismic activity at the Peach Bottom site compared to the Surry site. The NRC confirmed the applicant's assessment that the likely NuScale specific implementation costs would show that these SAMDAs are not cost beneficial.

The NRC notes that SAMDAs 17 and 85 would also be assessed at the license application stage, if applicable, due to their multi-unit aspects, and an applicant would address the site-specific external events and natural phenomena. SAMDA 197 (automate the NPM transport process) and SAMDA 199 (improve testing and maintenance procedures for the RBC),

related to RBC risk reductions, would also be addressed at the license application stage. Because of the SAMDA's sensitivity to site characteristics, the NRC also expects that an applicant would assess the costs and benefits of SAMDA 197. The license application stage is when the site characteristics are fully developed, with complete documentation in the application that would support a full and complete assessment of all possible SAMDA candidates for the severe accident scenario with the most significant risks.

For this reason, the NRC findings on the NuScale SAMDA analysis are limited to those SAMDAs that could reasonably be evaluated at the design certification stage. Therefore, the 37 SAMDAs that were not required to be resolved at the design certification stage are not considered resolved within the meaning of 10 CFR 52.63(a)(5). Rather, multi-unit aspects (SAMDAs 17 and 85), and the RBC design element details (SAMDA 197), as well as the 34 procedural and training SAMDAs, would need to be assessed when an application for a specific site to construct and operate a NuScale power plant is submitted.

The NRC's confirmatory analysis reached the same conclusion as NuScale Power that there were no cost-beneficial design alternatives for a single NPM for SAMDAs addressing RC 1 through RC 7. Based on the NRC's review of the methodology and associated analysis, NuScale Power's assessment of SAMDAs that could be evaluated at the design certification stage adequately incorporated the cost-benefit analysis. On May 11, 2020, NuScale Power and the NRC discussed the potential need to submit a revision to the ER because of recent design changes that prevent postulated boron redistribution scenarios. The discussion was conducted as part of the NRC audit of these design changes. As a result of the meeting, NuScale submitted a letter (LO-0720-70844, "NuScale Power, LLC Submittal of Environmental Report: Revision Status," dated July 10, 2020 (ML20192A326)) to document its evaluation of the potential need to revise the ER to reflect those design changes. The boron redistribution design changes have been evaluated for their effect on the ER. The NRC verified NuScale's conclusion

that the effect on the ER is limited to editorial changes associated with event sequence numbering and event descriptions for consistency with the Final Safety Analysis Report Chapter 19 changes that were included in design certification application Revision 4.1, dated June 19, 2020 (ML20197A413). A COL applicant that references the NuScale design certification will need to provide a revised ER with the noted editorial changes.

An applicant that references the NuScale design certification will confirm the validity of the key assumptions and data used in the design certification application PRA and modify them, as necessary, for applicability to the as-built, as-operated PRA as described in COL Item 19.1-8. As a result, a COL applicant will need to confirm the validity of the conclusions of the environmental report that are based on the design certification application PRA.

4.5. Conclusions on Severe Accident Mitigation Design Alternatives

The NRC reviewed NuScale Power's SAMDA analysis and concludes that the methods used and the implementation of the methods are appropriate. Based on the NRC's independent confirmatory evaluation as described in the previous sections, the NRC finds the results of the NuScale Power risk and maximum benefit analyses for the single NPM with respect to RC 1 through RC 7 to be reasonable, with no potentially cost-beneficial SAMDAs as assessed using the Surry site parameters for offsite consequence evaluation from the NuScale ER. However, the scope of this design certification does not include SAMDAs related to the procedural, training, siting, or design element details of the RBC; SAMDAs associated with multi-unit aspects; and procedural and training-related SAMDAs. Therefore, an applicant that references the NuScale design certification rule will need to reevaluate the maximum benefit and assessment of these SAMDAs.

The NRC based its independent evaluation on a reasonable treatment of costs, benefits, and sensitivities, as previously described in Section 4.4.2 of this environmental assessment.

Based on the NRC's review of NuScale Power's evaluation, including NuScale Power's response to requests for additional information, the NRC concludes that NuScale Power has adequately identified areas where risk could potentially be reduced in a cost-beneficial manner and has adequately assessed whether the implementation of the identified potential SAMDAs or candidate design alternatives would be cost beneficial for the given site parameters. This NRC conclusion is based on the site data and parameters that fall within those specified in the NuScale ER.

Accordingly, the NRC findings on the NuScale Power SAMDA analysis are limited to those SAMDAs evaluated as part of this design certification and do not include SAMDAs that address procedures, training, or RBC design element details, multi-unit aspects; and other procedural and training issues that would be included in an application referencing the NuScale certified design. These SAMDAs are considered outside the scope of the NuScale certified design. Therefore, the 37 SAMDAs associated with procedures and training, a multi-unit site, or the design element details of the RBC are not resolved within the meaning of 10 CFR 52.63(a)(5). In particular, an applicant that references the NuScale design certification rule will need to provide further SAMDA analyses after addressing the design element details of the RBC and after more information on procedures and training becomes available. SAMDAs on multi-unit aspects (SAMDAs 17 and 85) will need to be assessed if a specific multi-unit site is proposed in a future licensing action referencing the NuScale certified design.

5.0 Finding of No Significant Impact

On the basis of this environmental assessment, the NRC concludes that the proposed action will not have a significant effect on the quality of the human environment. Accordingly, the NRC is not required to prepare an environmental impact statement for the proposed action.

The design certification rule and the documents referenced in the preamble for the final rule contain further details with respect to the proposed action. Publicly available records will be

accessible online in the ADAMS Public Documents collection at https://www.nrc.gov/reading-rm/adams.html. Persons who do not have access to ADAMS or who encounter problems in accessing the documents in ADAMS should contact the NRC's Public Document Room reference staff at 1-800-397-4209, at 301-415-4737, or by e-mail to PDR.Resource@nrc.gov.