

NuScaleDCRaisPEm Resource

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Sent: Friday, December 15, 2017 9:32 AM
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Subject: Request for Additional Information No. 300 RAI No. 9186 (2.3.1)
Attachments: Request for Additional Information No. 300 (eRAI No. 9186).pdf

Attached please find NRC staff's request for additional information concerning review of the NuScale Design Certification Application.

Please submit your technically correct and complete response within 60 days of the date of this RAI to the NRC Document Control Desk. The NRC Staff recognizes that NuScale has preliminarily identified that the response to this question in this RAI is likely to require greater than 60 days.

If you have any questions, please contact me.

Thank you.

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Request for Additional Information No. 300 (eRAI No. 9186)

Issue Date: 12/15/2017

Application Title: NuScale Standard Design Certification - 52-048

Operating Company: NuScale Power, LLC

Docket No. 52-048

Review Section: 02.03.01 - Regional Climatology

Application Section: Part 02, Tier 2, Section 2.3.1 - Regional Climatology

QUESTIONS

02.03.01-6

QUESTIONS

02.03.01-6

Regulatory Background

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 2, "Design bases for protection against natural phenomena", states, in part, that "[s]tructures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena...without loss of capability to perform their safety functions" and that "[t]he design bases for these structures, systems, and components shall reflect...[a]ppropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated."

In addition, 10 CFR 52.47(a)(1) requires a design certification applicant to provide site parameters postulated for its design and an analysis and evaluation of the design in terms of those site parameters.

Further, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (SRP), Section 2.3.1, "Regional Climatology," establishes criteria that the NRC staff uses to evaluate whether an applicant meets the NRC's regulations. With respect to its review of the applicant's postulated design-basis dry- and/or wet-bulb temperature site parameter values, the NRC staff considered, in part, Item 6(e) under Subsection I (Areas of Review) and SRP Acceptance Criterion (7) under Subsection II (Acceptance Criteria) regarding ambient temperature and atmospheric moisture statistics for use in establishing heat loads for the design of normal plant heat sink systems, post-accident containment heat removal systems, and plant heating, ventilating, and air conditioning systems.

Key Issue

This question is seeking clarification on the definitions of the summer and winter outdoor dry- and/or wet-bulb temperatures listed as site parameters in FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1, including providing cross-references to those FSAR sections in which these postulated site parameters are used.

Information Requested

The NRC staff notes that the postulated design-basis summer and winter outdoor dry- and/or wet-bulb temperatures specified in FSAR Tier 1, Table 5.0-1, and Tier 2, Table 2.0-1 are the same numerical values listed in Table 1.2-6, “Envelope of ALWR Plant Site Design Parameters” of the Advanced Light Water Reactor Utility Requirements Document, Volume II – ALWR Evolutionary Plant, Chapter 1 (Overall Requirements), Revision 8, published by EPRI, March 1999. This indicates that there has been no change to the values of these “site design parameters” up through Revision 13 of the EPRI URD, which FSAR Tier 2, Section 2.3.1 cites as the basis for these postulated site parameter values. However, unlike FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1, Revision 8 of the EPRI URD designates these dry- and wet-bulb values as “0% Exceedance Values (historical limit excluding peaks < 2 hours)”.

In order for future potential COL applicants referencing the NuScale SMR plant design certification to be able to consistently develop and compare their climate-related site characteristics with the corresponding site parameter values, the applicant should address the following issues related to the design-basis dry- and/or wet-bulb temperature site parameter values in FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1 and in FSAR Tier 2, Section 2.3.1:

- (a) Confirm, for each of these site parameters, whether the postulated design-basis summer and winter outdoor dry- and/or wet-bulb temperatures represent 0 percent exceedance values relative to those specific seasons and, if so (considering the potential range of locations that the NuScale SMR plant design might be deployed in), what months define those seasons. If not, then please identify and explain what exceedance probability these site parameter values represent.
- (b) For each site parameter that represents a 0 percent exceedance value, confirm whether they also represent an absolute maximum or minimum value or, as in the EPRI URD, are based on historical limits excluding peaks less than 2 hours (or some other duration).
- (c) Define what the coincident wet-bulb temperature value represents (e.g., the overall maximum wet-bulb temperature that is coincident with the indicated dry-bulb temperature, the mean of the wet-bulb temperatures coincident with the indicated dry-bulb temperature, an estimated wet-bulb temperature value assumed to be coincident with the indicated dry-bulb temperature).
- (d) Consistent with SRP Section 2.3.1, Subsection I (Areas of Review), Item (6), last paragraph, which calls for “[a]ll references to FSAR (Final Safety Analysis Report) sections in which these conditions are used” to be identified by an applicant, please provide cross-references to those FSAR sections in which these postulated site parameters are used.
- (e) Annotate FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1 to clarify these postulated site parameter values as indicated above, and/or revise FSAR Tier 2, Section 2.3.1 and related discussions under Tier 2, Section 9.4 to further explain what these values represent.

02.03.01-7

QUESTIONS

02.03.01-7

Regulatory Background

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 2, “Design bases for protection against natural phenomena”, states, in part, that “[s]tructures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena...without loss of capability to perform their safety functions” and that “[t]he design bases for these structures, systems, and components shall reflect...[a]ppropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.”

In addition, 10 CFR 52.47(a)(1) requires a design certification (DC) applicant to provide site parameters postulated for its design and an analysis and evaluation of the design in terms of those site parameters.

NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (SRP), Section 2.3.1, “Regional Climatology,” establishes criteria that the NRC staff uses to evaluate whether an applicant meets the NRC’s regulations. With respect to its review of the applicant’s postulated design-basis dry- and/or wet-bulb temperature site parameter values, the NRC staff considered, in part, Item 6(e) under Subsection I (Areas of Review) and SRP Acceptance Criterion (7) under Subsection II (Acceptance Criteria) regarding ambient temperature and atmospheric moisture statistics for use in establishing heat loads for the design of normal plant heat sink systems, post-accident containment heat removal systems, and plant heating, ventilating, and air conditioning systems.

Further, SRP Section 2.3.1, Subsection IV (Evaluation Findings), Item 4(b), in part, calls for the NRC staff to reach a conclusion that “[t]he postulated site parameters are representative of a reasonable number of sites that have been or may be considered for a COL application.”

Key Issue

This question is seeking justification for the summer outdoor design non-coincident and coincident wet-bulb temperatures listed as site parameters in FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1. The chosen values are non-conservatively low in many geographical areas of the contiguous U.S., which may require COL applicants referencing the NuScale DCD for those locations to seek a departure from the DC rule.

Background Information

The NRC staff notes that the postulated design-basis summer and winter outdoor dry- and/or wet-bulb temperatures specified in FSAR Tier 1, Table 5.0-1, and Tier 2, Table 2.0-1 are the same numerical values listed in Table 1.2-6, “Envelope of ALWR Plant Site Design Parameters” of the Advanced Light Water Reactor Utility Requirements Document, Volume II – ALWR Evolutionary Plant, Chapter 1 (Overall Requirements), Revision 8, published by EPRI, March 1999. This indicates that there has been no change to the values of these “site design parameters” up through Revision 13 of the EPRI URD, which FSAR Tier 2, Section 2.3.1 cites as the basis for these postulated site parameter values.

In order for the NRC staff to reach the conclusion called for in SRP Section 2.3.1, Subsection IV (Evaluation Findings), Item 4(b), regarding these postulated site parameters, the applicant should address the following issues:

The postulated summer outdoor non-coincident wet-bulb temperature listed in FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1, and in Tier 2, Table 9.4.1-1 is 81 degrees (deg) F. The NRC staff notes that several of the previously reviewed DC applications for other new reactor designs initially referenced the EPRI URD for the same design ambient temperature site parameters, and in many cases subsequently revised several of these site parameter values, including the non-coincident wet-bulb temperature. The staff further notes that almost all of the Combined License (COL) and Early Site Permit (ESP) applications that it has reviewed identify a non-coincident wet-bulb temperature greater than the corresponding site parameter value listed in FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1. The table below summarizes many of these values (ESP applications are designated, all other entries are COL applications):

Site / Application	NCWB (deg F)
Bellefont	83.5
Callaway	81
Comanche Peak	86
Fermi	86.0
Grand Gulf	81
Levy County	85.5
Nine Mile Point	82.3
North Anna	88
PSEG ESP	86.2
River Bend	85.2
Shearon Harris	83.5
South Texas	88.3
Turkey Point	87.4
Victoria ESP	86.1
V.C. Summer	87.3
Vogtle	83.9
William States Lee	85

Note: NCWB = Non-Coincident Wet-Bulb Temperature

The geographical area covered by these site locations is diverse not only in latitude and longitude, but in topographic setting (i.e., coastal and interior) as well. Further, the NRC staff notes, based on data compiled by the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE) in its “Weather Data Viewer” (Version 3.0) that numerous locations throughout the contiguous 48 United States report maximum wet-bulb temperatures greater than the non-coincident wet-bulb temperature postulated for the NuScale SMR power plant design.

Requested Information

Therefore, given the preceding and with the NRC staff’s current understanding that the DC application does not appear to identify or explain the statistical bases for the postulated design-basis summer and winter outdoor dry- and/or wet-bulb temperatures, including the non-coincident wet-bulb temperature, the applicant should either:

- (1) update the DC application by justifying and clarifying the statement in FSAR Tier 2, Section 2.0, "Site Characteristics and Site Parameters" which reads "[t]he NuScale Power Plant design assumes site parameters that envelope conditions at most expected potential plant site locations in the United States", and elsewhere in the FSAR (if applicable), or
- (2) appropriately revise as necessary the postulated non-coincident wet-bulb temperature (81 deg F) and/or the postulated coincident wet-bulb temperature (80 deg F), such that the NRC staff can reach its conclusion as stated in the SRP Section 2.3.1, Subsection IV (Evaluation Findings), Item 4(b) that "[t]he postulated site parameters are representative of a reasonable number of sites that have been or may be considered for a COL application."

02.03.01-8

QUESTIONS

02.03.01-8

Regulatory Background

10 CFR Part 50, Appendix A, General Design Criterion (GDC) 2, "Design bases for protection against natural phenomena", states, in part, that "[s]tructures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena...without loss of capability to perform their safety functions" and that "[t]he design bases for these structures, systems, and components shall reflect...[a]ppropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated."

In addition, 10 CFR 52.47(a)(1) requires a design certification (DC) applicant to provide site parameters postulated for its design and an analysis and evaluation of the design in terms of those site parameters.

Further, NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (SRP), Section 2.3.1, "Regional Climatology," establishes criteria that the NRC staff uses to evaluate whether an applicant meets the NRC's regulations. With respect to its review of the applicant's postulated design-basis dry- and/or wet-bulb temperature site parameter values, the NRC staff considered, in part, Item 6(e) under Subsection I (Areas of Review) and SRP Acceptance Criterion (7) under Subsection II (Acceptance Criteria) regarding ambient temperature and atmospheric moisture statistics for use in establishing heat loads for the design of normal plant heat sink systems, post-accident containment heat removal systems, and plant heating, ventilating, and air conditioning systems.

Key Issue

This question is seeking justification regarding whether the "design-basis" summer and winter outdoor dry- and/or wet-bulb temperatures listed in FSAR Tier 2, Section 9.4 for the Reactor Building, Spent Fuel Pool Area, Radwaste Building, and Turbine Building ventilation systems should also be listed as site parameters in either FSAR Tier 1, Table 5.0-1 or FSAR Tier 2, Table 2.0-1, or both, and, if so, clarification of the definitions of these additional site parameter values, including providing cross-references to those FSAR sections in which these postulated site parameters are used.

Background Information

The NRC staff notes that other “design-basis” summer and winter outdoor dry- and/or wet-bulb temperatures are identified under FSAR Tier 2, Section 9.4, “Air Conditioning, Heating, Cooling, and Ventilation Systems”, but that they are not specified as postulated site parameters in FSAR Tier 1, Table 5.0-1, as part of the certified design, or in FSAR Tier 2, Table 2.0-1. These include:

- summer outdoor design dry- and wet-bulb temperatures of 100 deg F and 77 deg F, respectively, and a winter outdoor design dry-bulb temperature of -10 deg F, as listed in FSAR Tier 2, Table 9.4.2-1, “Outside Air Temperature Range for Reactor Building Ventilation System”, referenced from Tier 2, Subsection 9.4.2.1, “Design Bases”, under Tier 2, Section 9.4.2, “Reactor Building and Spent Fuel Pool Area Ventilation System”;
- summer outdoor design dry- and wet-bulb temperatures of 100 deg F and 77 deg F, respectively, and a winter outdoor design dry-bulb temperature of -10 deg F, as listed in FSAR Tier 2, Table 9.4.3-1, “Outside Air Design Temperature for the Radioactive Waste Building HVAC System”, referenced from Tier 2, Subsection 9.4.3.1, “Design Bases”, under Tier 2, Section 9.4.3, “Radioactive Waste Building Ventilation”; and
- summer outdoor design dry- and wet-bulb temperatures of 95 deg F and 77 deg F, respectively, and a winter design dry-bulb temperature of -5 deg F, as listed in FSAR Tier 2, Table 9.4.4-1, “Turbine Building HVAC System Outdoor Air Design Conditions”, referenced from Tier 2, Subsection 9.4.4.2, “System Description”, under Tier 2, Section 9.4.4, “Turbine Building Ventilation System”.

The NRC staff further notes that the “design-basis” summer and winter outdoor dry- and/or wet-bulb temperatures listed above are the same numerical values listed in Table 1.2-6, “Envelope of ALWR Plant Site Design Parameters” of the Advanced Light Water Reactor Utility Requirements Document, Volume II – ALWR Evolutionary Plant, Chapter 1 (Overall Requirements), Revision 8, published by EPRI, March 1999. This suggests that there has been no change to the values of these “site design parameters” up through Revision 13 of the EPRI URD. In addition, Revision 8 of the EPRI URD refers to the dry- and/or wet-bulb temperature values in the first two bulleted items above as “1% Exceedance Values” and the dry- and/or wet-bulb temperature values in the last bulleted item above as “5% Exceedance Values”. The wet-bulb temperatures in the bulleted items above are designated as “coincident wet bulb” temperatures in Revision 8 of the EPRI URD.

The referenced EPRI URD also identifies non-coincident wet-bulb temperature values of 80 deg F and 79 deg F for the 1% and 5% Exceedance Values, respectively. FSAR Tier 2, Section 9.4 does not appear to include any such values.

Information Requested

FSAR Tier 2, Section 1.2.1, “Principal Site Characteristics”, identifies the following structures as being included in the NuScale certified design (i.e., the Reactor Building (RXB), the Control Building (CRB), and the Radioactive Waste Building (RWB)). The applicant should address the following issues:

- (a) Confirm whether the “design-basis” summer and winter outdoor dry- and/or wet-bulb temperatures listed in the first two bulleted items above that are related to the “Reactor Building and Spent Fuel Pool Area Ventilation System” and to the “Radioactive Waste Building Ventilation” system should be identified as postulated site parameters in FSAR Tier 2, Table 2.0-1 or FSAR Tier 1, Table 5.0-1 as well. The NRC staff notes possible challenges to the listed wet-bulb temperature value similar to those discussed in RAI Question 02.03.01-7.

If these “design-basis” summer and winter outdoor dry- and/or wet-bulb temperatures are added to FSAR Tier 2, Table 2.0-1 and/or Tier 1, Table 5.0-1 as postulated site parameters:

- (1) Update the necessary text and any associated current or new table(s).
- (2) Confirm, for each of these site parameters, whether the postulated design-basis summer and winter outdoor dry- and/or wet-bulb temperatures represent a specific percent exceedance value relative to those specific seasons and, if so, specify the exceedance value. Also, considering the potential range of locations that the NuScale SMR plant design might be deployed in, indicate what months define those seasons. Otherwise, please explain the basis for these site parameter values.

- (3) Confirm whether the listed wet-bulb temperature value represents a coincident or non-coincident value and annotate accordingly.
 - (4) If the listed wet-bulb temperature is a value coincident with the indicated dry-bulb temperature, define what the coincident wet-bulb temperature represents (e.g., the overall maximum wet-bulb temperature that is coincident with the indicated dry-bulb temperature, the mean of the wet-bulb temperatures coincident with the indicated dry-bulb temperature, an estimated wet-bulb temperature value assumed to be coincident with the indicated dry-bulb temperature) so that COL applicants referencing the NuScale SMR plant design certification can consistently develop and compare their climate-related site characteristics with the corresponding site parameter values.
 - (5) Consistent with SRP Section 2.3.1, Subsection I (Areas of Review), Item (6), last paragraph, which calls for “[a]ll references to FSAR (Final Safety Analysis Report) sections in which these conditions are used” to be identified by an applicant, please provide cross-references to those FSAR sections in which these postulated site parameters are used.
- (b) Confirm whether the “design-basis” summer and winter outdoor dry- and/or wet-bulb temperatures listed in the last bulleted item above that are related to the “Turbine Building Ventilation System” should be identified as postulated site parameters in FSAR Tier 2, Table 2.0-1. The NRC staff notes possible challenges to the listed wet-bulb temperature value similar to those discussed in RAI Question 02.03.01-7.
- If these “design-basis” summer and winter outdoor dry- and/or wet-bulb temperatures are added to FSAR Tier 2, Table 2.0-1 as postulated site parameters, then the Applicant should address the same issues identified in Question 02.03.01-8, Items (a)(1) to (a)(5).
- (c) FSAR Tier 2, Table 9.2.7-1, “Site Cooling Water System Equipment Design Data”, as referenced from Tier 2, Subsection 9.2.7.2.1, “General Description”, under Tier 2, Section 9.2.7, “Site Cooling Water System” lists a design ambient wet-bulb temperature of 80 deg F. The applicant should confirm whether this value represents the postulated coincident wet-bulb temperature listed in FSAR Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1 and update the necessary text and the associated table accordingly.