2 SITE CHARACTERISTICS AND SITE PARAMETERS

This chapter of the safety evaluation report (SER) documents the U.S. Nuclear Regulatory Commission (NRC) staff's review of Chapter 2, "Site Characteristics and Site Parameters," of the NuScale Power, LLC (hereinafter referred to as "the applicant"), Design Certification Application (DCA), Part 2, "Final Safety Analysis Report (FSAR)."

The following evaluation focuses on the site parameters and site-related design characteristics the staff needs to be able to reach a conclusion about safety matters related to siting.

2.0 Site Characteristics

2.0.1 Introduction

This chapter discusses the assumed site envelope for the NuScale Small Modular reactor (SMR) design and focuses on the geography and demography, nearby facilities, and postulated site parameters for the design, including meteorology, hydrology, geology, seismology, and geotechnical parameters.

An applicant for a combined license (COL) (referred to as the "COL applicant") referencing the NuScale Power Plant design certification will compare site-specific data to the design parameter data identified in DCA Part 2 Tier 1, Table 5.0-1, "Site Design Parameters," and DCA Part 2 Tier 2, Table 2.0-1, "Site Design Parameters." If the specific data for the site fall within the assumed design parameter data and characteristics in DCA Part 2 Tier 1, Table 5.0-1 and DCA Part 2 Tier 2, Table 2.0-1, the NuScale SMR standard design is bounding for the site. If the specific data for the site fall outside the assumed design parameters in DCA Part 2 Tier 1, Table 5.0-1 and DCA Part 2, Tier 2 Table 2.0-1, the COL applicant will need to demonstrate, by some other means, that the proposed facility is acceptable at the proposed site.

2.0.2 Summary of Application

DCA Part 2 Tier 1: The Tier 1 information associated with this section is found in DCA Part 2 Tier 1, Section 5.0, "Site Parameters." DCA Part 2 Tier 1, Table 5.0-1, lists the key site parameters for the NuScale SMR design basis. DCA Part 2 Tier 1, Figures 5.0-1, "NuScale Horizontal Certified Seismic Design Response Spectra 5% Damping," and Figure 5.0-3, "NuScale Horizontal Certified Seismic Design Response Spectra – High Frequency 5% Damping," provide the horizontal NuScale SMR certified seismic design response spectra (CSDRS). DCA Part 2 Tier 1, Figures 5.0-2, "NuScale Vertical Certified Seismic Design Response Spectra 5% Damping," and Figure 5.0-4, "NuScale Vertical Certified Seismic Design Response Spectra - High Frequency 5% Damping," provide the vertical NuScale SMR certified seismic design response spectra (CSDRS).

DCA Part 2 Tier 2: The applicant has provided in DCA Part 2 Tier 2 description and summary table identifying design-basis parameters for the NuScale SMR design in Section 2.0, "Site Characteristics and Site Parameters," summarized here, in Part, as follows.

A COL applicant referencing the NuScale SMR Power Plant design certification (DC) will compare site-specific data to the design parameter data in DCA Part 2 Tier 2, Table 2.0-1. If the specific data for the site fall within the assumed design parameter data and characteristics in

DCA Part 2 Tier 2, Table 2.0-1, the NuScale SMR standard design is bounding for the site. For site-specific design parameter data or characteristics that are outside the bounds of the assumptions presented in DCA Part 2 Tier 2, Table 2.0-1, the COL applicant will confirm that the NuScale SMR design acceptably meets any additional requirements that may be imposed by the more limiting site-specific design parameter data or characteristics and that the design maintains conformance to the design commitments and acceptance criteria described in the NuScale SMR DCA Part 2.

DCA Part 2 Tier 2, Table 2.0-1 contains the same key site parameter descriptions and parameter values as those in DCA Part 2 Tier 1, Table 5.0-1.

Inspection, Test, Analysis, and Acceptance Criteria (ITAAC): There are no ITAAC for this area of review.

Technical Specifications (TS): There are no TS for this area of review.

Technical Reports: There are no technical reports associated with this area of review.

Topical Reports: NuScale Power LLC, Licensing Topical Report TR-0915-17565-P, "Accident Source Term Methodology," Revision 2, September 2017 (ADAMS Accession No. ML17254B068).

2.0.3 Regulatory Basis

Section 2.0, “Site Characteristics and Site Parameters,” of NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition” (hereafter referred to as the “SRP”), provides the relevant NRC staff requirements for these areas of review and the associated acceptance criteria, as summarized below.

- Title 10 of the *Code of Federal Regulations* (CFR), Section 52.47(a)(1) requires a DC applicant, among other things, to provide site parameters postulated for the design.

- The requirements in 10 CFR Part 100, “Reactor Site Criteria,” apply to the siting factors and criteria that apply to determining an acceptable site.

Review interfaces with other sections of the SRP can be found in SRP Section 2.0. The following provides the acceptance criteria that are adequate to meet the above requirements:

The related SRP Chapter 2 or other referenced sections of the SRP provide acceptance criteria associated with site characteristics and design parameters.

DC applications do not contain general descriptions of site characteristics because this information is site specific and is addressed by the COL applicant referencing the NuScale SMR Power Plant DC in the COL FSAR.

Acceptance is based on the COL applicant’s demonstration that the characteristics of the site fall within the site parameters of the certified design. If the actual site characteristics do not fall within the certified standard design site parameters, the COL applicant is to provide sufficient justification (e.g., by request for exemption or amendment from the DC) that the proposed facility is acceptable at the proposed site.

2.0.4 Technical Evaluation

The staff reviewed the DCA Part 2 using the review procedures described in SRP Section 2.0. The staff based its evaluation of the NuScale SMR site-related design parameters on a review of DCA Part 2, Chapter 2, "Site Characteristics and Site Parameters." The application addressed each of the pertinent site parameters described in 10 CFR 52.47(a)(1)(iii). The applicant described the adequacy of each site parameter in the individual safety analysis sections. As described in more depth below, the staff found that, within the scope of applicable COL Items as discussed in individual sections below, the postulated site parameters of the NuScale SMR design, as set forth in DCA Part 2 Tier 1, Table 5.0-1 and DCA Part 2 Tier 2, Table 2.0-1, were consistent with the applicable regulations and acceptance criteria cited in SRP Chapter 2 in that: (1) pertinent parameters were selected as key site parameters; (2) the key site parameters are representative of a reasonable number of sites that have been or may be considered for a COL application; and (3) a technical basis was provided for each site parameter.

2.0.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA Part 2 Tier 2, Table 1.8-2, "Combined License Information Items." The following table summarizes the COL information item related to Section 2.0.1.

Table 2.0-1. NuScale COL Information Item

Item No.	Description	FSAR Tier 2 Section
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

2.0.6 Conclusion

As set forth above, the staff reviewed the application to ensure that sufficient information was presented with respect to the characteristics of the postulated site parameters in the DC. Accordingly, as described in more depth below, the staff concludes that the applicant has addressed DC site parameters and thus meets the requirements in 10 CFR 52.47(a)(1).

2.1 Geography and Demography

2.1.1 Site Location and Description

2.1.1.1 Introduction

The staff uses the descriptions of the site area and reactor location to assess the acceptability of the reactor site. For applications submitted under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," the staff's review generally covers the following specific areas: (1) specification of reactor location with respect to latitude and longitude, political subdivisions, and prominent natural and manmade features of the area, (2) a site area map to determine the distance from the reactor to the boundary lines of the exclusion area, including consideration of the location, distance, and orientation of plant structures with respect to highways, railroads, and waterways that traverse or lie adjacent to the exclusion area, and (3) any additional information requirements prescribed by the "Contents of Application" sections of the applicable subparts to 10 CFR Part 52. The purpose of the review is to ascertain the accuracy of the applicant's description for use in independent evaluations of the exclusion area authority and control, surrounding population, and nearby manmade hazards.

2.1.1.2 Summary of Application

DCA Part 2 Tier 2: Section 2.1, "Geography and Demography," addresses the need for site location and description with a statement that a combined license (COL) applicant referencing the NuScale power plant design certification (DC) will provide site-specific information related to site location and description, exclusion area authority and control, and population distribution in accordance with COL Item 2.1-1.

2.1.1.3 Regulatory Basis

As specified in NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition" (SRP), Section 2.1.1, "Site Location and Description," the following regulations contain the relevant requirements generally applicable to site location and description:

- 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," and 10 CFR Part 52, as they relate to the inclusion, in the safety analysis report (SAR), of a detailed description and safety assessment of the site on which the facility will be located, with appropriate attention to features that affect the facility design (10 CFR 50.34(a)(1), 10 CFR 52.47(a)(1), and 10 CFR 52.79(a)(1)).

- 10 CFR Part 100, "Reactor Site Criteria," as it relates to: (1) defining an exclusion area and setting forth requirements for activities in that area (10 CFR 100.3, "Definitions"), (2) addressing and evaluating factors that are used to determine the acceptability of the site as identified in 10 CFR 100.20(a) and (b), (3) determining an exclusion area such that certain dose limits would not be exceeded in the event of a postulated fission product release as described in 10 CFR 50.34(a)(1), as it relates to the site evaluation factors identified in 10 CFR Part 100, and (4) requiring that the site location and the engineered features included as safeguards against the hazardous consequences of an accident, should one occur, should ensure a low risk of public exposure.

SRP Section 2.1.1 lists the acceptance criteria adequate to meet the above requirements, as well as review interfaces with other SRP sections. In addition, the following guidance provides acceptance criteria that confirm that the above requirements have been adequately addressed:

- Specification of Location: The information submitted by the applicant is adequate and meets the requirements in 10 CFR 50.34(a)(1), 10 CFR 52.47(a)(1), and 10 CFR 52.79(a)(1) if it describes highways, railroads, and waterways that traverse the exclusion area in sufficient detail to allow the reviewer to determine that the applicant has met the requirements in 10 CFR 100.3.

- Site Area Map: The information submitted by the applicant is adequate and meets the requirements in 10 CFR 50.34(a)(1), 10 CFR 52.17(a)(1), and 10 CFR 52.79(a)(1) if it describes the site location, including the exclusion area and the location of the plant within the area, in sufficient detail to enable the reviewer to evaluate the applicant's analysis of a postulated fission product release, thereby allowing the reviewer to determine (based on SRP Section 2.1.2, "Exclusion Area Authority and Control," and Section 2.1.3, "Population Distribution") that the applicant has met the requirements in 10 CFR 50.34(a)(1) and 10 CFR Part 100.

SRP Section 2.1.1 identifies the following DCA-specific guidance:

- Standard DC Reviews: DCAs do not contain general descriptions of site characteristics because this information is site specific and will be addressed by the COL applicant. Under 10 CFR 52.47(a)(1), a DC applicant must provide site parameters postulated for the design. However, the identification of site location and description are not applicable for this area of [Standard DC] review.

There are no postulated site parameters for a DC related to this SRP section. The site location and description are site specific and will be addressed by the COL applicant.

2.1.1.4 Technical Evaluation

In DCA Part 2 Tier 2, the applicant stated that a COL applicant referencing the NuScale power plant DC will address the site-specific information on the site location and description to include the boundaries of the site; the proposed general location of each facility on the site; the location and description of any industrial, military, or transportation facilities and routes; and prominent natural and manmade features in the site area. The detailed information included the following:

- The reactor location with respect to: (1) latitude and longitude and the universal transverse Mercator coordinate system, (2) political subdivisions, and (3) prominent natural and manmade features of the area for use in conducting independent evaluations of the exclusion area authority and control (SRP Section 2.1.2), the surrounding population (SRP Section 2.1.3), and nearby manmade hazards (SRP Section 2.2.3, "Evaluation of Potential Accidents").

- The site area map containing the reactor and associated principal plant structures to determine: (1) the distance from the reactor to the boundary lines of the exclusion area, including the direction and distance from the reactor to the nearest exclusion area boundary (EAB) line, and (2) the location, distance, and orientation of plant structures with respect to highways, railroads, and waterways that traverse or lie adjacent to the exclusion area to ensure that they are adequately described to permit

analyses of the possible effects of plant accidents on these transportation routes (SRP Section 2.1.1).

- Because the information related to site location and description is site specific and to be provided by a COL applicant referencing the NuScale SMR Power Plan DC, the NuScale DCA does not contain this information.

2.1.1.5 Combined License Information Items

Table 2.1-1 lists the COL information item related to DCA Part 2 Tier 2, Section 2.1.1, from DCA Part 2 Tier 2, Table 1.8-2, "Combined License Information Items."

Table 2.1-1 NuScale COL Information Items for Section 2.1.1

Item No.	Description	FSAR Tier 2 Section
COL Item 2.1-1	A COL Applicant that references the NuScale Power Plant design certification will describe the site geographic and demographic characteristics.	2.1.1

2.1.1.6 Conclusion

As set forth above, the applicant stated, in DCA Part 2 Tier 2, that the COL applicant will provide the site-specific information in accordance with COL Item 2.1-1. Because this information is site specific, the staff considers the applicant's statement in DCA Part 2 Tier 2 that the COL applicant will provide this site-specific information in accordance with COL Item 2.1-1 to be acceptable. Based on the foregoing regulatory basis, corresponding SRP guidance, and review of the DCA, the staff concludes that, because this information is site specific, it will be addressed by the COL applicant and, therefore, would be reviewed at the COL stage. The COL applicant should include information sufficient to demonstrate that the design of the plant falls within the values of the actual site characteristics as specified in a COL application.

2.1.2 Exclusion Area Authority and Control

2.1.2.1 Introduction

The staff uses the descriptions of exclusion area authority and control, as provided in the application, to verify the applicant's legal authority to determine and control activities within the designated exclusion area. For applications submitted under 10 CFR Part 52, the staff's review generally covers: (1) the establishment of the applicant's legal authority to determine all activities within the designated exclusion area, (2) the applicant's authority and control in excluding or removing personnel and property from the exclusion area in the event of an emergency, (3) the establishment that proposed or permitted activities in the exclusion area unrelated to operation of the reactor do not result in a significant hazard to public health and safety, and (4) any additional information requirements prescribed in 10 CFR Part 52.

2.1.2.2 Summary of Application

The applicant addressed the need for exclusion area authority and control with a statement that a COL applicant referencing the NuScale power plant DC will provide site-specific information related to exclusion area authority and control in accordance with COL Item 2.1-1.

2.1.2.3 Regulatory Basis

As specified in SRP Section 2.1.2, the following NRC regulations contain the relevant requirements generally applicable to exclusion area authority and control:

- 10 CFR Part 50 and 10 CFR Part 52, as they relate to including, in the SAR, a detailed description and safety assessment of the site on which the facility is to be located (10 CFR 50.34(a)(1), 10 CFR 52.17(a)(1), and 10 CFR 52.79(a)(1)).

- 10 CFR Part 100, as it relates to: (1) defining an exclusion area and setting forth requirements on activities in that area (10 CFR 100.3, 10 CFR 100.21(a)), (2) addressing and evaluating factors that are used in determining the acceptability of the site as identified in 10 CFR 100.20(a) and (b), and (3) determining an exclusion area such that certain dose limits would not be exceeded in the event of a postulated fission product release as identified in 10 CFR 50.34(a)(1), as it relates to site evaluation factors identified in 10 CFR Part 100.

- 10 CFR 50.33, "Contents of Applications; General Information," as it relates to ownership and control of property.

SRP Section 2.1.2 lists the following specific acceptance criteria adequate to meet the above requirements. In order to ensure the acceptance criteria are followed to the extent applicable, the staff utilizes the following review procedures. These procedures are based on the identified SRP acceptance criteria:

- Establishment of Authority: The information submitted by the applicant is adequate and meets the requirements of 10 CFR 50.33; 10 CFR 50.34(a)(1); 10 CFR 52.79, "Contents of Applications; Technical Information in Final Safety Analysis Report;" and 10 CFR Part 100 if it provides sufficient detail to enable the staff to evaluate the applicant's legal authority within the designated exclusion area.

- Exclusion or Removal of Personnel and Property: The information submitted by the applicant is adequate and meets the requirements of 10 CFR 50.33; 10 CFR 50.34(a)(1); 10 CFR 52.17, "Contents of Applications; Technical Information;" 10 CFR 52.79; and 10 CFR Part 100 if it provides sufficient detail to enable the staff to evaluate the applicant's legal authority for the exclusion or removal of personnel or property from the exclusion area.

- Proposed and Permitted Activities: The information submitted by the applicant is adequate and meets the requirements of 10 CFR 50.33, 10 CFR 50.34(a)(1), 10 CFR 52.17, 10 CFR 52.79, and 10 CFR Part 100 if it provides sufficient detail to enable the staff to evaluate the applicant's legal authority over all activities within the designated exclusion area.

SRP Section 2.1.2 identifies the following DCA-specific guidance:

- Standard DC Reviews: DCAs do not contain general descriptions of site characteristics because this information is site specific and will be addressed by the COL applicant. Under 10 CFR 52.47(a)(1), a DC applicant must provide site parameters postulated for the design. However, the identification of exclusion area authority and control is not applicable for this area of [Standard DC] review.

- Exclusion area authority and control is site specific and will be addressed by the COL applicant.

2.1.2.4 Technical Evaluation

The applicant need not postulate a location for the EAB or outer boundary of the low-population zone (LPZ) as site parameters because the points at which radiological doses are calculated under 10 CFR 52.47(a)(2)(iv) for these locations are implicit in the X/Qs discussed in Section 2.3, “Meteorology,” and Chapter 15, “Transient and Accident Analysis,” of this report.

In DCA Part 2 Tier 2, the applicant stated that a COL applicant referencing the NuScale power plant DC will address the site-specific information pertaining to exclusion area authority and control. SRP Section 2.1.2 addresses the specific criteria acceptable to meet the relevant requirements, which typically involve reviewing: (1) the applicant’s legal authority to determine all activities within the designated exclusion area, (2) the applicant's authority and control in excluding or removing personnel and property in the event of an emergency, (3) proposed or permitted activities in the exclusion area unrelated to the operation of the reactor to ensure they do not result in a significant hazard to public health and safety, (4) the presence of residences within the EAB (none are normally permitted; if so, the people who live within the EAB are subject to removal), and (5) traversal of highways, railways, or waterways across the exclusion area (which should not be close enough to the facility to interfere with normal operations).

The NuScale DCA does not contain this type of information because the information is site specific.

2.1.2.5 Combined License Information Items

Table 2.1-2 lists the COL information item related to DCA Part 2 Tier 2, Section 2.1.2, from DCA Part 2 Tier 2, Table 1.8-2.

Table 2.1-2. NuScale COL Information Items for Section 2.1.2

Item No.	Description	FSAR Tier 2 Section
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

2.1.2.6 Conclusion

As set forth above, the applicant has stated in DCA Part 2 Tier 2 that the COL applicant will provide the site-specific information called for in COL Item 2.1-1. Because this information is

site specific, the staff determined that the applicant's statement in DCA Part 2 Tier 2 that the COL applicant is to provide this site-specific information in accordance with COL Item 2.1-1 is acceptable. Based on the foregoing regulatory basis, corresponding SRP guidance, and review of the DCA, the staff also concludes that, because this information is site specific, it will be addressed by the COL applicant and, therefore, would be reviewed at the COL stage. The COL applicant should include information sufficient to demonstrate that the design of the plant falls within the values of the actual site characteristics specified in a COL application.

2.1.3 Population Distribution

2.1.3.1 Introduction

The description of population distribution addresses the need for information about: (1) the population in the site vicinity, including transient populations, (2) the population in the exclusion area, (3) whether appropriate protective measures could be taken on behalf of the populace in the specified LPZ in the event of a serious accident, (4) whether the nearest boundary of the closest population center containing 25,000 or more residents is at least 1⅓ times the distance from the reactor to the outer boundary of the LPZ, (5) whether the population density in the site vicinity is consistent with the guidelines provided in Regulatory Position C.4 of Regulatory Guide (RG) 4.7, "General Site Suitability Criteria for Nuclear Power Stations," Revision 3, issued March 2014, and (6) any additional information requirements in the sections titled, "Contents of Application," of the applicable subparts of 10 CFR Part 52.

2.1.3.2 Summary of Application

This applicant addressed the need for population distribution with a statement that a COL applicant referencing the NuScale power plant DC will provide site-specific information related to population distribution, in accordance with COL Item 2.1-1.

2.1.3.3 Regulatory Basis

As specified in SRP Section 2.1.3, the following NRC regulations contain the relevant requirements generally applicable to population distribution:

- 10 CFR 50.34(a)(1), as it relates to consideration of the site evaluation factors in 10 CFR 100.3; 10 CFR Part 100.20 and 100.21 (including consideration of population density); 10 CFR 52.47, "Contents of Applications; Technical Information"; and 10 CFR 52.79(a)(1)(v), as they relate to the applicant's SAR providing the existing and projected future population profile of the area surrounding the site.

- 10 CFR 100.20, "Factors to be Considered When Evaluating Sites," and 10 CFR 100.21, "Non-Seismic Site Criteria," as they relate to determining the acceptability of a site for a power reactor, and 10 CFR 100.3, 10 CFR 100.20(a), and 10 CFR 100.21(b), which include definitions and other requirements for determining an exclusion area, LPZ, and population center distance.

SRP Section 2.1.3 lists the acceptance criteria adequate to meet the above requirements, as well as review interfaces with other SRP sections. In order to ensure the acceptance criteria are followed to the extent applicable, the staff utilizes the following review procedures. These procedures are based on the identified SRP acceptance criteria:

- Population Data: The population data supplied by the applicant in the SAR are acceptable under the following conditions: (1) the SAR contains population data from the latest census and projected population at the year of plant approval and 5 years thereafter, consistent with the geographical format in Section 2.1.3 of RG 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants, LWR Edition," Revision 3, issued November 1978, and with the guidance in RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," issued June 2007; (2) the SAR describes the methodology and sources used to obtain the population data, including the projections; and (3) the SAR includes information on transient populations in the site vicinity.

- Exclusion Area: The exclusion area should either not contain any residents, or such residents should be subject to ready removal if necessary.

- Low-Population Zone: The specified LPZ is acceptable if a determination is made that appropriate protective measures could be taken on behalf of the enclosed populace in the event of a serious accident.

- Nearest Population Center Boundary: The nearest boundary of the closest population center containing 25,000 or more residents is at least 1⅓ times the distance from the reactor to the outer boundary of the LPZ.

- Population Density: If the population density exceeds the guidelines in Regulatory Position C.4 of RG 4.7, the applicant must consider alternative sites with lower population densities.

SRP Section 2.1.3 identifies the following DCA-specific guidance:

- Standard DC Reviews: DCAs do not contain general descriptions of site characteristics because this information is site specific and will be addressed by the COL applicant. Under 10 CFR 52.47(a)(1), a DC applicant must provide site parameters postulated for the design. However, the identification of population distribution is not applicable for this area of [Standard DC] review.

- The population distribution is site specific and will be addressed by the COL applicant.

2.1.3.4 Technical Evaluation

In DCA Part 2 Tier 2, the applicant stated that a COL applicant referencing the NuScale power plant DC will address the site-specific information on population distribution, population center, and population density. SRP Section 2.1.3 addresses the specific criteria deemed acceptable to meet the relevant regulatory requirements. Such requirements typically involve a review of the following:

- Data about the population in the site vicinity.

- The population in the exclusion area.

- The LPZ to determine whether appropriate protective measures could be taken on behalf of the populace in that zone in the event of a serious accident.

- The nearest boundary of the closest population center containing 25,000 or more residents to determine whether this boundary is at least 1⅓ times the distance from the reactor to the outer boundary of the LPZ.

- The population density in the site vicinity, including the weighted transient population at the time of initial site approval and within 5 years thereafter to determine whether it exceeds 500 persons per square mile averaged over any radial distance out to 32.2 kilometers (20 miles).

The NuScale DCA does not contain this type of information because the information is site specific.

2.1.3.5 Combined License Information Items

Table 2.1-3 lists the COL information item related to DCA Part 2 Tier 2, Section 2.1.3, from DCA Part 2 Tier 2, Table 1.8-2.

Table 2.1-3. NuScale COL Information Items for Section 2.1.3

Item No.	Description	FSAR Tier 2 Section
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

2.1.3.6 Conclusion

As set forth above, the applicant has stated in DCA Part 2 Tier 2, that the COL applicant will provide the site-specific information in accordance with COL Item 2.1-1. Because this information is site specific, the staff considers the applicant's statement in DCA Part 2 Tier 2 that the COL applicant is to provide this site-specific information in accordance with COL Item 2.1-1 to be acceptable.

Based on the foregoing regulatory basis, corresponding SRP guidance, and review of the DCA, the staff concludes that because this information is site specific, it will be addressed by the COL applicant and, therefore, would be reviewed at the COL stage. The COL applicant should include information sufficient to demonstrate that the design of the plant falls within the values of the actual site characteristics specified in a COL application.

2.2 Nearby Industrial, Transportation, and Military Facilities

2.2.1 Identification of Potential Hazards in Site Vicinity

2.2.1.1 Introduction

With respect to identification of potential hazards in site vicinity, the staff reviews site-specific information on the identification and evaluation of potential hazards stemming from nearby industrial, transportation, and military facilities within the site vicinity, including an evaluation of the potential effect such hazards might have on the proposed facility, such as from explosions, toxic chemicals, and fires.

2.2.1.2 Location and Routes

In an application for a DC, the description of locations and routes provides information about potential external hazards or hazardous materials that are present or may reasonably be expected to be present during the projected lifetime of the proposed plant. The purpose of including a description of location and routes in a DC application is to for the NRC staff to evaluate the sufficiency of information on the presence and magnitude of potential external hazards, so that the staff can perform the reviews as described in SRP Section 2.2.3; SRP Section 3.5.1.5, "Site Proximity Missiles (Except Aircraft)"; and SRP Section 3.5.1.6, "Aircraft Hazards." For applications submitted under 10 CFR Part 52, the staff's review generally covers: (1) the locations (identified on maps) of, and separation distances from the plant to, transportation facilities and routes, including airports and airways, roadways, railways, pipelines, and navigable bodies of water, (2) the presence of military and industrial facilities, such as fixed manufacturing, processing, and storage facilities, and (3) any additional information requirements in the sections titled, "Contents of Application," of the applicable subparts of 10 CFR Part 52.

2.2.1.3 Descriptions

Industrial, transportation, and military facilities are site-specific information. As stated in DCA Part 2 Tier 2, Section 2.2, "Nearby Industrial, Transportation, and Military Facilities," the NuScale SMR Power Plant certified design does not postulate any hazards from nearby industrial, transportation or military facilities. A COL applicant that references the NuScale Power Plant design certification will describe nearby industrial, transportation, and military facilities (see COL Item 2.2-1 in Table 2.2-1 below). The COL applicant's information should describe the primary function of each facility and the nature of the hazards that it presents. This information for each facility should include the facility's primary function; major products; number of employees; materials regularly manufactured, stored, used, or transported near the site; and the hazards that could result from accidents at each facility.

2.2.1.4 Summary of Application

DCA Part 2 Tier 2, Section 2.2, addresses the need to identify potential hazards in the site vicinity with a statement that a COL applicant referencing the NuScale power plant DC will provide site-specific information related to the location and routes for nearby industrial, transportation, and military facilities, consistent with COL Item 2.2-1.

2.2.1.5 Regulatory Basis

As specified in SRP Section 2.2.1–2.2.2, "Identification of Potential Hazards in Site Vicinity," the following NRC regulations contain the relevant requirements generally applicable to the identification of potential hazards in the site vicinity:

- 10 CFR 100.20(b), which requires that the applicant evaluate the nature and proximity of human-related hazards (e.g., airports, dams, transportation routes, military facilities, and chemical facilities) to establish site parameters for use in determining whether the plant design can accommodate commonly occurring hazards and whether the risk of other hazards is very low.

- 10 CFR 52.47(a)(1) and 10 CFR 52.79(a)(1)(iv), as they relate to the factors to be considered in the evaluation of sites that require the location and description of

industrial, military, or transportation facilities and routes, and 10 CFR 52.79(a)(1)(vi), as it relates to compliance with 10 CFR Part 100.

The guidance in SRP Section 2.2.1–2.2.2 lists the acceptance criteria adequate to meet the above requirements, as well as review interfaces with other SRP sections. In order to ensure the acceptance criteria are followed to the extent applicable, the staff utilizes the following review procedures. These procedures are based on the identified SRP acceptance criteria:

- The COL applicant will address the locations and distances from the plant of nearby industrial, military, and transportation facilities, and such data are in agreement with data obtained from other sources, when available.

- Descriptions of the nature and extent of activities conducted at the site and in its vicinity, including the products and materials likely to be processed, stored, used, or transported, are adequate to permit identification of the possible hazards cited in Section III, "Review Procedures," of SRP Section 2.2.1–2.2.2.

- Sufficient statistical data with respect to hazardous materials establish a basis for evaluating the potential hazards to the plant or plants considered at the site.

SRP Section 2.2.1–2.2.2 identifies the following DCA-specific guidance:

- Standard DC Reviews: DCAs do not contain general descriptions of site characteristics because this information is site specific and will be addressed by the COL applicant. Under 10 CFR 52.47(a)(1), a DC applicant must provide site parameters postulated for the design. However, the identification of potential hazards in site vicinity is not applicable for this area of [Standard DC] review.

- The identification of potential hazards in the site vicinity is site specific and will be addressed by the COL applicant.

2.2.1.6 Technical Evaluation

In DCA Part 2 Tier 2, the applicant stated that a COL applicant referencing the NuScale power plant DC will address the site-specific information on the identification of potential hazards stemming from the nearby industrial, transportation, and military facilities within the site vicinity. SRP Section 2.2.1–2.2.2 addresses the specific criteria acceptable to meet the relevant regulatory requirements. Such requirements typically involve a review of the following:

- The locations and distances of industrial, military, and transportation facilities near the plant.

- The nature and extent of activities conducted at the site and in its vicinity, including the products and materials likely to be processed, stored, used, or transported, to identify possible hazards.

- Statistical data with respect to hazardous materials to establish a basis for evaluating the potential hazard to the plant considered at the site**.**

The NuScale DCA does not contain this type of information because the information is site specific.

2.2.1.7 Combined License Information Items

Table 2.2-1 lists the COL information item related to DCA Part 2 Tier 2, Section 2.2.1–2.2.2, from DCA Part 2 Tier 2, Table 1.8-2.

Table 2.2-1 NuScale COL Information Items for Section 2.2.1–2.2.2

Item No.	Description	FSAR Tier 2 Section
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

2.2.1.8 Conclusion

As set forth above, the applicant stated in DCA Part 2 Tier 2 that the COL applicant will provide the site-specific information in accordance with COL Item 2.2-1. Because this information is site specific, the staff considers the applicant's statement in the DCA that the COL applicant is to provide this site-specific information in accordance with COL Item 2.2-1 to be acceptable. Based on the foregoing regulatory basis, corresponding SRP guidance, and review of the DCA, the staff concludes that, because this information is site specific, it will be addressed by the COL applicant and, therefore, would be reviewed at the COL stage. The COL applicant should include information sufficient to demonstrate that the design of the plant falls within the values of the actual site characteristics specified in a COL application

2.2.2 Evaluation of Potential Accidents

2.2.2.1 Introduction

An application under 10 CFR Part 52 must identify any design-basis event (DBE) caused by nearby industrial, transportation, and military facilities and must evaluate potential accidents near the plant, including human-related hazards. As defined in SRP Section 2.2.3, "Evaluation of Potential Accidents," a DBE is defined as an event with a probability of occurrence greater than an order of magnitude of $1x10^{-7}$ per year, resulting in a radiological dose exceeding the dose criteria in 10 CFR Part 100. If potential accidents having an unacceptable probability of occurrence with severe consequences are identified, the applicant must describe site-specific steps taken to mitigate the consequences.

The evaluation of potential accidents considers the applicant's probability analyses of potential accidents involving hazardous materials or activities on and near the proposed site to confirm that the applicant used appropriate data and analytical models. For applications submitted under 10 CFR Part 52, the staff's review generally covers: (1) hazards associated with nearby industrial activities, such as manufacturing, processing, or storage facilities, (2) hazards associated with nearby military activities, such as military bases, training areas, or aircraft flights, and (3) hazards associated with nearby transportation routes, such as aircraft routes, highways, railways, navigable waters, and pipelines. Each hazard review area considers the following principal types of hazards:

- Toxic vapors or gases and their potential for incapacitating nuclear plant control room operators.

- Overpressure resulting from explosions or detonations involving materials such as munitions, industrial explosives, or explosive vapor clouds resulting from the atmospheric release of gases (such as propane and natural gas) with a potential for ignition and explosion.

- Missile effects attributable to mechanical impacts (such as aircraft impact), impacts from explosion debris, and impacts from waterborne items (such as barges).

- Thermal effects attributable to fires.

2.2.2.2 Summary of Application

In DCA Part 2 Tier 2, Section 2.2, the applicant addressed the need for an evaluation of potential accidents in the plant vicinity with a statement that a COL applicant referencing the NuScale DCA will provide site-specific information related to the evaluation of accidents near the plant in accordance with COL Item 2.2-1.

2.2.2.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.47(a)(1) and 10 CFR 52.79(a)(1)(iv), as they relate to the factors to be considered in the evaluation of sites, which require the location and description of industrial, military, or transportation facilities and routes, and 10 CFR 52.47(a)(1) and 10 CFR 52.79(a)(1)(vi), as they relate to general compliance with 10 CFR Part 100.

- The regulation at 10 CFR 100.20(b) states that the nature and proximity of human-related hazards (e.g., airports, dams, transportation routes, military facilities, and chemical facilities) must be evaluated to establish site parameters for use in determining whether a plant design can accommodate commonly occurring hazards and whether the risk of other hazards is very low.

- The regulation at 10 CFR 100.21(e) states that potential hazards associated with nearby transportation routes and industrial and military facilities must be evaluated and site parameters established to ensure that potential hazards from such routes and facilities will not pose undue risk to the type of facility proposed to be located at the site**.**

The guidance in SRP Section 2.2.3 lists the acceptance criteria adequate to meet the above requirements, as well as review interfaces with other SRP sections. In order to ensure the acceptance criteria are followed to the extent applicable, the staff utilizes the following review procedures. These procedures are based on the identified SRP acceptance criteria:

- The identification of a DBE resulting from the presence of hazardous materials or activities near the plant or plants of a specified type is acceptable if it includes all postulated types of accidents for which the expected rate of occurrence of potential exposures resulting in radiological dose in excess of the limits in 10 CFR 50.34(a)(1),

as it relates to the requirements in 10 CFR Part 100, is estimated to exceed the staff objective of an order of magnitude of $1x10^{-7}$ per year.

- The effects of a DBE have been adequately considered, in accordance with 10 CFR 100.20(b), if the applicant has analyzed the effects of those accidents on the safety-related features of the plant or plants of a specified type and has undertaken measures (e.g., hardening and fire protection) to mitigate the consequences of such events.

SRP Section 2.2.3 identifies the following DCA-specific guidance:

- Standard DC Reviews: DCAs do not contain general descriptions of site characteristics because this information is site specific and will be addressed by the COL applicant. Under 10 CFR 52.47(a)(1), a DC applicant must provide site parameters postulated for the design. However, the evaluation of potential accidents in the site vicinity is not applicable for this area of [Standard DC] review.

- Exclusion area authority and control is site specific and will be addressed by the COL applicant.

2.2.2.4 Technical Evaluation

In DCA Part 2 Tier 2, the applicant stated that a COL applicant referencing the NuScale power plant DC will address the site-specific information on the evaluation of potential accidents within the plant vicinity. This includes hazards associated with nearby industrial activities (e.g., manufacturing, processing, or storage facilities), nearby military activities (e.g., military bases, training areas, or aircraft flights), and nearby transportation routes (e.g., aircraft routes, highways, railways, navigable waters, and pipelines). The applicant stated that the following principal types of hazards will be considered with respect to each of the above areas of review if they have a probability of occurrence greater than $1x10^{-7}$ per year:

- Missiles more energetic than the tornado missile spectra
- Pressure effects in excess of the design-basis tornado
- Explosions
- Fires
- Aircraft impacts
- Release of flammable vapor clouds; and
- Release of toxic chemicals

The NuScale DCA does not contain this type of information because the information is site specific.

2.2.2.5 Combined License Information Items

Table 2.2-2 lists the COL information item related to DCA Part 2 Tier 2, Section 2.2.3 from DCA Part 2 Tier 2, Table 1.8-2.

Table 2.2-2 NuScale COL Information Items for Section 2.2.3

Item No.	Description	FSAR Tier 2 Section
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

2.2.2.6 Conclusion

As set forth above, the applicant has stated, in DCA Part 2 Tier 2, that the COL applicant will provide the site-specific information under COL Item 2.2-1. Because this information is site specific, the staff considers the applicant's statement in the DCA that the COL applicant is to provide this site-specific information in accordance with COL Item 2.2-1 to be acceptable. Based on the foregoing regulatory basis, corresponding SRP guidance, and review of the DCA, the staff concludes that because this information is site specific it will be addressed by the COL applicant and, therefore, would be reviewed at the COL stage. The COL applicant should include information sufficient to demonstrate that the design of the plant falls within the values of the actual site characteristics specified in a COL application.

2.3 Meteorology

2.3.1 Regional Climatology

The DCA Part 2 Tier 2, Section 2.3, "Meteorology," states that "[t]he NuScale Power Plant is designed using meteorological parameters that are representative of a reasonable number of potential plant site locations in the United States [U.S.]." This is understood to include the contiguous (lower 48) states, the remainder of the continental U.S. (i.e., the State of Alaska), and the State of Hawaii. The DCA is silent with respect to the potential of the NuScale Power Plant design being deployed in U.S. Territories.

SER Section 2.3 discusses the staff's review of the related information provided in Revision 1 of the DCA Part 2 as supplemented in letters dated November 13, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17317B548); December 11, 2017 (ADAMS Accession No. ML17345A957); December 15, 2017 (ADAMS Accession No. ML17349A980), December 21, 2017 (ADAMS Accession No. ML17355A157); February 13, 2018 (ADAMS Accession No. ML18044A695), and September 14, 2018 (ADAMS Accession Nos. ML18257A297 and ML18257A299), including the values postulated in DCA Part 2 Tier 1, Table 5.0-1, "Site Design Parameters," and Tier 2, Table 2.0-1, "Site Design Parameters," and supporting DCA Part 2 Tier 2 descriptions and documentation.

In its review, the staff's used SRP Sections 2.3.1 through 2.3.5, and other related guidance and resources identified in or relevant to these SRP sections.

2.3.1.1 Introduction

FSAR Tier 2, Section 2.3.1, "Regional Climatology," states that "[r]egional DCA Part 2 Tier 2, Section 2.3.1, "Regional Climatology," states that "[r]egional climatology is site-specific and is addressed by the COL applicant as Part of the response to COL Item 2.3-1." This DCA Part 2 section identifies several climate-related conditions that are taken into account in the safe design and operation of the proposed NuScale Small Modular Reactor (SMR) Power Plant design. SER Section 2.3.1.2 summarizes these climate-related site parameters.

A COL applicant referencing the NuScale SMR Power Plant design evaluates the characteristics of its proposed site(s) in terms of these climate-related site parameters. A COL applicant also addresses other general climatic conditions in the site region (e.g., types of air masses, airflow patterns, synoptic-scale features, the influences of topography on the regional climatology, seasonal and annual frequencies of different weather elements and severe weather phenomena). However, these other climatic conditions are not within the scope of the DCA submittal because, while they provide context, they do not, of themselves, impact the design of the plant and are not specified as site parameters for the NuScale SMR Power Plant design.

SER Section 2.3.1.3 provides the regulatory basis for the staff's review of DCA Part 2 Tier 2, Section 2.3.1 and the related postulated site parameters. This report also identifies applicable regulations, review guidance and acceptance criteria, and other relevant review documentation.

SER Section 2.3.1.4 documents the staff's evaluation of each of the climate-related site parameters. Reasonableness of the postulated site parameter values was reviewed with respect to the applicable regulatory bases and relative to the applicant's clarified statement that the meteorological site parameters "are representative of a reasonable number of potential plant site locations in the United States." For the reasons stated above, however, the technical evaluation under SER Section 2.3.1.4 does not analyze or evaluate the design in terms of these site parameters from an engineering standpoint.

SER Section 2.3.1.5 identifies COL information items applicable to the climate-related information in DCA Part 2 Tier 2, Section 2.3.1. SER Section 2.3.1.6 summarizes the staff's conclusions based on its technical evaluation of DCA Part 2 Tier 2, Section 2.3.1, and the corresponding postulated site parameters in DCA Part 2 Tier 1, Table 5.0-1, and Tier 2, Table 2.0-1.

2.3.1.2 Summary of Application

The site parameters in DCA Part 2 Tier 1, Table 5.0-1, DCA Part 2 Tier 2, Table 2.0-1, and any related DCA Part 2 sections that reiterate these values for temperature, speed (or velocity), distance or depth, force (weight or pressure) per unit area, and change of pressure per unit time are given in the English system units of measure. However, standard convention used in the SER is for the International System (SI) units of measure to be presented first, followed by the given site parameter value in English units within parentheses. Note that the precision of any of these site parameter values is as given in the referenced DCA Part 2 tables and sections, but not as indicated by the values converted to the SI units of measure for presentation.

DCA Part 2 Tier 1: DCA Part 2 Tier 1, Table 5.0-1, includes the following climate-related site parameters:

- Maximum precipitation rates for roof design (as rainfall) of 492.8 millimeters (mm) per hour (mm/hr) (19.4 inches (in.) per hour (in/hr)) and 160.0 mm (6.3 in.) for a 5-minute period (reiterated in DCA Part 2 Tier 2, Section 2.3.1, and Tier 2, Section 3.4.2.2, "Probable Maximum Precipitation").

- Normal and extreme roof snow loads of 2.394 and 3.591 kiloPascals (kPa) (50 and 75 pounds per square foot (psf)), respectively (reiterated in DCA Part 2 Tier 2, Section 2.3.1, and Tier 2, Section 3.4.2.2).

- A 100-year return period 3-second (sec) wind gust speed of 64.8 meters per second (m/sec) (145 miles per hour (mph) for Exposure Category "C," with an Importance Factor of 1.15 for the reactor building (RXB), control building (CRB), and radioactive waste building (RWB) (reiterated in DCA Part 2 Tier 2, Section 2.3.1, and Tier 2, Section 3.3.1.1, "Design Parameters for Severe Wind").

- Design-basis tornado (DBT) parameters (i.e., a maximum wind speed of 102.8 m/sec (230 mph), a translational speed of 20.6 m/sec (46 mph), a maximum rotational speed of 184 mph, a radius of maximum rotational speed of 45.7 m (150 feet (ft)), a pressure drop of 8.274 kPa (1.2 pounds per square inch (psi)), and a rate of pressure drop of 3.447 kPa/sec (0.5 psi/sec) (reiterated in DCA Part 2 Tier 2, Section 3.3.2.1, "Design Parameters for Extreme Winds")).

- A tornado missile spectrum based on Table 2 of RG 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," Revision 1, issued March 2007, for (tornado intensity) Region 1 (as indicated in DCA Part 2 Tier 2, Section 3.5.1.4, "Missiles Generated by Tornadoes and Extreme Winds").

- A maximum design-basis hurricane wind speed of 129.6 m/sec (290 mph) (reiterated in DCA Part 2 Tier 2, Section 3.3.2.1).

- A hurricane missile spectrum based on Tables 1 and 2 of RG 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," Revision 0, issued October 2011, for the maximum design-basis hurricane wind speed (as indicated in DCA Part 2 Tier 2, Section 3.5.1.4).

- Zero-percent exceedance maximum and minimum outdoor design dry-bulb temperatures of 46.1 degrees Celsius (C) (115 degrees Fahrenheit (F)) and -40 degrees C (-40 degrees F), respectively, representing historical limits excluding peaks less than two hours (as indicated or reiterated in DCA Part 2 Tier 2, Section 2.3.1, and under Tier 2, Chapter 9, "Auxiliary Systems").

DCA Part 2 Tier 2: The climate-related site parameters listed in DCA Part 2 Tier 1, Table 5.0-1, are a subset of the site parameters in DCA Part 2 Tier 2, Table 2.0-1. DCA Part 2 Tier 2, Table 2.0-1, includes these additional design-basis dry- or wet-bulb temperature values:

- A maximum wet-bulb temperature of 26.7 degrees C (80 degrees F) coincident with the zero-percent exceedance maximum outdoor design dry-bulb temperature of 46.1 degrees C (115 degrees F).

- A zero-percent exceedance maximum non-coincident wet-bulb temperature of 27.2 degrees C (81 degrees F) representing an historical limit excluding peaks of less than two hours.

- One-percent (annual) exceedance maximum and minimum outdoor design dry-bulb temperatures of 37.8 degrees C (100 degrees F) and -23.3 degrees C (- 10 degrees F), respectively, a maximum wet-bulb temperature of 25.0 degrees C (77 degrees F), coincident with the 1-percent (annual) exceedance maximum dry-bulb temperature, and a one-percent (annual) exceedance maximum non-coincident wet-bulb temperature of 26.7 degrees C (80 degrees F).

- Five-percent (annual) exceedance maximum and minimum outdoor design dry-bulb temperatures of 35.0 degrees C (95 degrees F) and -20.6 degrees C (-5 degrees F), respectively, and a maximum wet-bulb temperature of 25.0 degrees C (77 degrees F), coincident with the five-percent (annual) exceedance maximum dry-bulb temperature.

These design-basis dry- and wet-bulb temperatures are as indicated or reiterated in DCA Part 2 Tier 2, Section 2.3.1, and under Tier 2, Chapter 9, Chapter 10, “Steam and Power Conversion System,” and Chapter 20, “Mitigation of Beyond-Design-Basis Events.” DCA Part 2 Tier 2, Table 2.0-1, also provides cross-references to where climate-related site parameters are applicable.

ITAAC: There are no Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) for this area of review.

Technical Specifications: There are no Technical Specifications (TS) for this area of review.

Technical Reports: There are no Technical Reports (TR) associated with this area of review.

2.3.1.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR Part 50, “Domestic Licensing of Production and Utilization Facilities,” Appendix A, “General Design Criteria for Nuclear Power Plants,” General Design Criterion (GDC) 2, “Design Bases for Protection Against Natural Phenomena,” as it relates to 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.

- 10 CFR Part 50, Appendix A, GDC 4, “Environmental and Dynamic Effects Design Bases,” as it relates to information on events and conditions outside the nuclear power plant, such as tornadoes and, where applicable, hurricane winds that generate missiles that could potentially affect structures, systems, and components (SSCs) important to safety.

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

Section II (Acceptance Criteria) of SRP Section 2.3.1, "Regional Climatology," under the heading, "SRP Acceptance Criteria," identifies site parameters and acceptance criteria considered to be acceptable in meeting the above requirements for DC applicants. The site parameters include the following:

- The ground-level weight of the 100-year return period snowpack and the ground-level weight of the 48-hour probable maximum winter precipitation (PMWP) for use in determining the weight of snow and ice on the roofs of safety-related structures.

- DBT parameters to be used in establishing pressure and tornado missile loadings on SSCs important to safety.

- The 100-year return period (straight-line) 3-sec gust wind speed to be used in establishing wind loading on plant structures.

- Ambient air temperature and humidity 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, ventilation, and air conditioning (HVAC) systems.

The regulatory guidance documents listed below support the staff's review of a DC applicant's development of the corresponding site parameter values postulated for its design:

- DC/COL-Interim Staff Guidance (ISG)-007, "Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures," dated June 23, 2009, issued subsequent to the current version of SRP Section 2.3.1, and that clarifies the staff's position on winter precipitation loads expressed in SRP Acceptance Criterion (6) under Section II (Acceptance Criteria) of SRP Section 2.3.1.

- RG 1.76, Revision 1, provides guidance for selecting the characteristics of design-basis tornado parameters and design-basis, tornado-generated missiles, depending on plant location in the contiguous (lower 48) United States, that a nuclear power plant should be designed to withstand to prevent undue risk to public health and safety.

- RG 1.221, Revision 0, issued subsequent to the current version of SRP Section 2.3.1, that provides guidance for selecting the design-basis hurricane wind speed and hurricane-generated missiles that a new nuclear power plant should be designed to withstand to prevent undue risk to public health and safety. Guidance applies to the contiguous United States. The staff will evaluate potential sites located along the Pacific coast or in Alaska, Hawaii, or Puerto Rico (or other U.S. Territories) on a case-by-case basis.

RGs do not address in detail other climate-related site parameters input to plant design and used to characterize a site where a given design might be deployed (e.g., design-basis straight-line wind speeds, ambient temperature and atmospheric moisture-related statistics) in terms of data selection and use. In those cases, the "SRP Acceptance Criteria," under Section II of SRP Section 2.3.1, call for that information to be presented and substantiated in accordance with acceptable practice and data as issued by the National Oceanic and Atmospheric Administration and as discussed in applicable industry standards and guidance

documents (e.g., by the American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)).

In the SRP Section 2.3.1 review guidance, the use of ambient temperature and atmospheric moisture statistics extends to the determination of maximum evaporation, minimum water cooling, and, if applicable, drift loss of water and the potential for water freezing in the ultimate heat sink (UHS) water storage facility. However, according to DCA PART 2 Tier 2, Section 1.2.2.4.2, "Ultimate Heat Sink," the NuScale SMR Power Plant design uses a passive containment cooling system consisting of the water in the reactor, refueling, and spent fuel pools, all of which are located below grade within the RXB. Therefore, although cited among the acceptance criteria in SRP Section 2.3.1, RG 1.27, "Ultimate Heat Sink for Nuclear Power Plants," Revision 3, does not apply to passive plants that utilize a PCCS as their UHS, such as the NuScale SMR Power Plant design. As such, it is not otherwise listed here, nor are its meteorological considerations evaluated under Section 2.3.1.4 of this report.

In addition, SRP Section 2.3.1 indicates the following among its review criteria:

- All references to DCA PART 2 sections in which meteorological conditions identified as site parameters are used for design purposes should be identified by an applicant (Section I (Areas of Review), Item 6, last paragraph).

- The postulated site parameters are representative of a reasonable number of sites that have been or may be considered for a COL application, the appropriate site parameters are included as Tier I information, pertinent parameters are stated in a site parameters summary table, and there is a basis for each of the site parameters (Section III (Review Procedures), Item 4(b)).

2.3.1.4 Technical Evaluation

The sections that follow discuss the staff's evaluation of the climate-related site parameters and the corresponding values postulated for the NuScale SMR Power Plant design as presented in DCA PART 2 Tier 1, Table 5.0-1 and Tier 2, Table 2.0-1, in DCA PART 2 Tier 2, Section 2.3.1, and other related sections of the DCA.

As stated previously, the site parameters in DCA PART 2 Tier 1, Table 5.0-1, DCA PART 2 Tier 2, Table 2.0-1, and any related DCA PART 2 sections that reiterate these values for temperature, speed (or velocity), distance or depth, force (weight or pressure) per unit area, and change of pressure per unit time are given in the English system units of measure. However, standard convention in the SER is for the SI units of measure to be presented first, followed by the given site parameter value in English units within parentheses. Again, note that the precision of any of these site parameter values is as given in the referenced DCA PART 2 tables and sections, but not as indicated by the values converted to the SI units of measure for presentation.

In the request for additional information (RAI) 9179, Question No. 02.03.01-2, (ADAMS Accession No. ML17289B257), the staff asked the applicant to update DCA PART 2 Tier 2, Section 2.3.1 with the appropriate cross-references to those sections in which each of the climate-related site parameters are applicable. In its response to this question and the supplemental response to RAI 9186, Question No. 02.03.01-6 (see ADAMS Accession Nos. ML17349A980 and ML18257A299, respectively), the applicant proposed revising DCA PART 2

Tier 2, Table 2.0-1 to include cross references to DCA PART 2 sections that reference the postulated site parameters. Additional discussion was included in various DCA PART 2 sections for some site parameters. The staff found the applicant's responses to these questions acceptable. The proposed changes to DCA PART 2 Tier 2, Table 2.0-1 and related text are being tracked as **Confirmatory Item 02.03.01-1**.

2.3.1.4.1 Design-Basis Maximum Precipitation Rates (Rainfall)

The DCA PART 2 Tier 1 and Tier 2 site parameter tables referenced in SER Section 2.3.1.2 2 indicate the postulated design-basis maximum precipitation rates (as rainfall) (i.e., 492.8 mm/hr (19.4 in/hr) and 160.0 mm (6.3 in.) for a 5-minute period). DCA PART 2 Tier 2, Section 3.4.2.2, refers to these values as "probable maximum precipitation [PMP]" rainfall rates "for roof design."

In addition, DCA PART 2 Tier 2, Section 2.3.1, states that "[t]hese values come from NWS HMR [National Weather Service Hydrometeorological Report] No. 52," and that they "address the majority of locations in the United States." With respect to the latter statement, the staff notes that HMR No. 52, published in August 1982, was based on measured precipitation rates for selected storms that occurred east of the 105th Meridian in the contiguous United States (i.e., nominally, east of easternmost Montana and Wyoming, eastern Colorado and New Mexico, and western Texas). The staff also notes that these PMP rates have been included in most (if not all) of the DCAs submitted for NRC review, several of which have been approved.

The applicant has selected the site parameters referenced above (i.e., maximum precipitation rates (as rainfall)) for plant (roof) design inputs. (SER Section 2.4.3, "Probable Maximum Flood (PMF) on Streams and Rivers," contains additional information.) The staff considers these values representative of a reasonable number of locations in the contiguous United States (given the limitations noted above for the areal extent of HMR No. 52) and for the State of Alaska at which a NuScale SMR Power Plant design might be deployed. However, COL and ESP applicants will need to evaluate this aspect in their applications and its implications on a case-by-case basis if deployment is planned where orographic (terrain) effects might influence these PMP rates or if a plant site is proposed in a coastal location (including the State of Hawaii) that is subject to potential impacts of tropical cyclone activity. The DCA is silent with respect to the potential of the NuScale power plant design being deployed in U.S. Territories.

The staff finds that the applicant satisfies the regulations at Appendix A to 10 CFR Part 50, GDC 2, and 10 CFR 52.47(a)(1), cited in SER Section 2.3.1.3, regarding the design-basis maximum precipitation (rainfall) rates postulated for the NuScale SMR Power Plant design by providing site parameters related to maximum precipitation rates.

2.3.1.4.2 Design Normal and Extreme Roof Snow Loads

The DCA PART 2 Tier 1 and Tier 2 site parameter tables referenced in SER Section 2.3.1.2 indicate the postulated design-basis normal and extreme roof snow loads (i.e., 2.394 and 3.591 kPa (50 and 75 psf), respectively). DCA PART 2 Tier 2, Section 2.3.1, and Tier 2, Section 3.4.2.2, reiterate the postulated design-basis conditions. Further, DCA PART 2 Tier 2, Section 2.3.1, states that "[t]he design normal roof snow load is 50 psf" and that "[f]or the extreme roof snow load, a value of 150 percent of the normal roof snow load, or 75 psf was selected." In addition, DCA PART 2 Tier 2, Section 3.4.2.2, refers to the (normal) roof snow load as the "design static roof load."

The applicant also cites ASCE 7-10, “Minimum Design Loads in [for] Buildings and Other Structures,” in DCA PART 2 Tier 2, Section 3.8.4.2.1, “Design Codes and Standards,” referring to that industry standard as being “applicable for all loads other than wind loading.” Neither DCA PART 2 Tier 1 nor Tier 2 discuss any other bases for the normal and extreme roof snow load site parameter values.

The staff notes that the 2.394 kPa (50 psf) value for the normal or “design static” roof snow load is the same value as the maximum snow load for roof design for precipitation types, as designated in Table 1.2-6, “Envelope of ALWR [Advanced Light Water Reactor] Plant Site Design Parameters,” of the Advanced Light Water Reactor Utility Requirements Document (URD), Volume II—ALWR Evolutionary Plant, Chapter 1 (Overall Requirements), Revision 8, published by the Electric Power Research Institute (EPRI), March 1999. This suggests that there has been no change to the value of this “site design parameter” up through the current revision of the EPRI URD, issued in December 2014, which addresses small modular reactors.

Further, DCA PART 2 Tier 2, Table 1.9-4, “Conformance with Interim Staff Guidance,” indicates, with respect to the assessment of normal and extreme winter precipitation loads on the roofs of seismic Category I structures, conformance with DC/COL-ISG-007. While these postulated site parameters do represent the end-point of the guidance in DC/COL-ISG-007 (i.e., estimation of the resulting normal and extreme winter precipitation live roof loads), the ISG first develops these values in terms of ground snow loads, which fall under the Section 2.3.1 review. DCA PART 2 Tier 2, Section 3.8.4.3.11, “Snow Loads (S),” provides an approach that allows ground snow loads to be back-calculated from the postulated roof snow loads (see Equation 3.8-1). Using this equation (as applied to seismic Category I structures), a normal roof snow load of 2.394 kPa (50 psf) converts to a normal ground snow load of 2.849 kPa (59.5 psf) and an extreme roof snow load of 3.591 kPa (75 psf) converts to an extreme ground snow load of 4.276 kPa (89.3 psf).

In addition, the staff notes that the applicant does not specify any recurrence interval(s) for the postulated normal (i.e., 2.394 kPa (50 psf)) and extreme (i.e., 3.591 kPa (75 psf)) roof snow loads. However, the staff also notes that most of the ground snow loads shown in Figure 7-1 (two pages) (“Ground Snow Loads, P_g, for the United States (Lb/Ft^2)”), more specifically for the contiguous United States, under Chapter 7, “Snow Loads” of ASCE/SEI 7-10, and which represent a 50-year mean recurrence interval, are less than the normal ground snow load back-calculated from the postulated normal roof snow load except for the following:

- portions of the northern tier of states (from about eastern North Dakota eastward to Maine)
- in the snow belts downwind of the Great Lakes
- in areas where ASCE/SEI 7-10 calls for case studies (designated in Figure 7-1 as “CS”) to be performed where extreme local variations in ground snow loads occur
- where higher terrain elevation may have an influence on snowfall event totals or accumulation of snowpack over the snow year

About 45 percent of the locations listed in Table 7-1, “Ground Snow Loads, p_g, for Alaskan Locations,” of ASCE/SEI 7-10 are less than the back-calculated 2.849 kPa (59.5 psf) normal ground snow load.

Table C7-3, “Factors for Converting from Other Annual Probabilities of Being Exceeded, and Other Mean Recurrence Intervals, to That Used in This Standard,” of ASCE/SEI 7-10 provides factors for converting from other mean recurrence intervals to the 50-year mean recurrence interval used for snow load values presented in that standard. The inverse of those factors would convert the 50-year mean recurrence interval ground snow load values to other return periods.

In determining the controlling ground snow load for the normal winter precipitation event, the guidance in DC/COL-ISG-007 considers, in part, the 100-year return period snowpack (snow depth). Dividing the 50-year mean recurrence interval ground snow loads by 0.82 (i.e., the factor in Table C7-3) is about equivalent to multiplying the 50-year values by a Snow Importance Factor of 1.20 as specified in Table 1.5-2 (“Importance Factors by Risk Category of Buildings and Other Structures for Snow, Ice, and Earthquake Loads”) of ASCE/SEI 7-10 to obtain 100-year return period values. Importance factors are applied in the calculation of various design loads, depending on the risk category assigned to the structure being evaluated and are based on the risk to human life, health, and welfare associated with its damage or failure. In this case, the category considered appropriate for seismic Category I buildings at a nuclear power plant site is “Risk Category IV,” based on DC/COL-ISG-007.

Consequently, the staff applied a 20-percent increase to the 50-year mean recurrence interval ground snow loads shown in Figure 7-1 and Table 7-1 of ASCE/SEI 7-10 as an indication of the 100-year return period snow pack (snow depth) ground snow loads. This evaluation indicates the following to the staff:

- The areas in the contiguous United States, where the 2.849 kPa (59.5 psf) normal ground snow load back-calculated from the postulated normal (i.e., 2.394 kPa (50 psf)) roof snow load could be exceeded, are slightly larger for the 100-year return period snow pack (snow depth) ground snow loads than the area based on the 50-year mean recurrence interval ground snow loads from ASCE/SEI 7-10.

- These areas are still located along the northern tier of States (extending from about central North Dakota and north-central South Dakota eastward to Maine) and in the snow belts downwind of the Great Lakes.

- The areas where ASCE/SEI 7-10 calls for case studies to be performed because of extreme local variations in ground snow loads or where higher terrain elevation may have an influence on snowfall event totals or accumulation of snowpack over the snow year are still locations where the postulated site parameters may be exceeded.

Fewer of the locations (i.e., about 27 percent) listed in Table 7-1 of ASCE/SEI 7-10 for the State of Alaska appear to be less than the ground snow load back-calculated from the postulated normal roof snow load based on the 100-year return period snow pack (snow depth) ground snow loads compared to the 50-year mean recurrence interval ground snow loads.

On the other hand, there appears to be little difference to the areas in the continental United States where the extreme ground snow load (i.e., 4.276 kPa (89.3 psf)) back-calculated from the postulated extreme roof snow load (i.e., 3.591 kPa (75 psf)) is exceeded based on either the 100-year return period snow pack (snow depth) ground snow loads or the 50-year mean recurrence interval ground snow loads (i.e., in extreme northern portions of Minnesota, Wisconsin, Michigan, and much of Maine in the contiguous United States, and about 20 percent of the locations listed in Table 7-1 of ASCE/SEI 7-10 for the State of Alaska).

Consistent with the review guidance in SRP Section 2.3.1 and DC/COL-ISG-007, the staff notes the following, among other things:

- The snow load-related site parameters in DCA PART 2 Tier 1, Table 5.0-1, and Tier 2, Table 2.0-1, and discussed in DCA PART 2 Tier 2, Section 3.4.2.2, are specified only as normal and extreme roof snow loads as opposed (or in addition) to ground-level winter precipitation loads, as called for in the referenced guidance.

- No recurrence interval(s) appear to be associated with the postulated normal (i.e., 2.394 kPa (50 psf)) and extreme (i.e., 3.591 kPa (75 psf)) roof snow loads.

- DCA PART 2 Section 3.8.4.3.11 addresses the determination of live roof snow loads on seismic Category I and other buildings for normal and extreme winter precipitation events which includes, among other factors, the ground-level snow (frozen winter precipitation) load (i.e., the equivalent ground-level site parameters can be back-calculated by COL applicants to compare to their corresponding site characteristics).

The scope of the SRP Section 2.3.1 review does not extend to an applicant's analysis and evaluation of the design in terms of those site parameters from an engineering standpoint (see, instead, SER Chapter 3).

The staff considered only one of the parameters used in estimating normal and extreme ground snow load values included in the guidance in DC/COL-ISG-007 (i.e., the 100-year return period snow pack (snow depth)), in evaluating the reasonableness of the postulated normal and extreme roof snow loads and back-calculated ground snow loads. Because these values are based on long-term observations at NWS stations, the staff considers this a reasonable approach at the DC stage.

The staff recognizes that in accordance with the guidance in DC/COL-ISG-007, the estimation of extreme roof loads caused by winter precipitation also takes into consideration liquid winter precipitation events if the resultant contribution to the extreme roof load is greater than that associated with the controlling frozen winter precipitation event. The staff notes that DCA PART 2 Tier 2, Section 3.8.4.3.10, "Rain Load (R)," discusses design characteristics of the RXB and CRB roofs and limits on their ability to accumulate liquid precipitation. Based on that information, the staff's evaluation focused primarily on the postulated roof snow loads (and back-calculated ground loads) associated with frozen winter precipitation events as discussed above.

The results of the staff's evaluation have been summarized above and suggest that the applicant's postulated normal and extreme roof snow load site parameters are representative of a reasonable number of potential locations in the continental United States where the NuScale SMR Power Plant design might be deployed. However, exceptions include along the northern tier of States from about the Dakotas eastward to much of Maine, in the snow belts downwind of the Great Lakes, much of the State of Alaska, and in areas where ASCE/SEI 7-10 calls for case studies to be performed where extreme local variations in ground snow loads occur or where higher terrain elevation may influence snowfall event totals or accumulation of snowpack over the snow year. COL and ESP applicants will need to evaluate this aspect in their applications and its implications on a case-by-case basis if deployment of the NuScale SMR Power Plant design is planned in any such locations.

2.3.1.4.3 Design-Basis Wind Speeds and Missile Spectra

DCA PART 2 Tier 1, Table 5.0-1, and Tier 2, Table 2.0-1, postulate three types of wind speed-related site parameters applicable to the NuScale SMR Power Plant design. Based on DCA PART 2 Tier 2, Section 3.3, "Wind and Tornado Loadings," these design-basis parameters were used in determining or evaluating severe (nontornado-induced) wind pressure forces, and extreme (tornado- and hurricane-induced) wind pressure forces and (tornado- and hurricane-wind-generated) missile impacts on the SSCs associated with the RXB, the CRB, and the RWB or nearby nonseismic Category I structures that could adversely affect the seismic Category I RXB and seismic Category I portions of the CRB.

2.3.1.4.3.1 Design-Basis Severe Wind Speed (Nontornado)

DCA PART 2 Tier 1, Table 5.0-1, and Tier 2, Table 2.0-1, provide a design-basis (nontornado) wind speed and other related attributes postulated for the NuScale SMR Power Plant design. A wind speed value of 64.8 m/sec (145 mph) is designated as a "100-year return period 3-second wind gust speed" for Exposure Category C with an Importance Factor of 1.15 for the RXB, CRB, and RWB.

These design-basis conditions, reiterated in DCA PART 2 Tier 2, Section 2.3.1, and in Tier 2, Section 3.3.1.1, both refer to this wind speed as a "design basis severe wind" and reference it to a height of 10 m (33 ft) above ground. In addition, these DCA PART 2 sections state that "[t]hese design parameters are based upon ASCE/SEI 7-05" ("Minimum Design Loads for Buildings and Other Structures").

The staff notes that a 3-sec gust wind speed and the indicated reference height and exposure category correspond to the "basic wind speed" as defined in Section 6.2, "Definitions," and Figure 6-1, "Basic Wind Speed," of ASCE/SEI 7-05 (i.e., an annual probability of 0.02 or a 50-year mean recurrence interval). The indicated Importance Factor corresponds to an Occupancy (or Risk) Category IV for structures designated as "essential facilities" in Table 1-1, "Occupancy Category of Buildings and Other Structures for Flood, Wind, Snow, Earthquake, and Ice Loads," of ASCE/SEI 7-05 and where its damage or failure pose a risk to human life, health, and welfare.

SRP Acceptance Criterion (4) in Section II (Acceptance Criteria) of SRP Section 2.3.1 calls for an applicant to provide "[t]he basic (straight-line) 100-year return period 3-second gust wind speed" and for it to be based on appropriate standards, which include ASCE/SEI 7-05. The staff recognizes that the term "basic" in the current SRP guidance is a misnomer because the 100-year return period in the guidance differs from the 50-year return period defined for the "basic wind speed" in the referenced industry standard. Nevertheless, the 100-year return period, 3-sec gust wind speed in the SRP guidance prevails.

Table C6-7, "Conversion Factors for Other Mean Recurrence Intervals," in ASCE/SEI 7-05 provides conversion factors for estimating peak 3-sec gust wind speeds for mean recurrence intervals other than 50 years. In evaluating the reasonableness of the postulated design-basis severe (or nontornado) wind speed (i.e., 64.8 m/sec (145 mph)), the staff used the 50- to 100-year return period conversion factor of 1.07 from Table C6-7 in interpreting the 50-year return period gust wind speed contours illustrated in Figure 6-1 of ASCE/SEI 7-05 (two pages for the continental United States).

Taking into account this conversion factor, the staff's evaluation indicates that the 100-year return period severe (or nontornado) 3-sec gust wind speed site parameter postulated for the NuScale SMR Power Plant design has the potential to be exceeded along a small portion of the immediate U.S. coastline from the western Gulf of Mexico (Texas) to the eastern Gulf of Mexico and the southeastern Atlantic coastlines (north to about the Carolinas). In addition, portions of the immediate western and southern coast of Alaska, including the Aleutian Islands, might also challenge the proposed 3-sec gust site parameter value of 64.8 m/sec (145 mph). Figure 6-1 of ASCE/SEI 7-05 also provides basic wind speed data for the State of Hawaii and certain U.S. Territories, indicating that, among these, the postulated site parameter value might be exceeded on the islands of Puerto Rico, Guam, and the Virgin Islands. However, as noted in SER Section 2.3.1.4.1 and elsewhere, the DCA is silent with respect to the potential of the NuScale SMR Power Plant design being deployed in U.S. Territories.

The staff notes that Figure 6-1 of ASCE/SEI 7-05 also indicates that "[m]outainous terrain, gorges, ocean promontories and special wind regions shall be examined for unusual wind conditions." Therefore, COL and ESP applicants will need to evaluate this aspect in their applications and its implications on a case-by-case basis if deployment of the NuScale SMR Power Plant design is planned in any such locations in the United States.

Nevertheless, the staff finds that the 100-year return period severe (or nontornado) 3-sec gust wind speed site parameter, provided in DCA PART 2 Tier 1, Table 5.0-1, and Tier 2, Table 2.0-1, and referenced in DCA PART 2 Tier 2, Section 2.3.1, and Section 3.3.1.1, is representative of a reasonable number of locations in the continental United States and the State of Hawaii at which a NuScale SMR Power Plant design might be deployed. The staff also finds that the applicant has provided an acceptable basis for this site parameter, having used information in ASCE/SEI 7-05 as cited in SRP Acceptance Criterion (4), Section II (Acceptance Criteria) of SRP Section 2.3.1. Therefore, the staff finds that the applicant satisfies the regulations in GDC 2 and 10 CFR 52.47(a)(1) and the applicable guidance.

2.3.1.4.3.2 Design-Basis Tornado Parameters and Missile Spectrum

The DCA PART 2 Tier 1 and Tier 2 site parameter tables referenced in SER Section 2.3.1.2 indicate postulated DBT parameters (i.e., maximum wind speed, translational speed and maximum rotational speed of 102.8 m/sec (230 mph), 20.6 m/sec (46 mph), and 82.3 m/sec (184 mph), respectively; a radius of maximum rotational speed of 45.7 m (150 ft.); a pressure drop of 8.274 kPa (1.2 psi); and a rate of pressure drop of 3.447 kPa/sec (0.5 psi/sec)). DCA PART 2 Tier 2, Section 3.3.2.1, reiterates these values.

These site parameter values are the same as those listed for Tornado Intensity Region I in Table 1, "Design Basis Tornado Characteristics," of RG 1.76 and, as such, are associated with an exceedance probability of 10^{-7} per year. As illustrated in Figure 1, "Tornado intensity regions for the contiguous United States for exceedance probabilities of 10^{-7} per year," of RG 1.76, Region I includes most of the central and southeastern portions of the contiguous United States, also extending into western New York, and southward into western and north-central Pennsylvania. Region I represents the area where the most severe tornadoes frequently occur and, as a result, corresponds to the most severe DBT characteristics in that guidance.

The applicant also postulated a tornado missile spectrum, as indicated in DCA PART 2 Tier 2, Section 3.5.1.4 (i.e., a massive, high-kinetic energy missile, a rigid missile, and a solid steel sphere) with characteristics based on Table 2, "Design-Basis Tornado Missile Spectrum and

Maximum Horizontal Speeds," of RG 1.76, Revision 1, for (tornado intensity) Region I. SER Section 3.5.1.4 discusses the staff's review of the postulated tornado missile spectrum site parameters from an engineering standpoint.

The staff finds that the applicant has provided an acceptable basis for the postulated DBT site parameters provided in DCA PART 2 Tier 1, Table 5.0-1, and Tier 2, Table 2.0-1, and referenced in DCA PART 2 Tier 2, Section 3.3.2.1. Further, the staff finds that these postulated site parameter values are the most conservative specified in RG 1.76, Revision 1, and consequently should be representative of a reasonable number of locations in the contiguous United States where a NuScale SMR Power Plant design might be deployed. The staff finds that the applicant satisfies the regulations cited in SER Section 2.3.1.3 for the DBT parameters postulated for the NuScale SMR Power Plant design.

The staff notes that RG 1.76 does not specify DBT parameters for Alaska or Hawaii nor does the applicant address this subject in the DCA for those locations. COL and ESP applicants will need to evaluate this aspect in their applications and its implications on a case-by-case basis for proposed deployment in these locations. As noted in SER Section 2.3.1.4.1 and elsewhere, the DCA is silent with respect to the potential of the NuScale SMR Power Plant design being deployed in U.S. Territories.

2.3.1.4.3.3 Design-Basis Hurricane Wind Speed and Missile Spectrum

The DCA PART 2 Tier 1 and Tier 2 site parameter tables referenced in SER Section 2.3.1.2 indicate the postulated design-basis hurricane conditions (i.e., a maximum hurricane wind speed of 129.6 m/sec (290 mph)). DCA PART 2 Tier 2, Section 3.3.2.1, reiterates that this value represents "the highest wind speed postulated in Regulatory Position 1 of RG 1.221, Rev. 0…which occurs in Figure 2 of RG 1.221."

The staff confirmed that the postulated hurricane wind speed is based on the highest of the wind speed values shown on the referenced contour plots from RG 1.221 (specifically Figure 2, located near the southern tip of the Florida peninsula in the vicinity of the Florida Keys). Areal coverage of Figures 1 to 3 in RG 1.221 includes the U.S. coastline along the western Gulf of Mexico, the eastern Gulf of Mexico and southeastern Atlantic coastline, and the mid- and northern Atlantic coastline, respectively, along with adjacent (nearby) interior States. The staff notes that the contours represent nominal 3-sec gust wind speeds at 10 m (33 ft) above ground over open terrain at exceedance probabilities of 10^{-7} per year.

The applicant also postulated a hurricane missile spectrum, as indicated in DCA PART 2 Tier 2, Section 3.5.1.4 (i.e., a massive, high-kinetic energy missile, a rigid missile, and a solid steel sphere), with characteristics based on Table 1, "Design-Basis Hurricane Missile Spectrum," and Table 2, "Design-Basis Missile Velocities as a Function of Hurricane Windspeed," of RG 1.221. Tier 2, Section 3.5.1.4, also provides the horizontal and vertical missile velocities associated with the postulated 129.6 m/sec (290 mph) hurricane wind speed for each missile type. SER Section 3.5.1.4 discusses the staff's review of the postulated hurricane missile spectrum site parameters from an engineering standpoint.

The staff finds that the applicant has provided an acceptable basis for the postulated design-basis hurricane wind speed provided in DCA PART 2 Tier 1, Table 5.0-1, and Tier 2, Table 2.0-1, and referenced in DCA PART 2 Tier 2, Section 3.3.2.1. Further, the staff finds that this postulated site parameter is the most conservative, based on RG 1.221, and consequently should be representative of potential, hurricane-prone site locations in the contiguous United

States along, and for States adjacent to, the Gulf of Mexico and Atlantic coastlines. The staff finds that the applicant satisfies the regulations cited in SER Section 2.3.1.3 with regard to the design-basis hurricane wind speed postulated for the NuScale SMR Power Plant design.

However, the staff notes that RG 1.221 and its supporting documentation do not estimate design-basis hurricane wind speeds for locations along the Pacific Coast of the contiguous United States or for the States of Alaska or Hawaii, nor does the applicant address this subject in the DCA for those locations. COL and ESP applicants will need to evaluate this aspect in their applications and its implications on a case-by-case basis for proposed deployment in these locations. As noted in SER Section 2.3.1.4.1 and elsewhere, the DCA is silent with respect to the potential of the NuScale SMR Power Plant design being deployed in U.S. Territories.

2.3.1.4.4 Design-Basis Dry- and Wet-Bulb Temperatures

The DCA PART 2 Tier 1 and Tier 2 site parameter tables referenced in SER Section 2.3.1.2 provide the postulated design-basis dry- and wet-bulb temperatures. Tier 2, Section 2.3.1, states that these design temperatures "are based on the EPRI Utility Requirements Document." Tier 2, Section 2.3.6, "References," lists Revision 13 of the URD ("Advanced Nuclear Technology: Advanced Light Water Reactor Utility Requirements Document"), issued by EPRI in 2014, as the source.

These postulated site parameters include zero-percent exceedance maximum and minimum outdoor design dry-bulb temperatures of 46.1 degrees C and -40 degrees C (115 degrees F and -40 degrees F), respectively, which represent historical limits excluding peaks less than two hours. These site parameters are included in both DCA PART 2 Tier 1, Table 5.0-1, and Tier 2, Table 2.0-1. DCA PART 2 Tier 2, Table 2.0-1, also includes a maximum outdoor design wet-bulb temperature of 26.7 degrees C (80 degrees F) coincident with the zero-percent exceedance maximum design dry-bulb temperature as well as a zero-percent exceedance maximum noncoincident wet-bulb temperature of 81 degrees F (the noncoincident value represents an historical limit excluding peaks less than two hours).

In addition, DCA PART 2 Tier 2, Table 2.0-1, indicates one-percent (annual) exceedance maximum and minimum outdoor design dry-bulb temperatures of 37.8 degrees C and -23.3 degrees C (100 degrees F and -10 degrees F), respectively, along with a maximum wet-bulb temperature of 25.0 degrees C (77 degrees F) coincident with the one-percent exceedance maximum dry-bulb temperature, and a one-percent (annual) exceedance maximum noncoincident wet-bulb temperature of 26.7 degrees C (80 degrees F). Tier 2, Table 2.0-1, also includes five-percent (annual) exceedance maximum and minimum outdoor design dry-bulb temperatures of 35.0 degrees C and -20.6 degrees C (95 degrees F and -5 degrees F), respectively, along with a maximum wet-bulb temperature of 25.0 degrees C (77 degrees F) coincident with the five-percent exceedance maximum dry-bulb temperature.

The postulated zero-percent exceedance maximum dry-bulb and maximum coincident wet-bulb temperatures, the zero-percent exceedance noncoincident wet-bulb temperature, and the zero-percent exceedance minimum dry-bulb temperature are associated with the design of the control room ventilation system (CRVS) (see DCA PART 2 Tier 2, Table 9.4.1-1, "CRVS Outdoor Air Design Conditions."

The postulated one-percent (annual) exceedance maximum dry-bulb and maximum coincident wet-bulb temperatures, and the one-percent (annual) exceedance minimum dry-bulb temperature specify design conditions for the RXB and RWB HVAC systems (see DCA PART 2

Tier 2, Table 9.4.2-1, “Outside Air Temperature Range for Reactor Building Ventilation System.” See also DCA PART 2 Tier 2, Table 9.4.3-1, “Outside Air Design Temperature for the Radioactive Waste Building HVAC System”).

The postulated one-percent (annual) exceedance noncoincident wet-bulb temperature specifies design conditions for site cooling water system equipment and the circulating water system (see DCA PART 2 Tier 2, Table 9.2.7-1, “Site Cooling Water System Equipment Design Data,” and Table 10.4-9, “Circulating Water System Design Parameters,” respectively).

The postulated five-percent (annual) exceedance maximum dry-bulb and maximum coincident wet-bulb temperatures, and the five-percent (annual) exceedance minimum dry-bulb temperature specify design conditions for the turbine generator building HVAC system (see DCA PART 2 Tier 2, Table 9.4.4-1, “Turbine Building HVAC System Outdoor Air Design Conditions.”

The staff notes that the postulated design-basis dry- and wet-bulb temperatures are the same site parameters and numeric values listed in Table 1.2-6, “Envelope of ALWR Plant Site Design Parameters,” of the ALWR URD, Volume II—ALWR Evolutionary Plant, Chapter 1 (Overall Requirements), Revision 8, published by EPRI in 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 cited as the basis for the site parameters postulated for the NuScale SMR Power Plant design.

The staff has determined during its review that the coincident wet-bulb temperatures listed in the EPRI URD represent mean coincident rather than maximum coincident values. This convention is consistent with the approach used by ASHRAE to report dry- and coincident wet-bulb temperatures. In its initial response to RAI 9186, Question No. 02.03.01-6(c) (ADAMS Accession No. ML18044A695), the applicant stated that “[t]he coincident wet-bulb temperature value represents the mean of the collected wet bulb temperatures that occurred coincident with the indicated dry-bulb temperature.” This is reflected in Revision 1 of DCA PART 2 Tier 2, Section 2.3.1. However, in a supplemental response to that question (ADAMS Accession No. ML18257A299), the applicant revised this definition stating that “[t]he coincident wet-bulb temperature value represents the overall maximum wet bulb temperature that is coincident with the indicated dry-bulb temperature.”

The supplemental response also included proposed changes to the description in DCA PART 2 Tier 2, Section 2.3.1 for consistency with this revised definition and how those values are labeled in DCA PART 2 Tier 2, Table 2.0-1 (i.e., as maximum coincident wet-bulb temperatures) and the other tables in Tier 2, Chapter 9 listed above. These proposed changes are being tracked as **Confirmatory Item 02.03.01-2**.

The staff recognizes that the NuScale SMR Power Plant design has a smaller areal extent of the overall plant site and likely a smaller size compared to that typical of larger light-water-reactor plant sites and structures. Consequently, this design might be able to be deployed in atypical nuclear plant site locations. The staff took this possibility into consideration in evaluating the dry- or wet-bulb temperatures, which are among “[t]he site parameters postulated for the design” of the NuScale SMR Power Plant in accordance with 10 CFR 52.47(a)(1), and based on the regulations at GDC 2 (although temperature is not mentioned specifically among the examples of “natural phenomena” listed there).

Zero-Percent Exceedance Maximum and Minimum Dry- Bulb Temperatures

Based on its review (and, in some cases, approval) of previous DCAs, the staff notes that the zero-percent exceedance maximum and minimum outdoor dry-bulb temperatures (i.e., 46.1 degrees C and -40.0 degrees C (115 degrees F and -40 degrees F), respectively) postulated for the NuScale SMR Power Plant design are the same for these submittals (i.e., AP1000, ABWR, APR1400, U.S. APWR, U.S. EPR). Therefore, the staff believes that these proposed site parameter values bound a reasonable number of potential COL and ESP sites for this design if deployed in most of the continental United States and in the State of Hawaii. However, the staff also recognizes that the postulated zero-percent exceedance maximum dry-bulb temperature may be challenged if deployment occurs in the western United States (i.e., primarily the desert southwest and drier portions of the State of California).

Similarly, the postulated zero-percent exceedance minimum outdoor design dry-bulb temperature may be challenged along the northern tier of the interior of the contiguous United States during the cold season (increasing in likelihood as possible siting progresses westward or with increasing elevation in these areas). Moreover, potential deployment of the NuScale SMR Power Plant design in Alaska is more likely to experience exceedances of the postulated zero-percent exceedance minimum dry-bulb temperature at locations in the interior of that State or with increasing elevation and latitude. This may also necessitate additional design considerations (e.g., extended persistence of these extreme conditions, the presence of and potential effects on permafrost) not addressed in this DCA. As with other climate-related site parameters, COL and ESP applicants will need to evaluate these aspects in their applications and their implications on a case-by-case basis if deployment of the NuScale SMR Power Plant design is planned in any such locations with extreme temperature conditions.

Zero-Percent Exceedance Non-coincident Wet-Bulb Temperature

Again, based on its review of previous DCAs, the staff notes that the zero-percent exceedance non-coincident wet-bulb temperature postulated for the NuScale SMR Power Plant design (i.e., 27.2 degrees C (81 degrees F)) has also been proposed for some other reactor designs (e.g., ABWR, APR1400). In some cases, subsequent revisions to other DCAs have incorporated higher values (e.g., AP1000) considering the applicant's evaluation of related RAI questions and the locations proposed for their first deployments. For other designs, higher zero-percent exceedance non-coincident wet-bulb temperatures have been initially proposed (e.g., US-APWR). And, in other cases, the initially postulated zero-percent exceedance non-coincident wet-bulb value of 27.2 degrees C (81 degrees F) has been retained (i.e., APR1400).

The staff noted in RAI 9186, Question 02.03.01-7 (ADAMS Accession No. ML17349A337), that it had compared the postulated zero-percent exceedance non-coincident wet-bulb temperature to corresponding site characteristic values submitted in 17 docketed COL and ESP applications. The staff found the following:

- Almost all of those applications identified a non-coincident wet-bulb temperature greater than the corresponding zero-percent exceedance non-coincident wet-bulb value proposed for the NuScale SMR Power Plant design.

- The geographical area covered by these proposed site locations, while in the contiguous United States and east of the Rocky Mountains, is diverse not only in latitude and longitude but in a topographic setting (i.e., coastal and interior).

- Based on data compiled by ASHRAE in its “Weather Data Viewer” (Version 3.0), numerous other locations throughout the entire contiguous United States have reported maximum wet-bulb temperatures greater than the postulated site parameter value.

Nevertheless, in its response to RAI 9186, Question 02.03.01-7 (ADAMS Accession No. ML18044A695), the applicant acknowledged and stated, in part, that “[l]ower postulated wet bulb temperatures used in a DC application would lead to some potential COL applicants in harsher environments departing from the standard design in order to assure year round operation at full capacity. Higher postulated wet bulb temperatures used in a DC application would lead to some potential COL applicants in milder environments departing from the standard design to save money on the operation of oversized cooling systems that are not necessary for their typical meteorological conditions.”

Further, the applicant has taken the position, in the referenced response, that “[r]egardless, it is a business decision rather than a safety issue because NuScale’s heating ventilation and air conditioning systems and cooling towers are not safety related (as shown in [DCA PART 2] Tier 2 Table 3.2-1 [Classification of Structures, Systems, and Components])” and has stated that “NuScale is not changing the postulated wet bulb temperatures used for the standard design.”

Although the staff finds that this site parameter should allow a proposed facility referencing the NuScale SMR Power Plant design to be sited at a number of locations in the continental United States, the staff makes the following observations and notes the following limitations on this finding:

- The staff’s comparisons included in RAI No. 9186, Question 02.03.01-7, are reiterated.

- Potential deployment in the State of Hawaii could pose similar challenges to the postulated zero-percent exceedance non-coincident wet-bulb temperature as in much of the coastal and southeastern United States as well as many other locations east of the Rocky Mountains based on the maximum observed wet-bulb temperatures summarized in the ASHRAE data base.

- Potential deployment in drier climates of the western United States and the State of Alaska should offer fewer challenges to the zero-percent exceedance noncoincident wet-bulb temperature.

- Given the preceding evaluation by the staff and the applicant’s response to RAI 9186, Question 02.03.01-7 (ADAMS Accession No. ML18044A695), a request for a departure, variance, or exemption might reasonably be expected from an applicant or licensee (as applicable) with respect to the postulated zero-percent exceedance noncoincident wet-bulb temperature.

COL and ESP applicants will need to evaluate this aspect in their applications and its implications on a case-by-case basis for proposed deployment in these locations. As noted earlier, the DCA is silent with respect to the potential of the NuScale SMR Power Plant design being deployed in U.S. Territories.

Maximum Wet-Bulb Temperature Coincident with the Zero-Percent Exceedance Maximum Dry-Bulb Temperature

Based on its review of previous DCAs, the staff notes that the postulated maximum wet-bulb temperature (i.e., 26.7 degrees C (80 degrees F)) coincident with the zero-percent exceedance maximum outdoor dry-bulb temperature (i.e., 46.1 degrees C (115 degrees F)) has also been proposed for other designs (e.g., ABWR, APR1400, US-APWR, U.S. EPR). However, while the numerical value of the coincident wet-bulb temperature is the same, the statistical bases differ. The site parameter value given in the applications indicated above represents a mean value coincident with the zero-percent exceedance dry-bulb temperature. On the other hand, the wet-bulb temperature coincident with the zero-percent exceedance maximum dry-bulb temperature postulated for the NuScale SMR Power Plant design represents a maximum coincident value as the applicant has stated in its supplemental response to RAI 9186, Question No. 02.03.01-6(c) (ADAMS Accession No. ML18257A299).

The staff understands that lower atmospheric moisture content (e.g., lower wet-bulb temperatures) is usually associated with relatively higher dry-bulb temperatures because increased atmospheric moisture tends to hold back the concurrent increase of the dry-bulb temperature. It also stands that a mean coincident wet-bulb temperature provides more margin in a design-basis dry-bulb / coincident wet-bulb temperature pair compared to a maximum coincident wet-bulb temperature.

As indicated previously, the staff recognizes that the postulated zero-percent exceedance maximum dry-bulb temperature (i.e., 46.1 degrees C (115 degrees F)) may be challenged in the western United States, primarily in the desert southwest and portions of the State of California (i.e. characterized by a drier climate). Nevertheless, whatever the zero-percent exceedance maximum dry-bulb temperature is for a particular location, the ASHRAE data base suggests that the postulated maximum coincident wet-bulb temperature (i.e., 26.7 degrees C (80 degrees F)) is likely to be exceeded at multiple locations in most of the other States in the contiguous United States as well as the State of Hawaii.

Consequently, a request for a departure, variance, or exemption might reasonably be expected from an applicant or licensee (as applicable) with respect to the postulated wet-bulb temperature coincident with the zero-percent exceedance maximum dry-bulb temperature. COL and ESP applicants will need to evaluate this aspect in their applications and its implications on a case-by-case basis. As noted before in this section and elsewhere, the DCA is silent with respect to the potential of the NuScale SMR Power Plant design being deployed in U.S. Territories.

One-Percent (Annual) Exceedance Maximum and Minimum Dry- Bulb Temperatures

The staff evaluated the one-percent (annual) exceedance maximum and minimum dry-bulb temperatures (i.e., 37.8 degrees C and -23.3 degrees C (100 degrees F and -10 degrees F), respectively) postulated for the NuScale SMR Power Plant design based on its review of the same values in the DCAs noted above for the zero-percent exceedance maximum and minimum dry-bulb temperatures as well as for the ESBWR design. Similar to the review of the zero-percent exceedance dry- or wet-bulb temperatures, the staff used meteorological data from the ASHRAE data base for observing stations located in the contiguous United States.

As an individual statistic, the one-percent (annual) exceedance maximum dry-bulb temperature was exceeded at less than five percent of the weather stations in the ASHRAE data base.

Similarly, the postulated one-percent (annual) exceedance minimum dry-bulb temperature was exceeded at only about 10 percent of the weather stations in that database. Therefore, the staff believes that these postulated site parameter values bound a reasonable number of potential COL and ESP sites if the NuScale SMR Power Plant design is deployed in most of the contiguous United States.

As with the corresponding zero-percent exceedance dry-bulb temperatures, the staff recognizes that the postulated one-percent (annual) exceedance maximum dry-bulb temperature may be challenged if deployment occurs primarily in the desert southwest and drier portions of the State of California. Similarly, the postulated one-percent (annual) exceedance minimum dry-bulb temperature may be challenged along the northern tier of the interior of the contiguous United States, also increasing in likelihood with increasing elevation in these areas. Further, potential deployment of the NuScale SMR Power Plant design in Alaska is more likely to experience exceedances of the postulated one-percent (annual) minimum dry-bulb temperature at locations in the interior of that State or with increasing elevation or latitude.

As with other climate-related site parameters, COL and ESP applicants will need to evaluate these aspects in their applications and their implications on a case-by-case basis if deployment of the NuScale SMR Power Plant design is planned in any such locations with extreme temperature conditions. And, as noted before in this section and elsewhere, the DCA is silent with respect to the potential of the NuScale SMR Power Plant design being deployed in U.S. Territories.

One-Percent (Annual) Exceedance Noncoincident Wet-Bulb Temperature

The staff evaluated the one-percent (annual) exceedance non-coincident wet-bulb temperature (i.e., 26.7 degrees C (80 degrees F)) postulated for the NuScale SMR Power Plant design using meteorological data from the ASHRAE data base for observing stations located in the contiguous United States and the State of Hawaii. The staff finds that this site parameter bounds a reasonable number of potential COL and ESP sites if this design is deployed in much of the contiguous United States, the State of Hawaii, and most likely, based on professional judgement, the State of Alaska. However, potential deployment in the southeastern United States (including States along the Atlantic coast and Gulf of Mexico) could pose challenges to the postulated value.

COL and ESP applicants will need to evaluate this aspect in their applications and its implications on a case-by-case basis for proposed deployment in these locations. As noted before in this section and elsewhere, the DCA is silent with respect to the potential of the NuScale SMR Power Plant design being deployed in U.S. Territories.

Maximum Wet-Bulb Temperature Coincident with the One-Percent (Annual) Exceedance Maximum Dry-Bulb Temperature

Based on its review of previous DCAs, the staff notes that the postulated maximum wet-bulb temperature (i.e., 25.0 degrees C (77 degrees F)) coincident with the one-percent (annual) exceedance maximum outdoor dry-bulb temperature (i.e., 37.8 degrees C (100 degrees F)) has also been proposed for other designs (e.g., ABWR, APR1400, US-APWR, U.S. EPR). The numerical value of the wet-bulb temperature coincident with the one-percent (annual) exceedance maximum dry-bulb temperature is the same as in the DCAs listed above. But, like the maximum wet-bulb temperature coincident with the zero-percent exceedance dry-bulb temperature, the statistical bases differ (i.e., the site parameter value in the indicated

applications represents a mean coincident value whereas the coincident wet-bulb temperature postulated for the NuScale SMR Power Plant design represents a maximum coincident value).

As mentioned previously, the staff understands that lower atmospheric moisture content is usually associated with relatively higher dry-bulb temperatures because increased atmospheric moisture tends to hold back the concurrent dry-bulb temperature, and that a mean coincident wet-bulb temperature provides more margin than a maximum coincident wet-bulb temperature in a design-basis dry-bulb / coincident wet-bulb temperature pair.

The staff also recognizes that the postulated one-percent (annual) exceedance maximum dry-bulb temperature (i.e., 37.8 degrees C (100 degrees F)) may be challenged in the western United States, primarily in the desert southwest and drier portions of the State of California. Nevertheless, whatever the one-percent (annual) exceedance maximum dry-bulb temperature is for a particular location, the ASHRAE data base suggests that the postulated maximum coincident wet-bulb temperature (i.e., 25.0 degrees C (77 degrees F)) is likely to be exceeded at multiple locations in most of the other States in the contiguous United States as well as the State of Hawaii.

Consequently, a request for a departure, variance, or exemption might reasonably be expected from an applicant or licensee (as applicable) with respect to the postulated wet-bulb temperature coincident with the one-percent exceedance maximum dry-bulb temperature. COL and ESP applicants will need to evaluate this aspect in their applications and its implications on a case-by-case basis. As noted before in this section and elsewhere, the DCA is silent with respect to the potential of the NuScale SMR Power Plant design being deployed in U.S. Territories.

Five-Percent (Annual) Exceedance Maximum and Minimum Dry- Bulb Temperatures

The ASHRAE data base does not directly summarize five-percent (annual) exceedance maximum and minimum dry-bulb temperatures. Rather, the data base includes statistics for dry-bulb temperatures on a 0.4-percent, 1.0-percent, and 2.0-percent annual exceedance basis, as well as dry-bulb temperatures on a 99.6-percent and 99.0-percent annual exceedance basis. The exceedance value for a given parameter at a particular observing location over a specified POR (typically 20 to 30 years) represents the value that is exceeded the indicated percentage of the time.

Consequently, the staff did not evaluate, in detail, the postulated five-percent (annual) maximum and minimum dry-bulb temperature site parameter values presented in DCA PART 2 Tier 2, Table 2.0-1. However, the preceding results for the one-percent (annual) exceedance maximum dry-bulb temperature, along with an indication from the two-percent annual exceedance statistics in the ASHRAE data base, suggest that the postulated five-percent (annual) exceedance maximum dry-bulb temperature (i.e., 35.0 degrees C (95 degrees F)) can be accommodated at a reasonable number of potential COL and ESP sites in the contiguous United States, and the States of Alaska and Hawaii.

The postulated five-percent (annual) exceedance minimum dry-bulb temperature (i.e., -20.6 degrees C (-5 degrees F)) can also be accommodated at a reasonable number of potential COL and ESP sites in the contiguous United States and the State of Hawaii. However, as with the postulated zero- and one-percent (annual) exceedance minimum dry-bulb temperatures, the staff notes that the five-percent (annual) exceedance minimum dry-bulb temperature may be challenged along the northern tier of the interior of the contiguous United States during the cold

season (increasing in likelihood as possible siting progresses westward or with increasing elevation, in these areas). Likewise, potential deployment of the NuScale SMR Power Plant design in Alaska is more likely to experience exceedances of the postulated five-percent minimum dry-bulb site parameter value at locations in the interior of that State or with increasing latitude.

As with other climate-related site parameters, COL and ESP applicants will need to evaluate these aspects in their applications and their implications on a case-by-case basis if deployment of the NuScale SMR Power Plant design is planned in any such locations with extreme temperature conditions. As noted before in this section and elsewhere, the DCA is silent with respect to the potential of the NuScale SMR Power Plant design being deployed in U.S. Territories.

Maximum Wet-Bulb Temperature Coincident with the Five-Percent (Annual) Exceedance Maximum Dry-Bulb Temperature

The staff notes that the postulated maximum wet-bulb temperature (i.e., 25.0 degrees C (77 degrees F)) coincident with the five-percent (annual) exceedance maximum dry-bulb temperature (i.e., 35.0 degrees C (95 degrees F)) is the same numerical value in the recently reviewed APR1400 DCA. However, like the maximum wet-bulb temperatures coincident with the zero-percent exceedance and the one-percent (annual) exceedance dry-bulb temperatures, the statistical bases are different (i.e., the site parameter value in the APR1400 DCA represents a mean coincident value but the coincident wet-bulb temperatures postulated for the NuScale SMR Power Plant design represent maximum coincident values).

The staff understands that lower atmospheric moisture content is usually associated with relatively higher dry-bulb temperatures because increased atmospheric moisture tends to hold back the concurrent dry-bulb temperature, and that a mean coincident wet-bulb temperature provides more margin than a maximum coincident wet-bulb temperature in a design-basis dry-bulb / coincident wet-bulb temperature pair.

As mentioned before, the postulated five-percent (annual) exceedance maximum dry-bulb temperature (i.e., 35.0 degrees C (95 degrees F)) can be accommodated at a reasonable number of potential COL and ESP sites in the contiguous United States, and the States of Alaska and Hawaii. The staff also recognizes that this parameter may be challenged in the western United States, primarily in the desert southwest and drier portions of the State of California. Nevertheless, whatever the five-percent (annual) exceedance maximum dry-bulb temperature is for a particular location, the ASHRAE data base suggests that the postulated maximum coincident wet-bulb temperature (i.e., 25.0 degrees C (77 degrees F)) is likely to be exceeded at multiple locations in most of the contiguous United States and possibly in the State of Hawaii as well.

Consequently, a request for a departure, variance, or exemption might reasonably be expected from an applicant or licensee (as applicable) with respect to the postulated wet-bulb temperature coincident with the five-percent exceedance maximum dry-bulb temperature. COL and ESP applicants will need to evaluate this aspect in their applications and its implications on a case-by-case basis. As noted before in this section and elsewhere, the DCA is silent with respect to the potential of the NuScale SMR Power Plant design being deployed in U.S. Territories.

2.3.1.5 Combined License Information Items

Table 2.3.1-1 lists COL information items related to DCA PART 2 Tier 2, Section 2.3.1, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.3.1-1 NuScale COL Information Items for Section 2.3

Item No.	Description	DCA PART 2 Tier 2 Section
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 2.3-1	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 3.3-1	A COL applicant that references the NuScale Power Plant design will confirm that nearby structures exposed to severe and extreme (tornado and hurricane) wind loads will not collapse and adversely affect the Reactor Building or Seismic Category I portion of the Control Building.	3.3
COL Item 3.5-3	A COL applicant that references the NuScale Power Plant certified design will confirm that automobile missiles cannot be generated within a 0.5 mile radius of safety-related structures, systems, and components and risk-significant structures, systems, and components requiring missile protection that would lead to impact higher than 30 feet above plant grade. Additionally, if automobile missiles impact at higher than 30 feet above plant grade, the COL applicant will evaluate and show that the missiles will not compromise safety-related and risk-significant structures, systems, and components.	3.5
COL Item 3.5-4	A COL applicant that references the NuScale Power Plant design certification will evaluate site-specific hazards for external events that may produce more energetic missiles than the design basis missiles defined in FSAR Tier 2, Section 3.5.1.4.	3.5
COL Item 19.1-7	A COL applicant that references the NuScale Power Plant design certification will evaluate site specific external event hazards, screen those for risk-significance, and evaluate the risk associated with external hazards that are not bounded by the design certification.	19.1
COL Item 20.1-3	A COL applicant that references the NuScale Power Plant design certification will determine if high wind and applicable missile hazards are applicable at the site location. If high wind and applicable missile hazards are applicable, then the COL	20.1

Item No.	Description	DCA PART 2 Tier 2 Section
	applicant will ensure equipment and structures credited for diverse and flexible coping strategies are designed to be available following a site-specific high wind and applicable missile hazards.	
COL Item 20.1-4	A COL applicant that references the NuScale Power Plant design certification will determine if snow, ice and extreme cold temperature hazards are applicable at the site location. If snow, ice and extreme cold hazards are applicable, the COL applicant will ensure equipment and structures credited for diverse and flexible coping strategies are designed to be available following a site-specific snow, ice or extreme cold temperature hazard.	20.1
COL Item 20.1-5	A COL applicant that references the NuScale Power Plant design certification will determine if extreme high temperature hazard is applicable at the site location. If extreme high temperature hazard is applicable, the COL applicant will ensure equipment and structures credited for diverse and flexible coping strategies are designed to be available following a site-specific extreme high temperature hazard.	20.1

2.3.1.6 Conclusion

The regional climatology is site specific and will be addressed by a COL applicant (see DCA PART 2 Tier 2, Table 1.8 2, COL Item 2.0 1). A COL or ESP applicant should provide information sufficient to demonstrate that the actual site characteristics specified in its COL application fall within the values of the postulated site parameters in the NuScale DCA PART 2. In accordance with SRP Section 2.3.1, the staff evaluated the applicant's postulated, climate-related site parameters (a subset of which is included as Tier 1 information) and, in general, considers them to be representative of a reasonable number of sites that have been or may be considered for a COL application and that the applicant provided a technical basis for each site parameter.

2.3.2 Local Meteorology

2.3.2.1 Introduction

DCA PART 2 Tier 2, Section 2.3.2, "Local Meteorology," states that "[l]ocal meteorology is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.3-1." The COL applicant is to provide summaries of the local (site) meteorology, including normal and extreme values for meteorological parameters, an assessment of the construction and operation impacts of the plant and its facilities on the local meteorology, and a topographical description of the site and its surroundings.

2.3.2.2 Summary of Application

DCA PART 2 Tier 1: There is no information for this area of review.

DCA PART 2 Tier 2: In DCA PART 2 Tier 2, Section 2.3.2, the applicant stated that local meteorology is site specific and is addressed by the COL applicant as part of the response to COL Item 2.3-1.

ITAAC: There are no ITAAC for this area of review.

Technical Specifications: There are no TS for this area of review.

Technical Reports: There are no technical reports associated with this area of review.

2.3.2.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.79(a)(1)(vi), as it relates to using site meteorology to evaluate offsite radiological consequences caused by postulated fission product releases.
- 10 CFR 100.20(c)(2) and 10 CFR 100.21(d) with respect to the consideration given to the local meteorological characteristics of the site.

The guidance in SRP Section 2.3.2, "Local Meteorology," lists the acceptance criteria adequate to meet the above requirements, as well as review interfaces with other SRP sections. SRP Section 2.3.2 states that the review of local meteorology includes the following specific areas:

- Summaries of local meteorological data based on onsite measurements and NWS station summaries or other standard installation summaries from appropriate locations in proximity.
- A discussion and evaluation of the impact of the plant and its facilities on the local meteorological and air quality conditions and identification of potential changes in normal and extreme values resulting from plant construction and operation.
- A complete topographical description of the site and the associated environment out to a distance of 80 km (50 miles) from the plant.

DCAs do not contain this type of information because it is site specific. A COL applicant referencing the NuScale DC will address this information.

2.3.2.4 Technical Evaluation

The NuScale DCA has no postulated site parameters related to local meteorology. A description of the anticipated local meteorological conditions and the impacts of a proposed plant and associated facilities on the local meteorological conditions (e.g., effects of plant structures, terrain modification, and heat and moisture sources caused by plant operation) are site specific and should be presented by a COL applicant referencing the NuScale DC. The staff finds COL Item 2.3-1, requiring the COL applicant to provide site-specific meteorological information for Sections 2.3.1 through 2.3.5, acceptable.

2.3.2.5 Combined License Information Items

Table 2.3.2-1 lists the COL information item related to DCA PART 2 Tier 2, Section 2.3.2, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.3.2-1 NuScale COL Information Items for Section 2.3.2

Item No.	Description	DCA PART 2 Tier 2 Section
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

SER Section 2.3.1 explains that the applicant has indicated that the NuScale SMR Power Plant design could be deployed in the continental United States (including the contiguous lower 48 States and the State of Alaska) as well as the State of Hawaii. The staff also notes that the DCA is silent with respect to the potential of this design being deployed in U.S. Territories and recognizes that this design might be able to be sited in other-than typical large-scale nuclear plant site locations. COL and ESP applicants should take this into consideration in evaluating the general language of COL Item 2.3-1 with respect to potential issues related to Section 2.3.2, "Local Meteorology," of a COL FSAR.

2.3.2.6 Conclusion

The NuScale DCA has no postulated site parameters related to local meteorology. COL Item 2.3-1 specifies that a COL applicant that references the NuScale DC will describe the local meteorological conditions for Section 2.3.2. The staff acknowledges that local meteorological conditions are site specific and will be addressed by a COL applicant referencing the NuScale DC. Based on the above information, the staff finds the applicant's discussions in Section 2.3.2 of the NuScale DCA acceptable.

2.3.3 Onsite Meteorological Measurements Programs

2.3.3.1 Introduction

DCA PART 2 Tier 2, Section 2.3.3, "Onsite Meteorological Measurements Programs," states that "[o]nsite meteorological measurement programs are site-specific and are addressed by the COL applicant as part of the response to COL Item 2.3-1." The COL applicant is to describe meteorological instrumentation, including sensor siting, sensor type and performance specifications, methods and equipment for recording sensor output, a quality assurance program for sensors and recorders, data acquisition and reduction procedures, and special considerations for complex terrain sites. These areas of review are relevant to both the preoperational and operational phases of a proposed facility. The COL applicant is to also provide a copy of the resulting onsite meteorological database and discuss the amenability of the data for use in characterizing atmospheric dispersion conditions.

2.3.3.2 Summary of Application

DCA PART 2 Tier 1: There is no information for this area of review

DCA PART 2 Tier 2: In DCA PART 2 Tier 2, Section 2.3.3, the applicant stated that the onsite meteorological measurement programs are site specific and are addressed by the COL applicant as part of the response to COL Item 2.3-1.

ITAAC: There are no ITAAC for this area of review.

Technical Specifications: There are no TS for this area of review.

Technical Reports: There are no technical reports associated with this area of review.

2.3.3.3 Regulatory Basis

From a preoperational standpoint, the onsite meteorological measurements program supports safety analyses that rely on a site's meteorological conditions or that may have an impact on plant design. A COL applicant referencing the NuScale DC will use onsite meteorological data from a preoperational monitoring program to satisfy the following regulatory requirements:

- Subpart D, "Radiation Dose Limits for Individual Members of the Public," of 10 CFR Part 20, "Standards for Protection against Radiation," with respect to demonstrating compliance with dose limits for individual members of the public.

- GDC 19, "Control Room," with respect to demonstrating compliance with dose limits inside the control room during radiological accident conditions.

- Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation To Meet the Criterion 'As Low As Is Reasonably Achievable' (ALARA) for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents," to 10 CFR Part 50, with respect to the means to be employed for determining compliance with the numerical guides for design objectives and limiting conditions for operation to meet the requirement that radioactive material in effluents released to unrestricted areas be kept ALARA.

- 10 CFR 100.21(c) to evaluate site atmospheric dispersion characteristics and to establish dispersion parameters so that (1) the plant can meet radiological effluent release limits associated with normal operation for any individual located off site and (2) radiological dose consequences of postulated accidents meet prescribed dose limits at the EAB and outer boundary of the LPZ.

During the operational phase, the COL applicant relies on information about, and data from, an established and acceptably maintained onsite meteorological measurements program to meet the following regulatory requirements:

- 10 CFR 50.47(b)(4), 10 CFR 50.47(b)(8), and 10 CFR 50.47(b)(9), and Sections IV.E.2 and VI.2(a) of Appendix E, "Emergency Planning and Preparedness for Production and Utilization Facilities," to 10 CFR Part 50, with respect to available meteorological equipment and information necessary for determining the magnitude and continuously assessing the impact of releases of radioactive materials to the environment during a radiological emergency.

The guidance in SRP Section 2.3.3, "Onsite Meteorological Measurements Program," lists the acceptance criteria adequate to meet the above requirements, as well as review interfaces with other SRP sections. Other regulatory guidance to be considered in establishing and maintaining an acceptable onsite meteorological measurements program includes the following:

- RG 1.23, “Meteorological Monitoring Programs for Nuclear Power Plants,” Revision 1, issued March 2007.

- RG 1.206.

DCAs do not contain this type of information because it is site specific. A COL applicant referencing the NuScale DC will address this information.

2.3.3.4 Technical Evaluation

The staff reviewed the NuScale DCA in accordance with SRP Section 2.3.3. This guidance recognizes that Section 2.3.3 of a DCA has no postulated site parameters and that the onsite meteorological monitoring program is site specific and will be addressed by a COL applicant.

Consistent with that understanding, DCA PART 2 Tier 2, Section 2.3.3, acknowledged the COL applicant’s need for preoperational and operational monitoring programs for measuring meteorological conditions at a site, consistent with the guidance in RG 1.23. Further, DCA PART 2 Tier 2, Section 2.3, “Meteorology,” reiterated COL Item 2.3-1 in DCA PART 2 Tier 2, Table 1.8-2, on the site-specific nature of the meteorological measurements program (along with other climatological, meteorological, and atmospheric dispersion-related information under Section 2.3), consistent with the guidance in RG 1.206 for preparation of this information by a COL applicant.

The staff also notes that the applicant identified relationships between the onsite meteorological measurements program and the systems, equipment, and information required for emergency preparedness planning and for availability in the appropriate emergency response facilities under those emergency conditions (i.e., as part of the Post-Accident Monitoring System described in Tier 2, Chapter 7, “Instrumentation and Controls,” and Section 13.3, “Emergency Planning”). This is responsive to the cited regulations at 10 CFR 50.47(b)(4), 10 CFR 50.47(b)(8), and 10 CFR 50.47(b)(9), and Sections IV.E.2 and VI.2(a) of Appendix E to 10 CFR Part 50.

2.3.3.5 Combined License Information Items

Table 2.3.3-1 lists COL information items related to DCA PART 2 Tier 2, Section 2.3.3, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.3.3-1 NuScale COL Information Items for Section 2.3.3

Item No.	Description	DCA PART 2 Tier 2 Section
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 13.3-3	A COL applicant that references the NuScale Power Plant design certification will provide a comprehensive emergency plan in	13.3

	accordance with 10 CFR 50.47, 10 CFR 50, Appendix E, 10 CFR 52.48, and 10 CFR 52.79(a)(21).	

SER Section 2.3.1 explains that the applicant has indicated that the NuScale SMR Power Plant design could be deployed in the continental United States (including the contiguous lower 48 States and the State of Alaska) as well as the State of Hawaii. The staff also notes that the DCA is silent with respect to the potential of this design being deployed in U.S. Territories and recognizes that this design might be able to be sited in other-than typical large-scale nuclear plant site locations. COL and ESP applicants should take this into consideration in evaluating the general language of COL Item 2.3-1 with respect to potential issues related to Section 2.3.3, "Onsite Meteorological Measurements Programs," of a COL FSAR.

2.3.3.6 Conclusion

The NuScale DCA has no postulated site parameters related to the onsite meteorological measurements program. COL Item 2.3-1 specifies that a COL applicant that references the NuScale DC will provide a detailed description of its onsite meteorological measurements program and the resulting database. The staff acknowledges that local meteorological conditions are site specific and will be addressed by a COL applicant referencing the NuScale DC. Based on the above information, the staff finds the applicant's discussions in Section 2.3.3 of the DCA acceptable.

2.3.4 Short-Term Atmospheric Dispersion Estimates for Accident Releases

2.3.4.1 Introduction

Short-term atmospheric dispersion estimates for accident releases are used to determine the amount of airborne radioactive materials expected to reach a specific location during an accident situation. These estimates address the requirements for developing conservative atmospheric dispersion factors (relative concentrations or χ/Q values) at the EAB, at the outer boundary of the LPZ, and at the main control room (MCR) and Technical Support Center (TSC) for postulated design-basis accident (DBA) radioactive airborne releases.

2.3.4.2 Summary of Application

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0, "Site Design Parameters," contains accident release χ/Q site parameters values at the MCR/TSC door and HVAC intake and at the EAB and outer boundary of the LPZ.

DCA PART 2 Tier 2: DCA PART 2 Tier 2, Section 2.3.4, "Short-Term Atmospheric Dispersion Estimates for Accident Releases," describes the methodology used for establishing and calculating the atmospheric dispersion factors used to determine accident radiological consequences at the MCR and TSC doors and HVAC intake and at the EAB and outer boundary of the LPZ. DCA PART 2 Tier 2, Table 2.0-1, contains accident release χ/Q site parameter values for these same receptors. The assumptions used to derive these χ/Q values (such as source and receptor locations, path directions and distances, and release point characteristics) are listed in DCA PART 2 Tier 2, Table 15.0-20, "Assumptions for Accident Airborne Effluent Release Point Characteristics for Offsite Receptors"; Figure 2.3-1, "Limiting

Analytical Distance to EAB and LPZ Outer Boundary"; Figure 2.3-2, "Source to Control Building Door Distances"; and Figure 2.3-3, "Source to Control Building HVAC Intake Distance."

ITAAC: There are no ITAAC for this area of review.

Technical Specifications: There are no TS for this area of review.

Technical Reports: There are no technical reports associated with this area of review.

Topical Reports: NuScale Power LLC, Licensing Topical Report TR-0915-17565-P, "Accident Source Term Methodology," Revision 2, September 2017 (ADAMS Accession No. ML17254B068).

2.3.4.3 Regulatory Basis

Acceptance criteria for short-term dispersion estimates for accidental releases are based on meeting the relevant requirements of the following Commission regulations:

- GDC 19, with respect to the meteorological considerations used to demonstrate compliance with dose limits inside the MCR during radiological accident conditions.
- Paragraph VI.2.a of Appendix E, "Emergency Planning and Preparedness for Production and Utilization Facilities," to 10 CFR Part 50, with respect to the meteorological considerations used to evaluate the personnel exposures inside the TSC during an emergency.
- 10 CFR 52.47(a)(1), with respect to the postulated site parameters that a DC applicant shall provide for the design.
- 10 CFR 52.47(a)(2)(iv), with respect to an assessment of the plant design features intended to mitigate the radiological consequences of accidents, which includes consideration of postulated site meteorology to evaluate the offsite radiological consequences at any point on the EAB and on the outer boundary of the LPZ.

A DCA does not contain general descriptions of site characteristics because this information is site specific and will be addressed by a COL applicant. However, under 10 CFR 52.47(a)(1), a DC applicant must provide site parameters postulated for the design.

SRP Section 2.3.4, "Short-Term Atmospheric Dispersion Estimates for Accident Releases," states that the DC applicant should include EAB, LPZ, and MCR atmospheric dispersion factors (χ/Q values) for the appropriate time periods in the list of site parameters. The DCA should also contain figures and tables showing the design features that the COL applicant would use to generate MCR χ/Q values (e.g., intake heights, release heights, building cross-sectional areas, and distance to receptors). SRP Section 2.3.4 also states that the postulated site parameters should be representative of a reasonable number of sites that may be considered within a COL application and that a basis should be provided for each of the site parameters.

The staff's review of DCA PART 2 Section 2.3.4, "Short-Term Atmospheric Dispersion Estimates for Accident Releases," also considered the following RGs and other related guidance documents (as applicable):

- RG 1.23, which includes guidance on the measurement and processing of onsite meteorological data for use as input to atmospheric dispersion models in support of plant licensing and operation

- RG 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," Revision 1, issued February 1983, which provides guidance on appropriate dispersion models for estimating offsite relative air concentrations (χ/Q values) as a function of downwind direction and distance (i.e., at the EAB and outer boundary of the LPZ) for various short-term time periods (up to 30 days) after an accident.

- RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," issued July 2000, which discusses the need for an evaluation of the radiological consequences of DBAs at emergency response facilities (such as the MCR and TSC).

- RG 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants," issued June 2003, which discusses acceptable approaches for estimating short-term (i.e., 2 hours to 30 days after an accident) average χ/Q values near the buildings at MCR ventilation air intakes and at other locations of significant air in-leakage to the control room envelope caused by postulated DBA radiological airborne releases.

- RG 1.206, which summarizes the types of information identified in SRP Section 2.3.4 that an applicant should provide in DCA PART 2 Section 2.3.4 for estimating dispersion factors (χ/Q values) used to assess the consequences of design-basis and other atmospheric radiological releases on MCR habitability.

- NUREG/CR-2858, "PAVAN: An Atmospheric-Dispersion Program for Evaluating Design-Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations," issued November 1982 (prepared by Pacific Northwest Laboratory (PNL-4413)), which is the user's manual for the NRC-sponsored PAVAN dispersion model that implements the guidance in RG 1.145.

- NUREG/CR-6331, "Atmospheric Relative Concentrations in Building Wakes," Revision 1, issued May 1997 (prepared by Pacific Northwest National Laboratory (PNNL-10521)), which is the user's manual for the NRC-sponsored ARCON96 dispersion model that is referenced in RG 1.194.

2.3.4.4 Technical Evaluation

The staff reviewed the DCA, in accordance with the guidance provided in SRP Section 2.3.4, to ensure that (1) the DCA included EAB, LPZ, and MCR χ/Q values in the list of standard plant site parameters; (2) the DCA contained figures and tables describing the design features that the COL applicant would use to generate MCR χ/Q values; (3) the EAB, LPZ, and MCR standard plant site parameter χ/Q values are representative of a reasonable number of sites that may be considered within a COL application; and (4) the DCA provides a basis for each of the EAB, LPZ, and MCR standard plant site parameter χ/Q values. The staff also reviewed the radiological consequence analyses presented in DCA PART 2 Tier 2, Chapter 15, "Transient and Accident Analyses," the control building habitability system (CRHS) description presented in

DCA PART 2 Tier 2, Section 6.4, “Control Room Habitability,” and the CRVS description presented in DCA PART 2 Tier 2, Section 9.4, “Air Conditioning, Heating, Cooling, and Ventilation Systems,” to ensure that the assumed fission product transport to the environment for each accident was compatible with the χ/Q values used to model the assumed release pathways.

In a letter dated May 25, 2018 (ADAMS Accession No. ML18149A404), the applicant proposed in a future revision to the DCA to change, among other items, DCA PART 2 Tier 1, Table 5.0-1; DCA PART 2 Tier 2, Table 2.0-1; Section 2.3.4; and Figure 2.3-1 to reference the “EAB and Outer Boundary of the LPZ” instead of “Security Owner Controlled Area Fence” and “Site Owner Controlled Area Fence.” This is **Confirmatory Item 02.03.04-1**.

2.3.4.4.1 Offsite χ/Q Values

SRP Section 2.3.4 states that the DC applicant should include EAB and LPZ boundary χ/Q values for the appropriate time periods in the list of site parameters. The staff noted that the applicant included accident release χ/Q values at the EAB and outer boundary of the LPZ as site parameters in DCA PART 2 Tier 1, Table 5.0-1, and in DCA PART 2 Tier 2, Table 2.0-1. The applicant stated in DCA PART 2 Tier 2, Section 2.3.4, that the EAB and LPZ outer boundary may be as close as 122 meters (m) (400 ft) from the closest release point. DCA PART 2 Tier 2, Figure 2.3-1, shows the assumed source and receptor relationships used to derive the 122-m (400-ft) source-to-receptor distance.

DCA PART 2 Tier 2, Section 2.3.4, states that TR-0915-17565 describes the methodology for calculating accident offsite atmospheric dispersion factors (i.e., at the EAB and outer boundary of the LPZ). The topical report uses the computer code ARCON96 methodology in lieu of the computer code PAVAN to calculate DBA χ/Q values for radiological releases to the EAB and outer boundary of the LPZ. The PAVAN computer code implements the guidance provided in RG 1.145 to estimate downwind ground-level air concentrations at the EAB and outer boundary of the LPZ, whereas ARCON96 implements a model for calculating relative concentrations in the vicinity of buildings that is endorsed by RG 1.194 for use in design-basis control room radiological habitability assessments.

NuScale generated its accident offsite χ/Q site parameter values using its topical report methodology with meteorological data from an 80th–90th percentile site. NuScale chose this meteorological data set from a study of atmospheric dispersion factors for 241 sites located across the United States.

The staff is currently evaluating TR-0915-17565 to determine if, subject to certain conditions and limitations, the NuScale methodology is acceptable for calculating accident offsite χ/Q values for the EAB and LPZ outer boundary in relation to the NuScale design or in a COL application referencing the NuScale design. This review is being tracked as **Open Item 02.03.04-1**.

To determine whether the NuScale EAB and outer boundary of LPZ χ/Q site parameter values bound a reasonable number of sites that may be considered within a COL application, the staff used a portion of the NuScale ARCON96 methodology to calculate χ/Q values, based on meteorological data collected at six nuclear power plant sites and assuming EAB and LPZ outer boundary distances of 122 m (400 ft). The staff found that one of these six sites had χ/Q values that are bounded by all of the NuScale site parameter values. The staff discussed these findings with NuScale during public meetings on January 24, 2018, and January 31, 2018

(ADAMS Accession No. ML18044A070). NuScale stated that it will take this feedback under advisement. If a COL applicant that references the NuScale design finds that its actual χ/Q site characteristic values do not fall within the corresponding site parameters postulated in the DC, the COL applicant will need to provide sufficient justification that the proposed facility is still acceptable at the proposed site. However, the staff expects from experience with other licensing actions that COL applicants will typically have EAB and outer boundary of the LPZ distances greater than 122 m (400 ft), which would result in lower site characteristic χ/Q values that could be bounded by the corresponding NuScale DCA site parameter χ/Q values.

2.3.4.4.2 Control Room χ/Q Values

SRP Section 2.3.4 states that the DC applicant should include MCR χ/Q values for the appropriate time periods in the list of site parameters. The staff noted that the applicant included accident release χ/Q values at the MCR/TSC door and HVAC intake as site parameters in DCA PART 2 Tier 1, Table 5.0-1, and in DCA PART 2 Tier 2, Table 2.0-1. DCA PART 2 Tier 2, Figures 2.3-2 and 2.3-3, show the assumed source and receptor relationships for releases to the MCR/TSC door and HVAC Intake, respectively.

The staff issued RAI No. 9185, Question 02.03.04-1 (ADAMS Accession No. ML17296A142), asking the applicant to provide a basis to support the applicant's position that the two source locations shown in DCA PART 2 Tier 2, Figures 2.3-2 and 2.3-3 (i.e., the reactor building SE and NE single personnel doors) are the limiting source locations for all radiological accidents evaluated in the DCA PART 2. The applicant responded in a letter dated December 11, 2017 (ADAMS Accession No. ML17345A957), stating that the two source locations shown in Figure 2.3-2 and Figure 2.3-3 are the limiting source locations because they are the closest source locations to the MCR personnel doors and MCR HVAC intake. The staff finds that the applicant provided the requested information and therefore concludes that Question 02.03.04-1 is resolved.

The applicant generated MCR χ/Q site parameter values using ARCON96 with meteorological data from the same 80th–90th percentile site discussed above.

To confirm that the MCR/TSC door and HVAC intake χ/Q site parameters are representative of a reasonable number of sites that have been or may be considered within a COL application, the staff generated a set of site-specific χ/Q values for six nuclear power plant sites using (1) the ARCON96 computer code with the source and receptor information presented in the DCA PART 2 (assuming the NuScale plant north was aligned to true north at each site), and (2) the site-specific hourly nuclear power plant meteorology data sets. The staff found that the applicant's χ/Q values were bounding for five of the six sites. Consequently, the staff finds that the applicant has provided MCR and TSC doors and HVAC intake χ/Q site parameter values that bound a reasonable number of sites that may be considered for a COL application. Therefore, these values are acceptable.

2.3.4.5 Combined License Information Items

Table 2.3.4-1 lists COL information items related to DCA PART 2 Tier 2, Section 2.3.4, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.3.4-1 NuScale COL Information Items for Section 2.3.4

Item No.	Description	DCA PART 2 Tier 2 Section
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 2.3-1	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

SER Section 2.3.1 explains that the applicant has indicated that the NuScale SMR Power Plant design could be deployed in the continental United States (including the contiguous lower 48 States and the State of Alaska), as well as the State of Hawaii. The staff also notes that the DCA is silent with respect to the potential of this design being deployed in U.S. Territories and recognizes that this design might be able to be sited in other-than typical large-scale nuclear plant site locations. COL and ESP applicants should take this into consideration in evaluating the general language of COL Item 2.3-1 with respect to potential issues related to Section 2.3.4 of a COL FSAR.

2.3.4.6 Conclusion

Subject to resolution of Open Item 02.03.04-1, the staff concludes that the applicant has appropriately provided the short-term (accident release) χ/Q site parameters referenced above for plant design inputs. The short-term atmospheric dispersion characteristics for accidental release are site specific and will be addressed by the COL applicant. The COL applicant should include information sufficient to demonstrate that the actual site characteristics fall within the values of the site parameters in the NuScale SMR Power Plant DCA PART 2.

2.3.5 Long-Term Atmospheric Dispersion Estimates for Routine Releases

2.3.5.1 Introduction

Long-term atmospheric dispersion and deposition factors are a direct input to the calculation of long-term (annual) radiological doses from routine releases to individual members of the public at offsite locations and, in some cases, to members of the public located at the plant site (e.g., during construction of additional units at, or adjacent to, an operating facility).

2.3.5.2 Summary of Application

DCA PART 2 Tier 1: There is no information for this area of review.

DCA PART 2 Tier 2: The applicant listed, as site parameters in DCA PART 2 Tier 2, Table 2.0-1, routine release atmospheric dispersion factors (χ/Q values) at the restricted area boundary that (1) reflect neither radioactive decay nor depletion by deposition effects (undepleted or no decay χ/Q values), (2) include a decay half-life of 2.26 days without depletion (undepleted or 2.26-day decay χ/Q values), and (3) account for a decay half-life of 8 days with depletion effects (depleted or 8.00-day decay χ/Q values). DCA PART 2 Tier 2, Table 2.0-1, also includes a routine release atmospheric deposition factor (D/Q value).

In DCA PART 2 Tier 2, Section 2.3.5, "Long-Term Atmospheric Dispersion Estimates for Routine Releases," the applicant stated that the routine release χ/Q and D/Q values at the restricted area boundary provided in Table 2.0-1 are conservatively estimated and used to calculate release concentrations for comparison to the activity release limits in 10 CFR Part 20, as discussed in DCA PART 2 Tier 2, Section 11.3, "Gaseous Waste Management System." In Section 2.3.5, the applicant also stated that the routine release χ/Q and D/Q values in unrestricted areas and at locations of interest are site specific and are developed by the COL applicant as part of the response to COL Item 2.3-1.

ITAAC: There are no ITAAC for this area of review.

Technical Specifications: There are no TS for this area of review.

Technical Reports: There are no technical reports associated with this area of review.

2.3.5.3 Regulatory Basis

The acceptance criteria for evaluating the analysis of long-term atmospheric dispersion and deposition conditions for routine releases of radiological effluents to the atmosphere during normal plant operation are based on meeting the relevant requirements in 10 CFR Part 20 and 10 CFR Part 50. The staff considered the following regulatory requirements in its review of the applicant's postulated site parameter values for atmospheric dispersion and deposition:

- Subpart D "Radiation Dose Limits for Individual Members of the Public," to 10 CFR Part 20, with respect to establishing atmospheric dispersion-related site parameters for demonstrating compliance with dose limits for individual members of the public.

- 10 CFR 50.34a, "Design Objectives for Equipment to Control Releases of Radioactive Material in Effluents—Nuclear Power Reactors," and Sections II.B, II.C, and II.D to Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation To Meet the Criterion, 'as Low as Is Reasonably Achievable,' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents," to 10 CFR Part 50, with respect radioactive material in effluents released to unrestricted areas.

A DCA does not contain general descriptions of site characteristics because this information is site specific and will be addressed by a COL applicant. However, under 10 CFR 52.47(a)(1), a DC applicant must provide site parameters postulated for the design.

SRP Section 2.3.5, "Long-Term Atmospheric Dispersion Estimates for Routine Releases," which states the staff's review of a standard DCA under 10 CFR Part 52, includes the following aspects:

- The postulated site parameters are representative of a reasonable number of sites that have been or may be considered for a COL application.

- The applicant has provided a basis for each of the site parameters.

The staff's review of DCA PART 2 Tier 2, Section 2.3.5, also considered the following RGs and other related guidance documents (as applicable):

- Revision 1 to RG 1.23 includes guidance on the measurement and processing of onsite meteorological data for use as input to atmospheric dispersion models in support of plant licensing and operation.

- RG 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, issued October 1977, includes guidance on identifying the location of potential receptors of interest.

- Revision 1 to RG 1.111 discusses different types of atmospheric transport and diffusion models and criteria for characterizing long-term (annual) average atmospheric dispersion and deposition conditions.

- RG 1.112, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Power Reactors," Revision 1, issued March 2007, includes guidance on identifying release point characteristics.

- NUREG/CR-2919, "XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations," issued September 1982 (prepared by Pacific Northwest Laboratory (PNL-4380)), is the user's manual for the NRC-sponsored XOQDOQ dispersion model, which is intended to implement portions of RG 1.111.

2.3.5.4 Technical Evaluation

The staff reviewed DCA PART 2 Tier 2, Section 2.3.5, in accordance with Revision 3 to SRP Section 2.3.5.

DCA PART 2 Tier 2, Table 2.0-1, lists the routine release atmospheric dispersion factors (χ/Q values) and atmospheric deposition factors (D/Q values) associated with the restricted area boundary. DCA PART 2 Tier 2, Section 2.3.5, states that these χ/Q and D/Q values at the restricted area boundary provided in Table 2.0-1 are conservatively estimated and are used to calculate release concentrations for comparison to the activity release limits in 10 CFR Part 20, as discussed in DCA PART 2 Tier 2, Section 11.3. These are the same χ/Q and D/Q values listed in DCA PART 2 Tier 2, Table 11.3-6, "GASPAR Code Input Parameter Values."

The staff issued RAI 9182, Question 02.03.05-1 (ADAMS Accession No. ML17307A376) asking the applicant to describe the assumptions used to derive the routine release χ/Q and D/Q values presented as site parameters in DCA PART 2 Tier 2, Table 2.0-1.

In its response (ADAMS Accession No. ML18257A297), the applicant stated that there are three normal gaseous effluent release points for the NuScale SMR Power Plant: the NuScale plant exhaust stack, which is 128 m (420 ft) from the site boundary, and the two turbine generator

buildings, which are each 122 m (400 ft) from the site boundary. Approximately 99 percent of the contribution to gaseous offsite concentrations from normal radioactive effluent discharges from the NuScale SMR Power Plant are from releases from the plant exhaust stack.

The applicant stated that it selected conservative χ/Q and D/Q values for use in this NuScale DCA, which were revised by the applicant from 5.43 x 10^{-5} seconds per cubic meter (s/m^3) and 5.43 x 10^{-7} per square meter ($1/m^2$) to 1.44 x 10^{-5} s/m^3 and 1.44 x 10^{-7} $1/m^2$, respectively, in the September 14, 2018, RAI response. The staff will confirm the changes to these values in DCA PART 2 Tier 2, Table 2.0-1 in a future revision to the DCA. This is **Confirmatory Item 02.03.05-1**. The applicant also stated that it used the XOQDOQ computer code to confirm the conservatism of the χ/Q and D/Q values by running the XOQDOQ with an example meteorological data set and comparing the output with the selected values.

The applicant states that the calculated offsite gaseous effluent doses from a NuScale plant are highly site specific due to distinct site features such as terrain, meteorology, and site receptors having an effect on results. These calculations must be performed by the COL applicant per COL Item 11.3-2. The gaseous effluent dose results shown in DCA PART 2 Tier 2, Table 11.3-8, "Gaseous Effluent Dose Results for 10 CFR 50 Appendix I," are example calculations using assumed inputs (such as the routine release χ/Q and D/Q site parameter values presented in DCA PART 2 Tier 2, Table 11.3-6) to show reasonable assurance that a COL applicant will be able to meet the design objectives of 10 CFR Part 50, Appendix I. The applicant notes that it would be acceptable for a COL applicant to use RG 1.111 and the XOQDOQ computer code to perform these calculations.

The staff independently evaluated the applicant's χ/Q and D/Q site parameter values with the XOQDOQ code using meteorological data from a number of nuclear power plant sites, assuming two release points (ground-level turbine generator building release and a 37-meter (m) (121-ft) elevated plant stack release). The staff developed composite χ/Q and D/Q values by multiplying the ground-level turbine generator building release χ/Q and D/Q values by 0.01 and the elevated plant stack release χ/Q and D/Q values by 0.99 and summing the two values, respectively. The staff found the applicant's 1.44 x 10^{-5} s/m^3 χ/Q and 1.44 x 10^{-7} $1/m^2$ D/Q site parameter values bounding.

Because the applicant provided the requested information for normal gaseous effluent release points and the staff used the XOQDOQ computer code to verify the conservatism of the χ/Q and D/Q values chosen by the applicant as site parameters, the staff finds the response acceptable.

The staff also asked the applicant, in RAI No. 9182, to explain an apparent discrepancy in distances for the routine release χ/Q and D/Q site parameter values: DCA PART 2 Tier 2, Table 11.3-6, showed the bounding χ/Q and D/Q distance as 820 m (2625 ft) whereas Revision 0 of DCA PART 2 Tier 2, Table 2.0-1, listed the same χ/Q and D/Q values occurring at the bounding offsite dose location distance of 122 m (400 ft).

The applicant responded by proposing to eliminate the references to the χ/Q and D/Q distances described in DCA PART 2 Tier 2, Table 11.3-6. Also, in the May 25, 2018, letter, the applicant proposed to revise DCA PART 2 Tier 2, Table 2.0-1, to state that the routine release χ/Q and D/Q values are "at restricted area boundary" rather than "associated with the bounding offsite dose location." The staff will confirm these changes to DCA PART 2 Tier 2, Table 2.0-1, and Table 11.3-6, in a future revision to the DCA. This is **Confirmatory Item 02.03.05-2**.

Because the applicant resolved the discrepancies in distances for the routine release χ/Q and D/Q site parameter values, the staff finds the response acceptable.

Additionally, the staff asked the applicant to explain some of the routine airborne effluent release point characteristics provided in Revision 0 to DCA PART 2 Tier 2, Table 2.0-1, and to revise the DCA PART 2 to identify the release point characteristics for all release points for use by COL applicants in developing their own site-specific routine release χ/Q and D/Q site characteristic values.

The applicant responded that the release point characteristics listed in Revision 0 to DCA PART 2 Tier 2, Table 2.0-1, are not site parameters and, therefore, moved them from DCA PART 2 Tier 2, Table 2.0-1, to DCA PART 2 Tier 2, Table 15.0-20 in Revision 1 to the DCA PART 2. The applicant also explained that releases from the RXB and the turbine generator building should be assumed to occur from the closet part of each building to the dose location at ground level with a minimum building cross-sectional area. The applicant also stated that the plant exhaust stack is not a part of the NuScale standard design and proposed adding the plant exhaust stack to DCA PART 2 Tier 2, Table 1.8-1, "Summary of NuScale Certified Design Interfaces with Remainder of Plant," as a design interface for the NuScale certified design. The staff will confirm this last change in a future revision to the DCA. This is **Confirmatory Item 02.03.05-3.**

Because the applicant has moved the release point characteristics from DCA PART 2 Tier 2, Table 2.0-1, to DCA PART 2 Tier 2, Table 15.0-20; provided conservative release assumptions for RXB and the turbine generator building; and explained that the COL applicant is to provide the plant exhaust stack design information, the staff finds the response acceptable.

The staff also asked the applicant to explain how it used the same set of routine release χ/Q and D/Q values listed in DCA PART 2 Tier 2, Table 2.0-1, to model the normal gaseous effluent releases from both the plant exhaust stack and the condenser air removal system (turbine generator building) release pathways listed in DCA PART 2 Tier 2, Table 11.3-5, "Gaseous Estimated Discharge for Normal Effluents," given the difference in release characteristics for these two pathways.

The applicant responded that, as discussed previously in the response to RAI No. 9182, the χ/Q and D/Q values listed in DCA PART 2 Tier 2, Table 2.0-1, are weighted averaged values of ground-level turbine generator building releases and plant exhaust stack elevated releases.

Because the applicant provided the requested information about how it could use the same set of χ/Q and D/Q values to model routine releases from both the turbine generator building and plant exhaust stack, the staff finds the response acceptable.

The staff finds the applicant's response to RAI No. 9182, Question 02.03.05-1, to be acceptable, and therefore, considers this question to be resolved and closed. However, the staff will confirm the applicant's DCA PART 2 markups in a future revision of the DCA.

2.3.5.5 Combined License Information Items

Table 2.3.5-1 lists COL information items related to DCA PART 2 Tier 2, Section 2.3.5, from DCA PART 2 Tier 2, Table 1.8-2.

Table Table 2.3.5-1 NuScale COL Information Items for Section 2.3.5

Item No.	Description	DCA PART 2 Tier 2 Section
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 2.3-1	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 11.3-2	A COL applicant that references the NuScale Power Plant design certification will calculate doses to members of the public using the site-specific parameters, compare those gaseous effluent doses to the numerical design objectives of 10 CFR 50, Appendix I, and comply with the requirements of 10 CFR 20.1302 and 40 CFR 190.	11.3

SER Section 2.3.1 explains that the applicant has indicated that the NuScale SMR Power Plant design could be deployed in the continental United States (including the contiguous lower 48 States and the State of Alaska), as well as the State of Hawaii. The staff also notes that the DCA is silent with respect to the potential of this design being deployed in U.S. Territories and recognizes that this design might be able to be sited in other-than typical large-scale nuclear plant site locations. COL applicants should take this into consideration in evaluating the general language of COL Item 2.3-1, with respect to potential issues related to Section 2.3.5 of a COL FSAR..

2.3.5.6 Conclusion

Based on the above information, the staff finds that the long-term (routine release) site parameter values selected by the applicant are representative of a reasonable number of sites that have been or may be considered for a COL application. Long-term atmospheric dispersion and deposition characteristics are site specific and will be addressed by the COL applicant. The COL applicant should include information sufficient to demonstrate that the design of the plant can accommodate the values of the actual site characteristics specified in the application.

2.4 Hydrologic Engineering

In DCA PART 2 Tier 2, Section 2.4, “Hydrologic Engineering,” the applicant provided information associated with all hydrologically related design-basis performance requirements and the basis for the operation of safety-related SSCs that are important to safety. The applicant stated that the NuScale SMR Power Plant design does not rely upon an external water supply for its UHS

or safety-related makeup water. DCA PART 2 Tier 1, Table 5.0-1, and DCA PART 2 Tier 2, Table 2.0-1, contain the site parameters selected to represent site conditions.

The staff conducted its review of Revision 1 of DCA PART 2 Tier 2, Section 2.4, consistent with guidance in the SRP. Specifically, the staff reviewed DCA PART 2 Tier 1, Table 5.0-1; DCA PART 2 Tier 2, Table 2.0-1; and DCA PART 2 Tier 2, Section 2.4, to determine the adequacy of the information submitted. In addition, the staff reviewed the supplement to the DCA PART 2, which the applicant included in its letter dated May 25, 2018 (ADAMS Accession No. ML18149A404), for proposed changes in COL Item 2.4-1, as well as changes in Sections 2.4.2, "Floods"; 2.4.7, "Ice Effects"; and 2.4.9, "Channel Diversions." The review areas included the hydrological description that addresses flooding issues, including the Probable Maximum Flood (PMF) on streams and rivers, the potential for dam failures, the probable maximum storm surge (PMSS) and seiche flooding, the probable maximum tsunami (PMT), ice effects, cooling water canals and reservoirs, channel diversions, flood protection requirements, low water considerations, potential ground water concerns, accidental releases of radioactive liquid effluents in ground and surface waters, and TS and emergency operation requirements.

Within the scope of a DCA, site-specific hydrologic issues are deferred to the COL applicant. This section of the DCA PART 2 is intended to address the hydrological site parameters that constitute the NuScale standard power plant design basis for siting suitability presented by a COL applicant under 10 CFR Part 52 or included in an application under 10 CFR Part 50.

2.4.1 Hydrologic Description

2.4.1.1 Introduction

This section describes the local and regional hydrologic conditions associated with a proposed power plant site.

The site specific hydrologic conditions will be addressed by the COL applicant.

2.4.1.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.1, "Hydrologic Description," states that "[t]he local hydrology is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1." The COL applicant is to provide the interface of the plant with the hydrosphere, hydrological causal mechanisms, surface and ground water uses, spatial and temporal data relevant for the site review, alternate conceptual models of the hydrology of the site, and other site-related floods that include the seismic- and nonseismic-induced floods. Because the standard power plant design basis is intended to be suitable for a variety of sites and conditions, the DC applicant defers to the COL applicant the presentation of the required site-specific information on the hydrologic description.

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, contains relevant site parameter information on the maximum flood elevation (probable maximum flood and coincident wind wave and other effects on maximum flood level— 0.3 m (1 ft) below the baseline plant elevation), maximum elevation of ground water (2 ft below the baseline plant elevation), and maximum precipitation rate (49.3 cm/hr (19.4 in/hr) and 16.0 cm (6.3 in.) for a 5-minute period).

DCA PART 2 Tier 2: The hydrologic description is site specific as indicated in DCA PART 2 Tier 2, Section 2.4.1. DCA PART 2 Tier 2, Table 2.0-1, contains relevant site parameter information on the maximum flood elevation, maximum elevation of ground water, and maximum precipitation rate.

ITAAC: ITAAC are not applicable for this section and are not provided.

Technical Specifications: TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.1.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 100.20(c)(3), as it relates to the PMF.
- 10 CFR 52.47(a)(1), as it relates to the site parameters postulated for the design.
- 10 CFR 52.79(a)(1)(iii), as it relates to the hydrologic characteristics of the proposed site with appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area and with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated.
- 10 CFR 100.23(d)(3), as it relates to establishing the design-basis flood, seismically induced floods, and water waves that could adversely affect a site from either locally or distantly generated seismic activity.
- GDC 2 states that SSCs important to safety must be designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches, without loss of capability to perform their intended safety functions**.**
- GDC 44 states that a system must be provided to transfer heat from SSCs important to safety to a UHS. The system's safety function must be to transfer the combined heat load of these SSCs under normal operating and accident conditions.
- GDC 60, "Control of Releases of Radioactive Material to the Environment," states that the nuclear power unit design must include a means to control suitably the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation, including anticipated operational occurrences. Sufficient holdup capacity must be provided for the retention of gaseous and liquid effluents containing radioactive materials, particularly where unfavorable site environmental conditions can be expected to impose unusual operational limitations upon the release of such effluents to the environment.
- According to 10 CFR 52.79(a)(1)(iii) and 10 CFR 100.20(c), consideration of the acceptability of a site will include such physical characteristics of the site as seismology, meteorology, geology, and hydrology.

The guidance in SRP Section 2.4.1, “Hydrologic Description,” lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff also used the following guidance documents in conducting its review:

- RG 1.27, as it relates to UHS capabilities.
- RG 1.29, as it relates to seismic design bases for safety-related SSCs.
- RG 1.59, as it relates to hydrometeorological design bases.
- RG 1.102, as it describes acceptable flood protection measures intended to prevent SSCs from being adversely affected.

2.4.1.4 Technical Evaluation

The COL Item 2.0-1 in DCA PART 2 Tier 2, Table 1.8-2, states that a COL applicant referencing the NuScale DC will demonstrate that site-specific characteristics are bounded by the site parameters. As shown in Table 5.0-1 of DCA PART 2 Tier 1, and Table 2.0-1 of DCA PART 2 Tier 2, the NuScale design assumes site parameters that (1) the maximum flood elevation is 0.3 m (1 ft) below the baseline plant elevation, (2) the maximum elevation of ground water is 2 ft below the baseline plant elevation, and (3) the maximum precipitation rate is 49.3 cm/hr (19.4 in/hr) and 16.0 cm (6.3 in.) for a 5-minute period. The NuScale DCA does not contain site-specific information because the COL will be site specific. The specific site is acceptable if the site characteristics are within the NuScale SMR Power Plant site parameters described in DCA PART 2 Tier 1, Table 5.0-1, and Tier 2, Table 2.0-1. DCA PART 2 Tier 2, Chapter 2, provides additional information on the site parameters in COL Item 2.0-1.

The COL applicant referencing the NuScale certified design will provide the site-specific information on the hydrologic description to satisfy the requirements in 10 CFR Part 52 and 10 CFR Part 100 and form the basis for the hydrologic evaluation. The need for this site-specific information is addressed as part of the response to COL Item 2.4-1, which notes that the COL applicant will investigate and describe the site-specific hydrologic characteristics for the reactor site and vicinity. The COL applicant referencing the NuScale DC should provide information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values. Both COL Items 3.4-1 and 3.4-4 associated with DCA PART 2 Section 3.4 addressrelevant information on flood protection of equipment.

2.4.1.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.1-1 lists COL information items related to a hydrologic description, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.1-1 NuScale COL Information Items for Section 2.4.1

Item No.	Description	DCA PART 2 Tier 2 Section
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 2.4-1	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, except Section 2.4.8 and Section 2.4.10.	2.4

2.4.1.6 Conclusion

The NuScale DCA has three site parameters related to the hydrologic description: maximum flood elevation, maximum elevation of ground water, and maximum rate of precipitation. COL Items 2.0-1 and 2.4-1 specify that a COL applicant that references the NuScale DC will demonstrate site-specific characteristics and provide the hydrologic description for Section 2.4.1. The staff acknowledges that the hydrologic description is site specific and will be addressed for the selected reactor site and vicinity by a COL applicant referencing the NuScale power plant DC. Based on the above information, the staff finds the applicant's discussions in Section 2.4.1 of the DCA acceptable.

If the actual site characteristics do not fall within the site parameters postulated in the DC, the COL applicant must provide sufficient justification (e.g., by requesting an exemption from or amendment to the DC) that the proposed facility is acceptable at the proposed site.

2.4.2 Floods

2.4.2.1 Introduction

This section describes historical flood events and their relevant hydraulic and hydrologic data, including reported flood elevations and peak flow rates at the site and region. It also summarizes and identifies the individual types of flood-causing phenomena for flood design considerations, such as those described in SER Sections 2.4.3 through 2.4.7. Furthermore, these flood considerations cover the LIP that is used for onsite local flooding analyses related to site-grading design.

Historical flooding is site specific and will be addressed by the COL applicant.

2.4.2.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.2, "Floods," states that "[t]he design assumes that the maximum flood elevation (including wind-induced wave runup) is one foot below baseline plant elevation. The baseline plant elevation corresponds to the top of the finished concrete on the ground floor of the Reactor Building." Both DCA PART 2 Tier 1, Table 5.0-1, and DCA PART 2 Tier 2, Table 2.0-1, also indicate that the maximum flood elevation (including wind-wave and runup effects) considered in the standard power plant design is 0.3 m (1 ft) below the baseline plant elevation for the finished power plant grade.

DCA PART 2 Tier 1, Table 5.0-1, and DCA PART 2 Tier 2, Table 2.0-1, also indicate that a maximum precipitation rate of 49.3 cm/hr (19.4 in/hr) and 16.0 cm (6.3 in.) in a 5-minute period are both considered in the power plant design. DCA PART 2 Tier 2, Section 2.4.2, also states that "[t]he potential for flooding is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1." The COL applicant is to provide descriptions, including local flooding on the site and drainage design, stream flooding, storm surges, seiches, tsunami, seismically induced dam failures (or breaches), flooding caused by landslides, effects of ice formation in water bodies, and combined events of individual flooding mechanisms. The applicant defers to the COL applicant the presentation of the required site-specific information on this hydrologic design topic.

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, contains relevant site parameter information on the maximum flood elevation and maximum precipitation rates.

DCA PART 2 Tier 2: The flood hazards and other related hydrodynamic phenomena are site specific as indicated in DCA PART 2 Tier 2, Section 2.4.2. DCA PART 2 Tier 2, Table 2.0-1, contains relevant site parameter information on the maximum flood elevation and maximum precipitation rates.

ITAAC: The ITAAC are not applicable for this section and are not provided.

Technical Specifications: The TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.2.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.79(a) and 10 CFR 100.20(c), which state that consideration of the acceptability of a site will include such physical characteristics of the site as seismology, meteorology, geology, and hydrology.

- 10 CFR 100.20(c)(3), which states that factors important to hydrological radionuclide transport that may affect the consequences of an escape of radioactive material from a power plant will be obtained from onsite measurements.

- 10 CFR 100.23(d)(3), which states that, in establishing the design-basis flood, seismically induced floods and water waves that could adversely affect a site from either locally or distantly generated seismic activity must be determined.

- GDC 2 states that SSCs important to safety must be designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches, without loss of capability to perform their intended safety functions.

The guidance in SRP Section 2.4.2, "Floods," lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff also used the following guidance documents in conducting its review:

- RG 1.27, as it relates to UHS capabilities.
- RG 1.29, as it relates to seismic design bases for safety-related SSCs.
- RG 1.59, as it relates to hydrometeorological design bases.
- RG 1.102, as it describes acceptable flood protection measures intended to prevent the SSCs from being adversely affected.

2.4.2.4 Technical Evaluation

The NuScale DCA does not contain historical flooding information because such information is site specific. As shown in Table 5.0-1 of DCA PART 2 Tier 1, and Table 2.0-1 of DCA PART 2 Tier 2, the NuScale design assumes site parameters associated with the design basis flood that include (1) the maximum flood elevation (including wind-induced wave runup) is 0.3 m (1 ft) below baseline plant elevation, and (2) the maximum precipitation rate is 49.3 cm/hr (19.4 in/hr) and 16.0 cm (6.3 in.) for a 5-minute period. The COL applicant should provide information sufficient to demonstrate that the actual flooding site characteristics described in any COL application fall within the range of site parameter values. This information is used to satisfy the requirements in 10 CFR Part 52 and 10 CFR Part 100.

The staff notes that the baseline plant elevation is 0.3 m (1 ft) above the maximum flood elevation. Therefore, the maximum flood elevation does not affect the NuScale Power plant design. Also the maximum flood elevation does not have impacts on a safety-related intake structure and water supply since the design does not rely upon a safety-related intake structure or an external water supply as a makeup source for the reactor pool, which would act as the UHS.

Accordingly, the COL applicant will provide the site-specific flooding information used to describe the site-specific hydrogeological parameters and hydraulic properties. The need for this site-specific information is addressed as part of the response to COL Item 2.4-1 in DCA PART 2 Tier 2 and in Table 1.8-2, which notes that the COL applicant needs to describe the hydrologic characteristics of the reactor site and vicinity.

Lastly, both COL Items 3.4-1 and 3.4-4, associated with DCA PART 2 Section 3.4, address relevant information on flood protection of equipment. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values.

2.4.2.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.2-1 lists COL information items related to this section on floods, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.2-1 NuScale COL Information Items for Section 2.4.2

Item No.	Description	DCA PART 2 Tier 2 Section
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 2.4-1	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, except Section 2.4.8 and Section 2.4.10.	2.4

2.4.2.6 Conclusion

In DCA PART 2 Tier 1, Table 5.0-1, and DCA PART 2 Tier 2, Table 2.0-1, the applicant provided the following site parameters related to Section 2.4.2: (1) the maximum flood elevation (including wind-induced wave runup) is 0.3 m (1 ft) below baseline plant elevation, and (2) maximum precipitation rates are 49.3 cm/hr (19.4 in/hr) and 16.0 cm (6.3 in.) in a 5-minute period. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics described in its application falls within the range of site parameter values consistent with COL Item 2.0-1. Furthermore, as part of the response to COL Item 2.4-1, a COL applicant that references the NuScale DC will provide a detailed description of its maximum flood elevation for those flood-causing mechanisms in Section 2.4.2.

The staff concludes that the NuScale DCA provides an appropriate site parameter that the maximum flood elevation, including wind-wave runup, is 0.3 m (1 ft) below the baseline plant elevation for the plant design. Both the baseline plant elevation and the maximum flood elevation are site specific and will be addressed by the COL applicant. The COL applicant should include information sufficient to demonstrate that the actual site characteristics fall within the values of the site parameters in the NuScale certified design. The staff finds this acceptable.

If the actual site characteristics do not fall within the site parameters postulated in the DC, the COL applicant must provide sufficient justification (e.g., by requesting an exemption from, or amendment to, the DC) that the proposed facility is acceptable at the proposed site.

2.4.3 Probable Maximum Flood on Streams and Rivers

2.4.3.1 Introduction

The PMF is the probable flood resulting from the most severe combination of critical meteorological and hydrologic conditions that could reasonably occur within a particular drainage area. A critical meteorological condition can generate an extreme precipitation event referred to as Probable Maximum Precipitation (PMP), which is one of the key parameters used to determine the PMF. The PMP is the greatest depth (amount) of precipitation, for a given storm duration, that is theoretically possible for a particular area and geographic location. PMP values are typically calculated through the procedures described in the NWS HMRs.

The PMF on streams and rivers is site specific and will be addressed by the COL applicant.

2.4.3.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.3, "Probable Maximum Flood (PMF) on Streams and Rivers," states that "[t]he probable maximum flood (PMF) is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1." The COL applicant is to describe design bases for flooding in streams and rivers, design bases for site drainage, and seismic and non-seismic effects on the postulated design bases related to floods in streams and rivers.

DCA PART 2 Tier 1, Table 5.0-1, and DCA PART 2 Tier 2, Table 2.0-1, list the maximum flood elevation of 0.3 m (1 ft) below the baseline power plant elevation near safety related SSCs as a site design parameter. Table 2.0-1 also specifies maximum rainfall rates of 49.3 cm/hr (19.4 in./hr) for one-hour duration and 16.0 cm (6.3 in.) for 5-minute duration as site design parameters. The applicant defers to the COL applicant the presentation of the required site-specific information on the PMF and PMP.

DCA PART 2 Tier 2, Section 2.4, states that the influences of local hydrologic conditions on a NuScale power plant site are reduced because the design of an SSC in the power plant does not rely on the external water supply, such as streams or rivers, as an UHS.

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, contains relevant site parameter information on the maximum flood elevation and maximum precipitation rates.

DCA PART 2 Tier 2: DCA PART 2 Tier 2, Section 2.4.3, "Probable Maximum Flood (PMF) on Streams and Rivers," indicates that the PMF on streams and rivers is site specific. DCA PART 2 Tier 2, Table 2.0-1, contains relevant site parameter information on maximum flood elevation and maximum precipitation rates.

ITAAC: The ITAAC are not applicable for this section and are not provided.

Technical Specifications: The TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.3.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.17(a) and 10 CFR 100.20(c), which state that the consideration of the acceptability of a site will include such physical characteristics of the site as seismology, meteorology, geology, and hydrology.

- 10 CFR 100.23(d)(3), which states that, in establishing the design-basis flood, seismically induced floods and water waves that could adversely affect a site from either locally or distantly generated seismic activity must be determined.

- GDC 2 states that SSCs important to safety must be designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches, without loss of capability to perform their intended safety functions.

The guidance in SRP Section 2.4.3, "Probable Maximum Flood (PMF) on Streams and Rivers," lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff also used the following guidance documents in conducting its review:

- RG 1.27, as it relates to UHS capabilities.

- RG 1.29, as it relates to seismic design bases for safety-related SSCs.

- RG 1.59, as it relates to hydrometeorological design bases.

- RG 1.102, as it describes acceptable flood protection to prevent the SSCs from being adversely affected.

2.4.3.4 Technical Evaluation

The NuScale DCA does not contain PMF information because such information is site specific. However, the DCA provides site parameters, as shown in Table 5.0-1 of DCA PART 2 Tier 1 and Table 2.0-1 of DCA PART 2 Tier 2, related to the maximum flood elevation and maximum precipitation rate. The PMF elevation is site specific and will be incorporated with COL Items 2.0-1 and 2.4-1. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values. This information is used to satisfy the requirements in 10 CFR Part 52 and 10 CFR Part 100.

Accordingly, the COL applicant will provide the site-specific PMF information used to describe the site-specific hydrogeological parameters and hydraulic properties. The need for this site-specific information is addressed as part of the response to COL Information Item 2.4-1 in DCA PART 2 Tier 2 and in Table 1.8-2, which notes that the COL applicant needs to describe the hydrologic characteristics of the reactor site and vicinity.

Lastly, both COL Items 3.4-1 and 3.4-4, associated with DCA PART 2 Section 3.4, address the need for relevant information on flood protection of equipment. The COL applicant should

provide information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values.

2.4.3.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.3-1 lists COL information items related to this section on PMF of streams and rivers, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.3-1 NuScale COL Information Items for Section 2.4.3

Item No.	Description	DCA PART 2 Tier 2 Section
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 2.4-1	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, except Section 2.4.8 and Section 2.4.10.	2.4

2.4.3.6 Conclusion

In DCA PART 2 Tier 1, Table 5.0-1 and DCA PART 2 Tier 2, Table 2.0-1, the applicant provided the following site parameters related to Section 2.4.3: (1) that the maximum flood elevation (including wind-induced wave runup) is 0.3 m (1 ft) below the baseline plant elevation, and (2) maximum precipitation rates are 49.3 cm/hr (19.4 in./hr) and 16.0 cm (6.3 in.) in a 5-minute period. The staff concludes that the NuScale DCA provides appropriate site parameters related to the maximum flood elevation and maximum precipitation rates. As part of the response to COL Item 2.4-1, a COL applicant that references the NuScale DC will provide a description of its PMF for streams and rivers in Section 2.4.3.

The baseline plant elevation, the maximum flood elevation, and the maximum precipitation rates are site specific and will be addressed by the COL applicant. The COL applicant should include information sufficient to demonstrate that the actual site characteristics fall within the values of the site parameters in the NuScale DCA PART 2. The staff finds this acceptable.

If the actual site characteristics do not fall within the site parameters postulated in the DC, the COL applicant must provide sufficient justification (e.g., by requesting an exemption from, or an amendment to, the DC) that the proposed facility is acceptable at the proposed site.

2.4.4 Potential Dam Failures

2.4.4.1 Introduction

This section describes the potential failures of onsite, upstream, and downstream water control structures or impoundments such as dams that could potentially exceed the baseline power plant elevation near safety-related SSCs. It also examines the hydrological design basis that is developed to compensate for any potential hazard from dam failures faced by the safety-related facilities.

The potential hazards caused by failures of dams, water control, or water storage structures are site specific and will be addressed by the COL applicant.

2.4.4.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.4, "Potential Dam Failures," states that "[t]he presence of dams is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1." The COL applicant is to describe flood waves from severe breaching of an upstream dam, domino-type or cascading dam failures, dynamic effects on structures, loss of water supply from the failure of a downstream dam, effects of sediment deposition and erosion, and failure of onsite water control or storage structures, as well as seismic and nonseismic effects on the postulated design bases related to dam failures.

The NuScale design assumes a site parameter that the maximum flood elevation (including wind-induced wave runup) is 0.3 m (1 ft) below baseline plant elevation, as shown in Table 5.0-1 of DCA PART 2 Tier 1, and Table 2.0-1 of DCA PART 2 Tier 2. Because the standard power plant design basis is intended to be suitable for a variety of sites and conditions for flooding from potential failures of dams, water control, or water storage structures, the applicant defers to the COL applicant the presentation of the required site-specific information on this hydrologic design topic concerning potential failures.

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, contains relevant site parameter information on the maximum flood elevation.

DCA PART 2 Tier 2: The potential for failures of dams, water control, or water storage structures are site specific, as indicated in DCA PART 2 Tier 2, Section 2.4.4. DCA PART 2 Tier 2, Table 2.0-1, provides relevant site parameter information about maximum flood elevation.

ITAAC: The ITAAC are not applicable for this section and are not provided.

Technical Specifications: The TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.4.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.17(a) and 10 CFR 100.20(c), which state that consideration of the acceptability of a site will include such physical characteristics of the site as seismology, meteorology, geology, and hydrology.

- 10 CFR 100.20(c)(3), which states that factors important to hydrological radionuclide transport that may affect the consequences of an escape of radioactive material from a power plant will be obtained from onsite measurements.

- 10 CFR 100.23(d)(3), which states that, in establishing the design-basis flood, seismically induced floods and water waves that could adversely affect a site from either locally or distantly generated seismic activity must be determined.

- GDC 2 states that SSCs important to safety must be designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches, without loss of capability to perform their intended safety functions.

- GDC 44 states that a system must be provided to transfer heat from SSCs important to safety to a UHS. The system's safety function must be to transfer the combined heat load of these SSCs under normal operating and accident conditions.

The guidance in SRP Section 2.4.4, "Potential Dam Failures," lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff also used the following guidance documents in conducting its review:

- RG 1.27, as it relates to UHS capabilities.

- RG 1.29, as it relates to seismic design bases for safety-related SSCs.

- RG 1.59, as it relates to hydrometeorological design bases.

- RG 1.102, as it describes acceptable flood protection to prevent the SSCs from being adversely affected.

2.4.4.4 Technical Evaluation

The NuScale DCA does not contain potential information on the failure of dams, water control, or water storage structures because such information is site specific. However, the DCA provides a site parameter as shown in Table 5.0-1 of DCA PART 2 Tier 1 and Table 2.0-1 of DCA PART 2 Tier 2, related to maximum flood elevation. The flood elevation resulting from failures of dams, water control, or water storage structures is site specific and will be incorporated with COL Items 2.0-1 and 2.4-1. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values. This information is used to satisfy the requirements in 10 CFR Part 52 and 10 CFR Part 100 and, in doing so, demonstrates that any flood resulting

from seismically induced dam or surface-water impoundment failure will not exceed the standard power plant design-basis flood elevation.

Accordingly, the COL applicant will provide the site-specific information on the failure of dams, water control, or water storage structures used to describe the site-specific hydrogeological parameters and hydraulic properties. The need for this information is identified as COL Information Item 2.4-1 in DCA PART 2 Tier 2 and in Table 1.8-2, which notes that the COL applicant needs to describe the hydrologic characteristics of the reactor site and vicinity.

Lastly, both COL Items 3.4-1 and 3.4-4, associated with DCA PART 2 Section 3.4, address relevant information about flood protection of equipment. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values.

2.4.4.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.4-1 lists COL information items related to this section on potential dam failures, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.4-1 NuScale COL Information Items for Section 2.4.4

Item No.	Description	DCA PART 2 Tier 2 Section
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 2.4-1	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, except Section 2.4.8 and Section 2.4.10.	2.4

During a clarification telephone conference call, held on July 17, 2018, the staff informed the applicant that the actions described in DCA PART 2 Tier 2, Section 2.4.4 on site-specific flooding hazards for the COL applicant to take in responding to COL Item 2.4-1 were limited to dams only, in contrast with the guidance in SRP Section 2.4.4, which provides for consideration of any potential onsite, upstream, or downstream water control or storage structures. This includes site-specific water control features such as levees and dikes, as well as engineered water-storage facilities, such as dams and water storage tanks. The applicant agreed, via an email on July 18, 2018, to update DCA PART 2 Section 2.4.4 in the next revision of the DCA to

read: “The presence of onsite, upstream, and downstream water control structures is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1.” (ADAMS Accession No. ML18312A249). This proposed revision addresses the staff’s question. The staff will be tracking incorporation of this update as **Confirmatory Item 02.04.04-1.**

2.4.4.6 Conclusion

The NuScale design assumes a site parameter that the maximum flood elevation (including wind-induced wave runup) is 0.3 m (1 ft) below the baseline plant elevation, as shown in DCA PART 2 Tier 1, Table 5.0-1, and DCA PART 2 Tier 2, Table 2.0-1. The staff concludes that the NuScale DCA provides an appropriate site parameter that the maximum flood elevation, including wind-wave runup, caused by failures of dams, water control, or water storage structures is 0.3 m (1 ft) below the baseline plant elevation for the plant design. As part of the response to COL Item 2.4-1, that a COL applicant that references the NuScale DC will provide a description of flooding, caused by failures of dams, water control, or water storage structures, in Section 2.4.4.

Both the baseline plant elevation and the maximum flood elevation are site specific and will be addressed by the COL applicant. The COL applicant should include information sufficient to demonstrate that the actual site characteristics fall within the values of the site parameters in the NuScale certified design. The staff finds this acceptable.

If the actual site characteristics do not fall within the site parameters postulated in the DC, the COL applicant must provide sufficient justification (e.g., by requesting an exemption from, or amendment to, the DC) that the proposed facility is acceptable at the proposed site.

2.4.5 Probable Maximum Surge and Seiche Flooding

2.4.5.1 Introduction

This section describes the effects of PMSS and seiche. It also reviews the development of the hydrometeorological design basis to ensure that potential hazards caused by the PMSS or seiche and faced by the safety-related facilities are properly considered.

The potential hazards from PMSS or seiche are site specific and will be addressed by the COL applicant.

2.4.5.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.5, “Probable Maximum Surge and Seiche Flooding,” states that “[t]he potential for surge or seiche flooding is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1.” The COL applicant is to describe a probable maximum hurricane and probable maximum wind storm, seiche and resonance, wave runup, and the effects of sediment erosion and deposition.

The NuScale design assumes a site parameter that the maximum flood elevation (including wind-induced wave runup) is 0.3 m (1 ft) below the baseline plant elevation, as shown in Table 5.0-1 of DCA PART 2 Tier 1 and Table 2.0-1 of DCA PART 2 Tier 2. Because the standard power plant design basis is intended to be suitable for a variety of sites and conditions for flooding caused by the PMSS or seiche, the applicant defers to the COL applicant the presentation of the required site-specific information on the hydrologic design topic of PMSS.

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, contains relevant site parameter information on the maximum flood elevation.

DCA PART 2 Tier 2: The PMSS and seiche flooding are site specific, as indicated in Section 2.4.5 of DCA PART 2 Tier 2. DCA PART 2 Tier 2, Table 2.0-1, contains relevant site parameter information about the maximum flood elevation.

ITAAC: The ITAAC are not applicable for this section and are not provided.

Technical Specifications: The TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.5.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.17(a) and 10 CFR 100.20(c), which state that the consideration of the acceptability of a site will include such physical characteristics of the site as seismology, meteorology, geology, and hydrology.

- 10 CFR 100.23(d)(3), which states that, in establishing the design-basis flood, seismically induced floods and water waves that could adversely affect a site from either locally or distantly generated seismic activity must be determined.

- GDC 2 states that SSCs important to safety must be designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches, without loss of capability to perform their intended safety functions.

- GDC 44 states that a system must be provided to transfer heat from SSCs important to safety to a UHS. The system's safety function must be to transfer the combined heat load of these SSCs under normal operating and accident conditions.

The guidance in SRP Section 2.4.5, "Probable Maximum Surge and Seiche Flooding," lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff also used the following guidance documents in conducting its review:

- RG 1.27, as it relates to UHS capabilities.

- RG 1.29, as it relates to seismic design bases for safety-related SSCs.

- RG 1.59, as it relates to hydrometeorological design bases.

- RG 1.102, as it describes acceptable flood protection to prevent the SSCs from being adversely affected.

2.4.5.4 Technical Evaluation

The NuScale DCA does not contain PMSS or seiche flooding information because such information is site specific. However, the DCA provides a site parameter related to the

maximum flood elevation, as shown in Table 5.0-1 of DCA PART 2 Tier 1 and Table 2.0-1 of DCA PART 2 Tier 2. The PMSS or seiche flooding elevation is site specific and will be incorporated with the COL Items 2.0-1 and 2.4-1. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values. This information is used to satisfy the requirements in 10 CFR Part 52 and 10 CFR Part 100 and in doing so, demonstrates that any flood resulting from the PMSS or seiche flooding will not exceed the maximum flood elevation.

Accordingly, the COL applicant will provide the site-specific PMSS or seiche flooding information used to describe the site-specific hydrogeological parameters and hydraulic properties. The need for this site-specific information is site-specific as part of the response to COL Information Item 2.4-1 in DCA PART 2 Tier 2 and in Table 1.8-2, which notes that the COL applicant needs to describe the hydrologic characteristics of the reactor site and vicinity.

Lastly, both COL Items 3.4-1 and 3.4-4, associated with DCA PART 2 Section 3.4, address the need for relevant information about flood protection of equipment. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values.

2.4.5.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.5-1 lists COL information items related to this section on PMSS and seiche flooding, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.5-1 NuScale COL Information Items for Section 2.4.5

Item No.	Description	DCA PART 2 Tier 2 Section
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 COL application.	2.0
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, except Section 2.4.8 and Section 2.4.10.	2.4

2.4.5.6 Conclusion

The NuScale design assumes a site parameter that the maximum flood elevation (including wind-induced wave runup) is 0.3 m (1 ft) below the baseline plant elevation, as shown in DCA

PART 2 Tier 1, Table 5.0-1, and DCA PART 2 Tier 2, Table 2.0-1. The staff concludes that the NuScale DCA provides an appropriate site parameter that the maximum flood elevation, including wind-wave runup, is 0.3 m (1 ft) below the baseline plant elevation for plant design. As part of the response to COL Item 2.4-1, a COL applicant that references the NuScale DC will provide a detailed description of its PMF caused by a PMSS and seiche in Section 2.4.5.

Both the baseline plant elevation and the maximum flood elevation are site specific and will be addressed by the COL applicant. The COL applicant should include information sufficient to demonstrate that the actual site characteristics fall within the values of the site parameters in the NuScale DCA PART 2. The staff finds this acceptable.

If the actual site characteristics do not fall within the site parameters postulated in the DC, the COL applicant must provide sufficient justification (e.g., by requesting an exemption from, or amendment to, the DC) that the proposed facility is acceptable at the proposed site.

2.4.6 Probable Maximum Tsunami Hazards

2.4.6.1 Introduction

This section describes the PMT and the development of the geohydrological design basis to ensure that potential tsunami hazards faced by the safety-related facilities are properly considered.

The potential hazards from a tsunami are site specific and will be addressed by the COL applicant.

2.4.6.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.6, "Probable Maximum Tsunami Hazards," states that "[t]he potential for tsunami is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1." The COL applicant is to provide historical tsunami data, probable maximum tsunami, tsunami propagation models, wave runup, inundation and drawdown, hydrostatic and hydrodynamic forces, debris and water-borne projectiles, and the effects of sediment erosion and deposition.

The NuScale design assumes a site parameter that the maximum flood elevation (including wind-induced wave runup) is 0.3 m (1 ft) below the baseline plant elevation, as shown in Table 5.0-1 of DCA PART 2 Tier 1 and Table 2.0-1 of DCA PART 2 Tier 2. Because the standard power plant design basis is intended to be suitable for a variety of sites and conditions for the flooding caused by tsunami hazards, the applicant defers to the COL applicant the presentation of the required site-specific information on this probable maximum tsunami topic.

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, contains relevant site parameter information about the maximum flood elevation.

DCA PART 2 Tier 2: The PMT hazards are site specific, as indicated in Section 2.4.6 of DCA PART 2 Tier 2. DCA PART 2 Tier 2, Table 2.0-1, contains relevant site parameter information about the maximum flood elevation.

ITAAC: The ITAAC are not applicable for this section and are not provided.

Technical Specifications: The TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.6.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.17(a) and 10 CFR 100.20(c), which state that consideration of the acceptability of a site will include such physical characteristics of the site as seismology, meteorology, geology, and hydrology.

- 10 CFR 100.23(d)(3), which states that, in establishing the design-basis flood, seismically induced floods and water waves that could adversely affect a site from either locally or distantly generated seismic activity must be determined.

- GDC 2 states that SSCs important to safety must be designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches, without loss of capability to perform their intended safety functions.

The guidance in SRP Section 2.4.6, "Probable Maximum Tsunami Hazards," lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff also used the following guidance documents in conducting its review:

- RG 1.27, as it relates to UHS capabilities.

- RG 1.29, as it relates to seismic design bases for safety-related SSCs.

- RG 1.59, as it relates to hydrometeorological design base.

- RG 1.102, as it describes acceptable flood protection to prevent the SSCs from being adversely affected.

2.4.6.4 Technical Evaluation

The NuScale DCA does not contain PMT information because it is site specific. However, the DCA provides site parameters, as shown in Table 5.0-1 of DCA PART 2 Tier 1 and Table 2.0-1 of DCA PART 2 Tier 2, related to the maximum flood elevation. The PMT elevation is site specific and will be incorporated with the COL Items 2.0-1 and 2.4-1. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values. This information is used to satisfy the requirements in 10 CFR Part 52 and 10 CFR Part 100 and in doing so demonstrates that any flood resulting from tsunami events will not exceed the standard power plant design-basis flood elevation.

Accordingly, the COL applicant will provide site-specific PMT information used to describe the site-specific hydrogeological parameters and hydraulic properties. The need for this site-specific information is addressed as part of the response to COL Item 2.4-1 in DCA PART 2 Tier 2 and in Table 1.8-2, which notes that the COL applicant needs to describe the hydrologic characteristics of the reactor site and vicinity.

Lastly, both COL Items 3.4-1 and 3.4-4, associated with DCA PART 2 Section 3.4, address relevant information about flood protection of equipment. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values.

2.4.6.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.6 1 lists COL information items related to this section on PMT hazards, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.6-1 NuScale COL Information Items for Section 2.4.6

Item No.	Description	DCA PART 2 Tier 2 Section
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 2.4-1	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, except Section 2.4.8 and Section 2.4.10.	2.4

2.4.6.6 Conclusion

The NuScale design assumes a site parameter that the maximum flood elevation (including wind-induced wave runup) is 0.3 m (1 ft) below the baseline plant elevation, as shown in DCA PART 2 Tier 1, Table 5.0-1, and DCA PART 2 Tier 2, Table 2.0-1. The staff concludes that the NuScale DCA provides an appropriate site parameter that the maximum flood elevation, including wind-wave runup, caused by a tsunami, is 0.3 m (1 ft) below the baseline plant elevation for the plant design. As part of the response to COL Item 2.4-1 a COL applicant that references the NuScale DC will provide a detailed description of its PMF caused by a tsunami in Section 2.4.6.

Both the baseline plant elevation and the maximum flood elevation are site specific and will be addressed by the COL applicant. The COL applicant should include information sufficient to demonstrate that the actual site characteristics fall within the values of the site parameters in the NuScale certified design. The staff finds this acceptable.

If the actual site characteristics do not fall within the site parameters postulated in the DC, the COL applicant must provide sufficient justification (e.g., by requesting an exemption from,, or amendment to, the DC) that the proposed facility is acceptable at the proposed site.

2.4.7 Ice Effects

2.4.7.1 Introduction

This section describes the potential for the development of ice dams, jams, or other types of formation that could potentially exceed the baseline power plant elevation near safety-related SSCs. It also examines the hydrological design basis that is developed to compensate for any potential ice effect hazards faced by the safety-related facilities.

The potential hazards from ice effects are site specific and will be addressed by the COL applicant.

2.4.7.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.7, "Ice Effects," states that "[t]he design does not rely upon a safety-related intake structure as a makeup source for the reactor pool, which acts as the ultimate heat sink. Therefore, ice effects do not affect safety related cooling."

DCA PART 2 Tier 2, Section 2.4.7, also states that "[t]he potential for ice effects to contribute to flooding is site specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1." The COL applicant is to provide information on the potential for the development of ice dams, jams, or other types of formation that could potentially produce a water level higher than 0.3 m (1 ft) below the baseline plant elevation.

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, contains relevant site parameter information about the maximum flood elevation.

DCA PART 2 Tier 2: The ice effects do not affect safety-related cooling, as indicated in DCA PART 2 Tier 2, Section 2.4.7, but there is a potential for ice effects to contribute to flooding. DCA PART 2 Tier 2, Table 2.0-1, contains relevant site parameter information about the maximum flood elevation.

ITAAC: The ITAAC are not applicable for this section and are not provided.

Technical Specifications: The TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.7.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.17(a) and 10 CFR 100.20(c), which state that consideration of the acceptability of a site will include such physical characteristics of the site as seismology, meteorology, geology, and hydrology.

- GDC 44, which states that a system must be provided to transfer heat from SSCs important to safety to a UHS and that the system's safety function must be to transfer the combined heat load of these SSCs under normal operating and accident conditions

The guidance in SRP Section 2.4.7, "Ice Effects," lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff used the following guidance documents in conducting its review:

- RG 1.27, as it relates to UHS capabilities.
- RG 1.29,as it relates to seismic design bases for safety-related SSCs.
- RG 1.59,as it relates to hydrometeorological design bases.
- RG 1.102, as it describes acceptable flood protection to prevent the SSCs from being adversely affected.

2.4.7.4 Technical Evaluation

The NuScale DCA does not contain ice effect information because it is site specific. However, the DCA provides a site design parameter as shown in Table 5.0-1 of DCA PART 2 Tier 1 and Table 2.0-1 of DCA PART 2 Tier 2, related to maximum flood elevation. The ice-effect flooding elevation is site specific and will be incorporated with the COL Items 2.0-1 and 2.4-1. The COL applicant should provide ice-effect information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site design parameter values. Investigation of ice effects is needed to ensure that the safety-related SSCs are not affected by ice-induced flooding hazards. This information is used to satisfy the requirements in 10 CFR Part 52 and 10 CFR Part 100. The applicant stated that the power plant design does not rely upon a safety-related intake structure and an external water supply as a makeup source for the reactor pool, which would act as the UHS. Therefore, the applicant notes that no safety-related water systems could be subjected to ice-induced flooding effects or blockage.

Nevertheless, the COL applicant should provide the site-specific information on hydrogeological parameters and hydraulic properties. The need for this site-specific information is addressed as part of the response to COL Item 2.4-1 in DCA PART 2 Tier 2 and in Table 1.8-2, which notes that the COL applicant needs to describe the hydrologic characteristics of the reactor site and vicinity.

Lastly, both COL Items 3.4-1 and 3.4-4, associated with DCA PART 2 Section 3.4, address relevant information about flood protection of equipment. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values.

2.4.7.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.7-1 lists COL information items related to this section on ice effects, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.7-1 NuScale COL Information Items for Section 2.4.7

Item No.	Description	DCA PART 2 Tier 2 Section
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 2.4-1	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, except Section 2.4.8 and Section 2.4.10.	2.4

During a telephone conference call, held on April 2, 2018, the staff asked the applicant to either justify why DCA PART 2 Tier 2, Section 2.4.7, does not state that the potential for flooding effects from ice-induced high water levels is site specific and should be addressed by the COL applicant as part of the response to COL Item 2.4-1 or propose changes to DCA PART 2 Tier 2, Section 2.4.7, indicating that COL Item 2.4-1 is applicable. SRP Section 2.4.7 states, in part, that the potential effects of ice-induced high water levels on safety-related facilities should be evaluated. This should include estimates of water levels resulting from collapse of an upstream ice dam or an ice jam or the backwater effects from a downstream ice dam or an ice jam that may result in flooding at the proposed site. The applicant responded to the staff's clarification request in a letter dated May 25, 2018 (ADAMS Accession No. ML18149A404), that included a draft revision of DCA PART 2 Tier 2, Section 2.4.7. In the draft revision, the applicant stated: "The potential for ice effects to contribute to flooding is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1." Since the proposed revision is a draft, this is **Confirmatory Item 02.04.07-1.**

2.4.7.6 Conclusion

As described above in connection with **Confirmatory Item 02.04.07-1,** the ice-induced flooding is site specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1**.** Based on incorporation into the NuScale DCA PART 2 of information tracked by **Confirmatory Item 02.04.07-1** and site parameters shown in DCA Part 2 Tier 1, Table 5.0-1 and DCA Part 2 Tier 2, Table 2.0-1, the staff finds that the DCA addressed site parameters for the ice-induced flooding acceptable.

If the actual site characteristics do not fall within the site parameters postulated in the DC, the COL applicant must provide sufficient justification (e.g., by requesting an exemption from, or amendment to, the DC) that the proposed facility is acceptable at the proposed site.

The NuScale standard design does not rely upon a safety-related intake structure as a makeup source for the reactor pool, which acts as the UHS. Therefore, the staff finds it reasonable that ice effects do not affect the safety-related cooling system.

2.4.8 Cooling Water Canals and Reservoirs

2.4.8.1 Introduction

This section describes the hydraulic design basis that is developed for canal and reservoirs used to transport and impound water supplied to the safety-related facilities.

As discussed in SRP Section 2.4.8, “Cooling Water Canals and Reservoirs,” the hydraulic design basis of cooling water canals and reservoirs is site specific and should be addressed by the COL applicant.

2.4.8.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.8, ”Cooling Water Canals and Reservoirs,” states that “[t]he design does not rely upon safety-related cooling water canals or reservoirs as a makeup source for the reactor pool, which act as the ultimate heat sink.”

DCA PART 2 Tier 1: There is no Tier 1 information about cooling water canals and reservoirs.

DCA PART 2 Tier 2: The NuScale standard design does not rely upon safety-related cooling water canals or reservoirs as a makeup source for the reactor pool, which acts as the UHS, as indicated in DCA PART 2 Tier 2, Section 2.4.8.

ITAAC: The ITAAC are not applicable for this section and are not provided.

Technical Specifications: The TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.8.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.17(a) and 10 CFR 100.20, which state that consideration of the acceptability of a site will include such physical characteristics of the site as seismology, meteorology, geology, and hydrology.
- GDC 1, “Quality Standards and Records,” which states that SSCs important to safety must be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.
- GDC 2, which states that SSCs important to safety must be designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches, without loss of capability to perform their intended safety functions.
- GDC 44, which states that a system must be provided to transfer heat from SSCs important to safety to a UHS and that the system’s safety function must be to transfer the combined heat load of these SSCs under normal operating and accident conditions.

The guidance in SRP Section 2.4.8 lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff also used the following guidance documents in conducting its review:

- RG 1.27, as it relates to UHS capabilities.
- RG 1.29, as it relates to seismic design bases for safety-related SSCs.
- RG 1.59, as it relates to hydrometeorological design bases.
- RG 1.102, as it describes acceptable flood protection to prevent the SSCs from being adversely affected.
- RG 1.125, “Physical Models for Design and Operation of Hydraulic Structures and Systems for Nuclear Power Plants,” Revision 2, as it provides guidance in the use and evaluation of physical models for design and operation of hydraulic structures and systems for nuclear power plants

2.4.8.4 Technical Evaluation

The NuScale DCA does not contain information on cooling water canals and reservoirs because the COL is site specific. The applicant stated that the power plant design does not rely upon safety-related cooling water canals and reservoirs as a makeup water supply source for the reactor pool, which would act as the UHS. Therefore, no safety-related cooling water systems could be affected by flooding or blockage in the canals and reservoirs

As discussed in SRP Section 2.4.8, the COL applicant should provide the information used to describe the site-specific surface water parameters and properties for water supplied to safety-related SSCs. Since the power plant design does not rely upon cooling water canal and reservoir as a safety-related water supply source, the need for the site-specific information is thus not considered applicable to the design, as currently proposed. This issue is addressed in COL Item 2.4-1 in DCA PART 2 Tier 2 and in Table 1.8-2, which notes that the COL applicant needs to describe the hydrologic characteristics of the reactor site and vicinity, except Section 2.4.8 and Section 2.4.10.

2.4.8.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

COL Item 2.4-1, which specifies that a COL applicant should investigate and describe site-specific hydrological characteristics, is not applicable to this section since the NuScale design does not rely on safety-related cooling water canals and reservoirs as a makeup water supply source for the reactor pool, which would act as the UHS.

2.4.8.6 Conclusion

The applicant stated that the power plant design does not rely on cooling water canals and reservoirs as a makeup water supply source for the reactor pool, which would act as the UHS.

Therefore, a COL applicant that references the NuScale DC does not need to describe the makeup water supply source for safety-related SSCs. The staff finds this acceptable.

2.4.9 Channel Diversions

2.4.9.1 Introduction

This section describes the potential for channel diversions that could potentially exceed the baseline power plant elevation near safety-related SSCs. It also examines the hydrological design basis that is developed to compensate for any potential channel diversion hazards against the safety-related facilities.

The potential for channel diversions is site specific and will be addressed by the COL applicant.

2.4.9.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.9, "Channel Diversions," indicates that the plant-specific design does not rely upon a safety-related makeup water supply source. Therefore upstream channel diversions are not expected to adversely affect safety-related cooling sources.

DCA PART 2 Tier 2, Section 2.4.9, also states that "[t]he potential for channel diversions to contribute to flooding is site specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1." The COL applicant is to provide information on the potential for channel diversions to produce a water level higher than 0.3 m (1 ft) below the baseline plant elevation.

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, contains relevant site parameter information about maximum flood elevation.

DCA PART 2 Tier 2: DCA PART 2 Tier 2, Table 2.0-1, contains relevant site parameter information on the maximum flood elevation. The NuScale standard design does not rely on a safety-related water supply. Therefore, upstream channel diversions would not adversely affect safety-related cooling, as indicated in Section 2.4.9 of DCA PART 2 Tier 2. The potential for channel diversions to contribute to flooding is site specific, as indicated in Section 2.4.9 of DCA PART 2 Tier 2.

ITAAC: The ITAAC are not applicable for this section and are not provided.

Technical Specifications: The TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.9.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.17(a) and 10 CFR 100.20(c), which state that consideration of the acceptability of a site will include such physical characteristics of the site as seismology, meteorology, geology, and hydrology.

The following GDC contain the relevant requirements for this review:

- GDC 1, which states that SSCs important to safety must be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

- GDC 2, which states that SSCs important to safety must be designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches, without loss of capability to perform their intended safety functions.

- GDC 44, which states that a system must be provided to transfer heat from SSCs important to safety to a UHS and that the system's safety function must be to transfer the combined heat load of these SSCs under normal operating and accident conditions.

The guidance in SRP Section 2.4.9, "Channel Diversions," lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff also used the following guidance documents in conducting its review:

- RG 1.27, as it relates to UHS capabilities.

- RG 1.29, as it relates to seismic design bases for safety-related SSCs.

- RG 1.59, as it relates to hydrometeorological design bases.

- RG 1.102, as it describes acceptable flood protection to prevent the SSCs from being adversely affected.

2.4.9.4 Technical Evaluation

The NuScale DCA does not contain channel diversion information because it is site specific. However, the DCA provides site parameters related to maximum flood elevation, as shown in Table 5.0-1 of DCA PART 2 Tier 1 and Table 2.0-1 of DCA PART 2 Tier 2. The flooding elevation caused by channel diversions is site specific and will be incorporated in COL Items 2.0-1 and 2.4-1. The COL applicant should provide channel diversion information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values. This information is used to satisfy the requirements in 10 CFR Part 52 and 10 CFR Part 100 and, in doing so, demonstrates that any flood resulting from channel diversions will not exceed the standard power plant design-basis flood elevation.

Accordingly, the COL applicant will provide the site-specific information on hydrogeological parameters and hydraulic properties. The need for this site-specific information is addressed as part of the response to COL Item 2.4-1 in DCA PART 2 Tier 2 and in Table 1.8-2, which notes that the COL applicant needs to describe the hydrologic characteristics of the reactor site and vicinity.

Lastly, both COL Items 3.4-1 and 3.4-4 associated with DCA PART 2 Section 3.4 address relevant information about flood protection of equipment. The COL applicant should provide

information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values.

2.4.9.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.9-1 lists COL information items related to this section on channel diversions, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.9-1 NuScale COL Information Items for Section 2.4.9

Item No.	Description	DCA PART 2 Tier 2 Section
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 2.4-1	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, except Section 2.4.8 and Section 2.4.10.	2.4

During a telephone conference call held on April 2, 2018, the staff asked the applicant to either justify why DCA PART 2 Tier 2, Section 2.4.9, does not state that the potential for the effects of stream channel diversion flooding is site specific and should be addressed by the COL applicant as part of the response to COL Item 2.4-1 or propose changes to DCA PART 2 Tier 2, Section 2.4.9, indicating that COL Item 2.4-1 is applicable. SRP Section 2.4.9 states, in part, that the potential for stream channel diversions towards the site, which may lead to flooding in excess of the design basis, should be evaluated. The applicant responded to the staff's question by a letter dated May 25, 2018 (ADAMS Accession No. ML18149A404), that included a draft revision of DCA PART 2 Tier 2, Section 2.4.9. In the draft revision, the applicant stated: "The potential for channel diversions to contribute to flooding is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1." Since the revision is a draft, this change is **Confirmatory Item 02.04.09-1.**

2.4.9.6 Conclusion

As described above in connection with **Confirmatory Item 02.04.09-1**, the flooding caused by channel diversions is site specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1. Based on incorporation into the NuScale DCD of information tracked by **Confirmatory Item 02.04.09-1** and the site design parameters shown in Tables 5.0-1 of DCA PART 2 Tier 1 and Table 2.0-1 of DCA PART 2 Tier 2, the staff finds it acceptable that the NuScale DCA addressed site parameters for the flooding caused by the channel diversions.

The NuScale standard design does not rely upon a safety-related makeup source for the reactor pool, which acts as the UHS. Therefore, the staff finds it reasonable that channel diversions do not affect the safety-related cooling system.

2.4.10 Flood Protection Requirements

2.4.10.1 Introduction

This section describes the locations and elevations of safety-related facilities and components required for flood protection. It also examines the design-basis flood conditions to determine if flood effects need to be considered in the power plant design or in emergency procedures.

Flood protection requirements are site specific and will be addressed by the COL applicant.

2.4.10.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.10, "Flood Protection Requirements," states that "[t]he design assumes that the baseline plant elevation is one foot above the maximum flood level. Therefore there are no flood protection requirements." Accordingly, the DCA does not provide flood protection requirements. DCA PART 2 Tier 2, Table 2.0-1, indicates that the maximum flood level considered in the power plant design is 0.3 m (1 ft) below the baseline elevation for the finished power plant grade. The DCA states that the standard baseline power plant elevation is intended to be 0.3 m (1 ft) above the maximum flood level, there are no applicable flood protection requirements.

DCA PART 2 Tier 1: There is no Tier 1 information on flood protection requirements.

DCA PART 2 Tier 2: There are no flood protection requirements because the design assumes that the baseline power plant elevation is 0.3 m (1 ft) above the maximum flood level, as indicated in Section 2.4.10 of DCA PART 2 Tier 2.

ITAAC: The ITAAC are not applicable for this section and are not provided.

Technical Specifications: The TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.10.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.17(a) and 10 CFR 100.20(c), which state that consideration of the acceptability of a site will include such physical characteristics of the site as seismology, meteorology, geology, and hydrology.

- GDC 1, which states that SSCs important to safety must be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

- GDC 2, which states that SSCs important to safety must be designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes,

floods, tsunami, and seiches, without loss of capability to perform their intended safety functions.

- GDC 44, which states that a system must be provided to transfer heat from SSCs important to safety to a UHS and that the system's safety function must be to transfer the combined heat load of these SSCs under normal operating and accident conditions.

The guidance in SRP Section 2.4.10, "Flooding Protection Requirements," lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff also used the following guidance documents in conducting its review:

- RG 1.29, as it relates to seismic design bases for safety-related SSCs.
- RG 1.59, as it relates to hydrometeorological design bases.
- RG 1.102, as it describes acceptable flood protection to prevent the SSCs from being adversely affected.

2.4.10.4 Technical Evaluation

The NuScale DCA does not contain information on flood protection requirements because it is site specific. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameter values. This information is used to satisfy the requirements in 10 CFR Part 52 and 10 CFR Part 100 and, in doing so, demonstrates that the flood protection requirements are adequate.

The staff notes that the baseline plant elevation is 0.3 m (1 ft) above the maximum flood level, and the design does not rely upon a safety-related intake structure (canal or reservoir) or an external water supply as a makeup source for the reactor pool, which would act as the UHS. Therefore, the staff agrees with the applicant's statement that the external flood protection requirements for these features are not needed. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics described in any COL application fall within the range of site parameters related to flood protection.

Both COL Items 3.4-1 and 3.4-4 address preventing internal flooding associated with DCA Part 2, Section 3.4.

2.4.10.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

COL Item 2.4-1, which specifies that a COL applicant should investigate and describe site-specific hydrological characteristics, is not applicable to this section since the NuScale design

sets the baseline plant elevation at 0.3 m (1 ft) above the maximum flood elevation and therefore does not require flood protection.

2.4.10.6 Conclusion

The NuScale design assumes a site parameter that the maximum flood elevation (including wind-induced wave runup) is 0.3 m (1 ft) below the baseline plant elevation, as shown in DCA PART 2 Tier 1, Table 5.0-1, and DCA PART 2 Tier 2, Table 2.0-1. The staff concludes that the NuScale DCA provides an appropriate site parameter that the maximum flood elevation, including wind-wave runup, caused by the bounding flood-causing mechanism, is 0.3 m (1 ft) below the baseline plant elevation for the plant design and, therefore, does not require flood protection.

The staff determines that the site-specific the maximum flood elevation must be estimated by the COL applicant to confirm with the specified site design parameter in DCA. The COL applicant should provide flood protection measures against external flood if the site-specific maximum flood elevation exceeds the site design parameter. The flood protection for internal flood is site-specific as addressed in COL Item 3.4-1 and 3.4-4, and is acceptable.

2.4.11 Low Water Considerations

2.4.11.1 Introduction

This section describes the potential for an adequate water source during low water supply conditions to ensure that sufficient safety-related cooling water is available for safely shutting down the power plant.

Low water considerations are site specific and will be addressed by the COL applicant.

2.4.11.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.11, "Low Water Considerations," states that "[t]he design does not rely upon a safety-related source of makeup water." Therefore, low flow conditions in streams, rivers, or water-supply canals have no impact on the safety-related facilities in the power plant.

The same section also states that "[t]he potential effects of low water levels on non-safety-related water supplies is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1." The COL applicant is to describe low water from drought, low water from other phenomena, effects of low water on nonsafety-related water supply, water use limits, and the postulated worst case of low water caused by seismic and nonseismic effects.

The staff notes that DCA PART 2 Tier 2, Section 2.4.11, includes nonsafety-related water supplies for low water impacts as part of the response to COL Item 2.4-1.

DCA PART 2 Tier 1: There is no Tier 1 information on the potential for low water considerations.

DCA PART 2 Tier 2: The low water considerations do not affect safety-related cooling as indicated in Section 2.4.11 of DCA PART 2 Tier 2. However, in this section, the applicant

indicated that the effects of low water considerations for the nonsafety-related water supply will be addressed by a COL applicant as part of the responses to COL Item 2.4-1.

ITAAC: The ITAAC are not applicable for this section and are not provided.

Technical Specifications: The TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.11.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.17(a) and 10 CFR 100.20(c), which state that consideration of the acceptability of a site will include such physical characteristics of the site as seismology, meteorology, geology, and hydrology.
- GDC 44, which states that a system must be provided to transfer heat from SSCs important to safety to a UHS and that the system's safety function must be to transfer the combined heat load of these SSCs under normal operating and accident conditions.

The guidance in SRP Section 2.4.11, "Low Water Considerations," lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff also used the following guidance documents in conducting its review:

- RG 1.27, as it relates to UHS capabilities.
- RG 1.29, as it relates to seismic design bases for safety-related SSCs.

2.4.11.4 Technical Evaluation

The NuScale DCA does not contain information on low water considerations because it is site specific. Based on the information provided in DCA PART 2 Tier 2, Section 2.4.11, the staff noted that the design does not rely upon an external, safety-related source for makeup water. Therefore, the staff determines that a low water level is not a consideration in the staff evaluation of this design. The applicant states in the DCA that the potential effects of low water levels on nonsafety-related water supplies is site specific and is addressed by the COL applicant as needed. The staff determines this item should be addressed as part of the response to COL Item 2.4-1.

Accordingly, the COL applicant will provide the site-specific information on hydrogeological parameters and hydraulic properties. The need for this site-specific information is addressed as part of the response to COL Item 2.4-1 in DCA PART 2 Tier 2 and in Table 1.8-2, which notes that the COL applicant needs to describe the hydrologic characteristics of the reactor site and vicinity.

Lastly, in the matter of water supply that is not safety-related, the staff notes that the evaluation of external water supply is site specific and is expected to be addressed by the COL applicant.

2.4.11.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.11-1 lists COL information item related to this section on low-water considerations for water supplies that are not safety-related, which is site specific, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.11-1 NuScale COL Information Items for Section 2.4.11

Item No.	Description	DCA PART 2 Tier 2 Section
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, except Section 2.4.8 and Section 2.4.10.	2.4.11

2.4.11.6 Conclusion

The NuScale standard design does not rely on a safety-related source of makeup water and, therefore, low water considerations would not affect safety-related systems. Hence, low water levels resulting from some probable maximum tsunami, ice effects, storm surge and seiche, channel diversions, downstream dam failures, and potential ground water concerns will not affect safety-related cooling. However, in the DCA PART 2 Tier 2, Section 2.4.11, the applicant factored water supplies that are not safety-related into an evaluation of low water impacts as part of the response to COL Item 2.4-1.

COL Item 2.4-1 in DCA PART 2 Tier 2, Section 2.4, states that "[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, except Section 2.4.8 and Section 2.4.10." Thus, the COL applicant should evaluate the potential effects of low water considerations on water supplies that are not safety-related. The staff finds this acceptable.

2.4.12 Ground Water

2.4.12.1 Introduction

This section describes the ground water effects on power plant foundations and the reliability of safety-related water supply and dewatering systems.

Ground water effects are site specific and will be addressed by the COL applicant.

2.4.12.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.12, "Groundwater," states that "[t]he design does not employ a permanent dewatering system" and "[g]roundwater is assumed a minimum of two feet below site grade" and "[g]roundwater is site-specific and is addressed by the COL applicant as part of the

response to COL Item 2.4-1." The ground water elevation is a site-specific consideration and is one of key site parameters to be evaluated for a candidate site.

The COL applicant is to describe local and regional ground water characteristics and use, effects on plant foundations and other safety-related SSCs, and the reliability of ground water resources and systems used for safety-related purposes.

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, contains relevant site parameter information on the maximum ground water elevation.

DCA PART 2 Tier 2: The ground water is site specific, as indicated in Section 2.4.12 of DCA PART 2 Tier 2. DCA PART 2 Tier 2, Table 2.0-1, contains relevant site parameter information on the maximum ground water elevation.

ITAAC: The ITAAC are not applicable for this section and are not provided.

Technical Specifications: The TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.12.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.79(a)(1)(iii) and 10 CFR 100.20(c), which state that consideration of the acceptability of a site will include such physical characteristics of the site as seismology, meteorology, geology, and hydrology.

- 10 CFR 100.20(c)(3), which states that factors important to hydrological radionuclide transport that may affect the consequences of an escape of radioactive material from a power plant will be obtained from onsite measurements.

- 10 CFR 100.23, "Geologic and Seismic Siting Criteria," which requires the applicant to evaluate siting factors (including the cooling water supply), taking into account information concerning the physical and hydrological properties of the materials underlying the site.

The guidance in SRP Section 2.4.12, "Groundwater," lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff also used the following guidance documents in conducting its review:

- RG 1.27, as it relates to UHS capabilities.

2.4.12.4 Technical Evaluation

The NuScale DCA does not contain information on ground water because it is site specific. However, the DCA provides a site parameter related to the maximum ground water elevation to be two feet below the baseline plant elevation, as shown in Table 5.0-1 of DCA PART 2 Tier 1 and Table 2.0-1 of DCA PART 2 Tier 2. The maximum ground water elevation is site specific and will be incorporated into COL Items 2.0-1 and 2.4-1. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics described in any COL

application fall within the range of site parameter values. This information is used to satisfy the requirements in 10 CFR Part 52 and 10 CFR Part 100.

Accordingly, the COL applicant will provide the site-specific hydrogeological information and hydraulic parameters for the reactor site and vicinity. The need for this site-specific information is addressed as part of the response to COL Item 2.4-1 in DCA PART 2 Tier 2.

2.4.12.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.12-1 lists COL information items related to this section on ground water, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.12-1 NuScale COL Information Items for Section 2.4.12

Item No.	Description	DCA PART 2 Tier 2 Section
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 2.4-1	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, except Section 2.4.8 and Section 2.4.10.	2.4.12

2.4.12.6 Conclusion

The staff concludes that the NuScale DCA provides an appropriate site parameter that the maximum ground water elevation is two feet below baseline plant elevation for plant design. Both the baseline plant elevation and the maximum ground water elevation are site specific and will be addressed by the COL applicant. The COL applicant should include information sufficient to demonstrate that the actual site characteristics fall within the values of the site parameters in the NuScale certified design. The staff finds this acceptable.

If the actual site characteristics do not fall within the site parameters postulated in the DC, the COL applicant must provide sufficient justification (e.g., by requesting an exemption from, or amendment to, the DC) that the proposed facility is acceptable at the proposed site.

2.4.13 Accidental Releases of Radioactive Liquid Effluents in Ground and Surface Waters

2.4.13.1 Introduction

This section discusses the effects of accidental releases of radioactive liquid effluents into ground and surface waters on existing uses and known future uses of these water resources.

The effects of accidental releases of radioactive liquid effluents in ground and surface waters are site specific and will be addressed by the COL applicant.

2.4.13.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.13, "Accidental Releases of Radioactive Liquid Effluents in Groundwater and Surface Waters," states that "[d]ilution factors, dispersion coefficients, flow velocities, travel times, adsorption, and pathways of liquid contaminants for radioactive liquid effluents from accidental releases into groundwater or surface water is site-specific and is addressed by the COL applicant as part of the response to COL Item 2.4-1." The source term provided in Table 12.2-10 is associated with the pool surge control system storage tank. This parameter is to be used in the COL applicant's site-specific analysis to evaluate the effects of an accidental release of radioactive liquid. This information is to be provided as part of the response to COL Item 2.4-1, demonstrating the adequacy of the site's hydrogeologic properties.

Because the standard power plant design basis is intended to be suitable for a variety of sites and conditions for hazards caused by accidental releases in ground water and surface water, DCA PART 2 Tier 2, Chapter 2, defers to the COL applicant the presentation of the required site-specific information on this hydrologic design topic. The COL applicant is to describe alternate conceptual models, pathways, characteristics that affect transport, and consideration of the accidental releases combined with the potential effects of seismic and nonseismic events.

DCA PART 2 Tier 1: There is no Tier 1 information about the accidental releases of radioactive liquid effluents in ground and surface waters.

DCA PART 2 Tier 2: The accidental releases of radioactive liquid effluents in ground and surface waters are site specific, as indicated in DCA PART 2 Tier 2, Section 2.4.13.

ITAAC: The ITAAC are not applicable for this section and are not provided.

Technical Specifications: The TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.13.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.17(a) and 10 CFR 100.20(c), which state that consideration of the acceptability of a site will include such physical characteristics of the site as seismology, meteorology, geology, and hydrology.

- 10 CFR 100.20(c)(3), which states that factors important to hydrological radionuclide transport that may affect the consequences of an escape of radioactive material from a power plant will be obtained from onsite measurements.

- 10 CFR 100.21, which provides nonseismic siting criteria.

- GDC 60, which states that the nuclear power unit design must include a means to control suitably the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation, including anticipated operational occurrences, and that sufficient holdup capacity must be provided for the retention of gaseous and liquid effluents that contain radioactive materials, particularly where unfavorable site environmental conditions can be expected to impose unusual operational limitations on the release of such effluents to the environment.

The guidance in SRP Section 2.4.13, "Accidental Releases of Radioactive Liquid Effluents in Ground and Surface Waters," lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff also used the following guidance document in conducting its review:

- RG 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," Revision 1, as it relates to the selection of surface water models.

2.4.13.4 Technical Evaluation

The applicant stated, in DCA PART 2 Tier 2, Section 2.4.13, "Accidental Releases of Radioactive Liquid Effluents in Groundwater and Surface Waters," that a COL applicant referencing the NuScale certified design will address the site-specific information pertaining to flooding and other related hydrodynamic phenomena. Accordingly, the COL applicant will provide the site-specific information that is used to satisfy the requirements in 10 CFR Part 52 and 10 CFR Part 100, and to describe the site-specific accidental releases of radioactive liquid effluents in ground and surface waters.

The need for this site-specific information is addressed as part of the response to COL Information Item 2.4-1 in DCA PART 2 Tier 2, which notes that the COL applicant is to describe both the surface and subsurface hydrologic characteristics of the reactor site and vicinity. Special attention should be given to the consideration of those physicochemical properties that affect contaminant fate and transport of radioactive effluents.

2.4.13.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.13-1 lists COL information item related to this section on accidental releases of radioactive liquid effluents in ground and surface waters, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.13-1 NuScale COL Information Items for Section 2.4.13

Item No.	Description	DCA PART 2 Tier 2 Section
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, except Section 2.4.8 and Section 2.4.10.	2.4.13

2.4.13.6 Conclusion

The NuScale DCA has identified the source term provided in Table 12.2-10 to be used in the site-specific analysis related to the accidental releases of radioactive liquid effluents in ground and surface waters. A COL applicant that references the NuScale certified design will describe accidental releases of radioactive liquid effluents in ground and surface waters for Section 2.4.13 as part of the response to COL Item 2.4-1. The staff acknowledges that the accidental releases of radioactive liquid effluents in ground and surface waters is site specific and will be addressed by a COL applicant referencing the NuScale DC. Based on the above information, the staff finds the applicant's discussions in DCA PART 2 Section 2.4.13 of the DCA acceptable.

2.4.14 Technical Specifications and Emergency Operation Requirements

2.4.14.1 Introduction

This section describes the TS and emergency procedures that are required to implement protection against floods for safety-related facilities and to ensure that an adequate water supply for power plant shutdown and cooldown is available.

The implementation of TS and emergency operation requirements is site specific and will be addressed by the COL applicant.

2.4.14.2 Summary of Application

DCA PART 2 Tier 2, Section 2.4.14, "Technical Specifications and Emergency Operation Requirements," states that "[t]he design does not require emergency protective measures to minimize the impact of adverse hydrology-related events on safety-related facilities." However, the same section also states that "[s]ite-specific emergency protective measures are addressed by the COL applicant as part of the response to COL Item 2.4-1." The COL applicant is to describe bases for emergency actions, available response time, TS, and potential seismic and nonseismic effects on the postulated TS and emergency operations.

DCA PART 2 Tier 2, Table 2.0-1, and DCA PART 2 Tier 1, Table 5.0-1, indicate how the power plant design considers the basic hydrologic design basis related to the maximum water level. Because the site-specific hazards related to any emergency condition for power plant operation or limiting conditions of operation are not available at the DC stage, DCA PART 2 Tier 2, Section 2.4.14, defers to the COL applicant the presentation of the required site-specific information on this hydrologic design topic.

DCA PART 2 Tier 1: There is no Tier 1 information about the TS and emergency operation requirements.

DCA PART 2 Tier 2: The NuScale standard design does not require emergency protective measures to minimize the impact of adverse hydrology-related events on safety-related facilities, as indicated in DCA PART 2 Tier 2, Section 2.4.14. However, in this section, the applicant indicated that site-specific emergency protective measures are addressed by the COL applicant as part of the response to COL Item 2.4-1.

ITAAC: The ITAAC are not applicable for this section and are not provided.

Technical Specifications: The TS are not applicable for this section and are not provided.

Technical Reports: No technical reports are provided for this section.

2.4.14.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 50.36(c)(ii)(B)(2), which details the lowest functional capability or performance of equipment required for safe operation of the facility.
- GDC 2, which states that SSCs important to safety must be designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches, without loss of capability to perform their intended safety functions.

The guidance in SRP Section 2.4.14, “Technical Specifications and Emergency Operation Requirements,” lists the acceptance criteria that could be used to meet the above requirements, as well as review interfaces with other SRP sections.

The staff also used the following guidance documents in conducting its review:

- RG 1.29, as it relates to seismic design bases for safety-related SSCs.
- RG 1.59, as it relates to hydrometeorological design bases.
- RG 1.102, as it describes acceptable flood protection to prevent the SSCs from being adversely affected.

2.4.14.4 Technical Evaluation

The applicant stated in DCA PART 2 Tier 2, Section 2.4.14, “Technical Specifications and Emergency Operation Requirements,” that a COL applicant referencing the NuScale DC will address the site-specific emergency protective measures pertaining to flooding and other related hydrodynamic phenomena. Accordingly, the COL applicant will provide the site-specific information that is used to satisfy the requirements in 10 CFR 50.36(c)(ii)(B)(2) and to describe the site-specific emergency conditions of operation. The need for this information is identified as COL Item 2.4-1 in DCA PART 2 Tier 2, which notes that the COL applicant is to describe the hydrologic characteristics of the reactor site and vicinity.

2.4.14.5 Combined License Information Items

As part of its review of this portion of the application, the staff considered the adequacy of the COL information items presented in DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.14-1 lists COL information item related to this section on TS and emergency operation requirements, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.4.14-1 NuScale COL Information Items for Section 2.4.14

Item No.	Description	DCA PART 2 Tier 2 Section
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, except Section 2.4.8 and Section 2.4.10.	2.4.14

2.4.14.6 Conclusion

The NuScale DCA has no postulated site parameters related to TS and emergency operation requirements. A COL applicant that references the NuScale DC will describe TS and emergency operation requirements for Section 2.4.14 as part of the response to COL Item 2.4-1. The staff acknowledges that TS and emergency operation requirements are site specific and will be addressed by a COL applicant referencing the NuScale DC. Based on the above information, the staff finds the applicant's discussions in DCA PART 2 Tier 2, Section 2.4.14, of the NuScale DCA acceptable.

2.5 Geology, Seismology, and Seismic Information

2.5.1 Basic Geologic and Seismic Information

2.5.1.1 Introduction

This section documents the staff's review of regional and site geologic and seismic information for the NuScale design.

2.5.1.2 Summary of Application

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, provides specific design requirements and site and design parameters related to regional and site geologic and seismic information. SER Sections 2.5.2 through 2.5.5 discuss these site parameters.

DCA PART 2 Tier 2: DCA PART 2 Tier 2, Section 2.5.1, "Basic Geologic and Seismic Information," states that basic regional and site geologic and seismic information is site specific and will be addressed by the COL applicant.

2.5.1.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.47, “Contents of Applications; Technical Information,” with respect to requiring DC applicant to provide site parameters postulated for the design and an analysis and evaluation of the design in terms of those site parameters.

- 10 CFR 100.23, with respect to obtaining geologic and seismic information necessary to determine site suitability and ascertain that any new information derived from site-specific investigations would not affect the ground motion response spectra derived by a probabilistic seismic hazard analysis.

The guidance in SRP Section 2.5.1, “Basic Geologic and Seismic Information,” lists the acceptance criteria adequate to meet the above requirements, as well as review interfaces with other SRP sections, such as Sections 2.5.2 and 2.5.4, which provide the following:

- The staff reviews information presented by the applicant for a DC to determine if the site parameters postulated for the design, with respect to basic geologic and seismic information, are correctly identified, are representative of a reasonable number of sites that have been or may be considered for a COL application, and are appropriately justified.

The following document provides additional criteria, or guidance, in support of the SRP acceptance criteria to meet the above requirements.

- RG 1.208, “A Performance-Based Approach to Define Site-Specific Earthquake Ground Motion,” issued March 2007.

2.5.1.4 Technical Evaluation

Regional and site geologic and seismic information provides the basis for a site suitability determination for any reactor design. As stated in the SRP, the regional and site geologic and seismic information is site specific and must be provided and evaluated by ESP, COL, or construction permit (CP) applicants, and DCA PART 2 Tier 2, Section 2.5.1, “Basic Geologic and Seismic Information,” specifies that basic regional and site geologic and seismic information is site specific and to be addressed by the COL applicant. COL applicants referencing the NuScale power plant DC are responsible for providing adequate regional and site geologic and seismic information to be bounded by NuScale design parameters.

2.5.1.5 Combined License Information Items

Table 2.5-1 lists COL information item related to basic geologic and seismic information, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.5-1 NuScale COL Information Items for Section 2.5.1

Item No.	Description	DCA PART 2 Tier 2 Section
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

2.5.1.6 Conclusion

The applicant specified in COL Item 2.5-1 the need for the COL applicant referencing the NuScale Power Plant DC to describe regional and site geologic and seismic information. The staff concludes that the applicable requirements of 10 CFR 52.47 and 10 CFR 100.23, can be met by addressing this COL information item, and, therefore, the staff finds this acceptable.

2.5.2 Vibratory Ground Motion

2.5.2.1 Introduction

This section documents the staff's review of vibratory ground motion for the NuScale design.

2.5.2.2 Summary of Application

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, specifies ground motion response spectra and safe-shutdown earthquake (SSE). Figures 2.5-1 and 2.5-2 of this SER illustrate these certified seismic design response spectra (CSDRS).

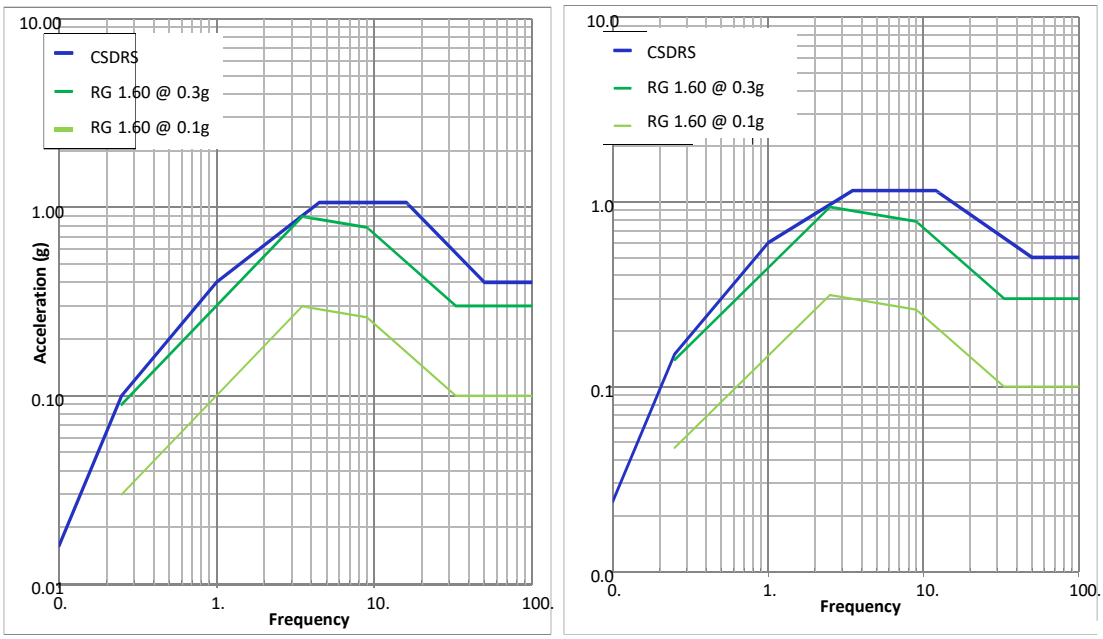

Figure 2.5-1 NuScale horizontal (a) and vertical (b) certified seismic design response spectra 5-percent damping (after DCA PART 2 Figures 5.0-1 and 5.0-2)

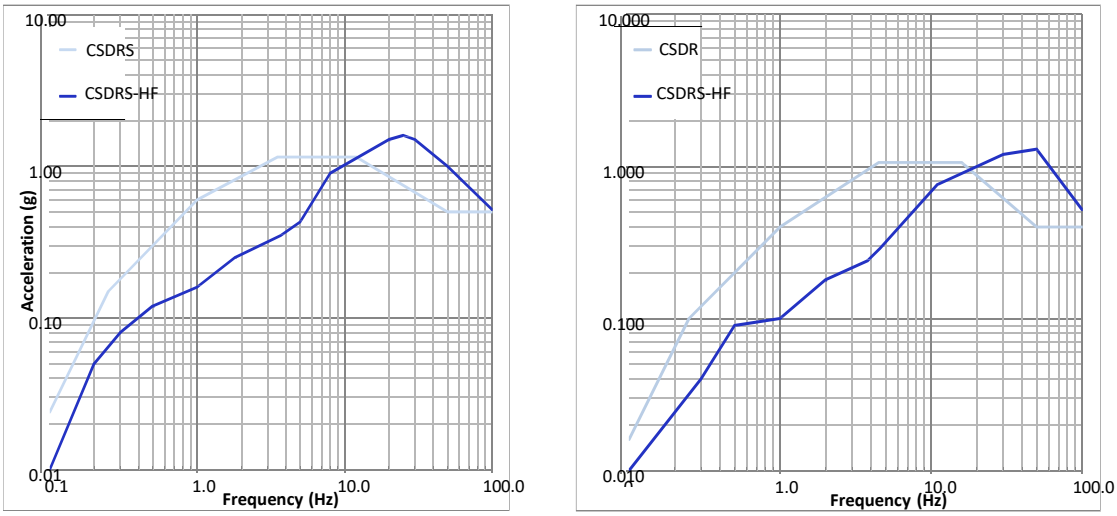

Figure 2.5-2 NuScale horizontal (c) and vertical (d) certified seismic design response spectra— high frequency 5-percent damping (after DCA PART 2 Figures 5.0-3 and 5.0-4)

DCA PART 2 Tier 2: Section 2.5.2, "Vibratory Ground Motion," states that the CSDRS and the CSDRS-high frequency (CSDRS-HF) were developed by reviewing earthquake design data from the U.S. nuclear industry and are intended to bound most of the central and eastern United States, as well as sites in the western United States. It also states that local vibratory ground motion, including development of an SSE, is site specific and to be addressed by the COL applicant.

2.5.2.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.47, with respect to requiring a DC applicant to provide site parameters postulated for the design and an analysis and evaluation of the design in terms of those site parameters.

- 10 CFR 100.23, with respect to obtaining geologic and seismic information necessary to determine site suitability and development of the SSE.

The guidance in SRP Section 2.5.2 lists the acceptance criteria adequate to meet the above requirements, as well as review interfaces with other SRP sections.

- The staff reviews information presented by a DC applicant to determine if the site parameters postulated for the design, with respect to seismic ground motion, are correctly identified, are representative of a reasonable number of sites that have been or may be considered for a COL application, and are appropriately justified.

The following documents provide additional criteria, or guidance, in support of the SRP acceptance criteria to meet the above requirements:

- RG 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion."

- RG 1.60, "Design Response Spectra for Seismic Design of Nuclear Power Plants," Revision 2, issued August 1977.

2.5.2.4 Technical Evaluation

As stated in DCA PART 2 Tier 2, Section 2.5.2, the CSDRS and the CSDRS-HF are key design parameters. DCA PART 2 Tier 2, Section 3.7.1, "Seismic Design Parameters," discusses these parameters. The CSDRS is shown in Figure 3.7.1-1, "NuScale Horizontal CSDRS at 5 Percent Damping," and Figure 3.7.1-2, "NuScale Vertical CSDRS at 5 Percent Damping," and the CSDRS-HF is shown in Figure 3.7.1-3, "NuScale Horizontal CSDRS-HF at 5 Percent Damping," and Figure 3.7.1-4, "NuScale Vertical CSDRS-HF at 5 Percent Damping." Tables 3.7.1-1 and 3.7.1-2 provide the horizontal and vertical control points for the CSDRS and CSDRS-HF at 5-percent damping.

The CSDRS is broad spectra (similar to what is in RG 1.60), which is intended to encompass the ground motion response spectra at most sites except hard rock sites in the central and eastern United States. To improve the range of acceptable locations, site-independent seismic Category I SSCs are also evaluated using spectra that have more content above 10 hertz (Hz) than the CSDRS. This is identified as the CSDRS-HF. The CSDRS are developed at 5-percent damping. The horizontal components of the CSDRS have a peak ground acceleration (PGA) of 0.5g and the vertical components have a PGA of 0.4g. The vertical response spectrum is 2/3 or more of the horizontal response spectrum. Both the horizontal and the vertical CSDRS bound the RG 1.60 response spectra anchored at a PGA of 0.1g.

The staff reviewed the applicant's CSDRS and evaluated the completeness and adequacy of those site parameters. The staff examined the CSDRS and CSDRS-HF, which are intended to

cover sites at most of the central and eastern United States, as well as sites in the western United States. As stated in the SRP, the regional and site geologic and seismic information is site specific and must be provided and evaluated by ESP, COL, or CP applicants. The applicant stated, in DCA PART 2 Tier 2, Section 2.5.2, that local vibratory ground motion, including development of an SSE, is site specific and to be addressed by the COL applicant as part of the response to COL Item 2.5-1. COL applicants referencing the NuScale power plant DC are responsible for providing adequate information on local vibratory ground motion, including development of an SSE, to be bounded by NuScale design parameters.

2.5.2.5 Combined License Information Items

Table 2.5-2 lists COL information item related to vibratory ground motion, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.5-2 NuScale COL Information Items for Section 2.5.2

Item No.	Description	DCA PART 2 Tier 2 Section
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

2.5.2.6 Conclusion

Based on the review of DCA PART 2 Section 2.5.2, the staff concludes that the applicant provided the necessary seismic plant design parameters, CSDRS and CSDRS-HF, that are consistent with 10 CFR 100.23, and specified the scope of the information associated with those site parameters in COL Item 2.5-2 that, when addressed by COL applicants, will meet the applicable requirements of 10 CFR 52.47 and 10 CFR 100.23. The staff, therefore, finds the vibratory ground motion site parameters specified in the NuScale power plant design acceptable.

2.5.3 Surface Deformation

2.5.3.1 Introduction

This section documents the staff's review of surface faulting for the NuScale design.

2.5.3.2 Summary of Application

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, specifies that there should be no fault displacement potential at a site.

DCA PART 2 Tier 2: DCA PART 2 Tier 2, Section 2.5.3, "Surface Faulting," states that the design analysis assumes that there is no fault displacement potential under the plant structures. It also states that detailed surface and subsurface geological, seismological, and geophysical information, including surface faulting, is site specific and to be addressed by the COL applicant.

2.5.3.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.47, with respect to requiring DC applicants to provide site parameters postulated for the design and an analysis and evaluation of the design in terms of those site parameters.

- 10 CFR 100.23, as it provides the nature of the investigations required to obtain the geologic and seismic data necessary to determine site suitability and identify geologic and seismic factors required to be taken into account in the siting and design of nuclear power plants.

The guidance in SRP Section 2.5.3, "Surface Deformation," lists the acceptance criteria adequate to meet the above requirements, as well as review interfaces with other SRP sections such as 2.5.2 and 2.5.4, which provide the following:

- The staff reviews information presented by a DC applicant to determine if the postulated site parameters for the design, with respect to the potential for surface deformation at the site, are correctly identified and are appropriately justified.

The following document provides additional criteria, or guidance, in support of the SRP acceptance criteria to meet the above requirements:

- RG 1.198, "Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites," issued November 2003.

2.5.3.4 Technical Evaluation

As stated in SRP Section 2.5.3, surface deformation is one of the geologic hazards that will affect the suitability of a site for a nuclear power plant and the stability of facilities at the site. DCA PART 2 Tier 2, Section 2.5.3, "Surface Faulting," specifies that the design analysis assumes that there is no fault displacement potential under the plant structures, thus eliminating any potential adverse impact on the plant structures by this geologic hazard. SRP Section 2.5.3 states that the surface deformation characteristics are site specific, provided by the applicant for an ESP, COL, or CP, and reviewed by the staff. In DCA PART 2 Tier 2, Section 2.5.3, the applicant stated that detailed surface and subsurface geological, seismological, and geophysical information, including surface faulting, will be addressed by the COL applicant, consistent with COL Item 2.5-1. COL applicants referencing the NuScale power plant DC are responsible for providing adequate information regarding the potential for surface deformation to be bounded by NuScale design parameters.

2.5.3.5 Combined License Information Items

Table 2.5-3 lists COL information item related to surface faulting, from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.5-3 NuScale COL Information Items for Section 2.5.3

Item No.	Description	DCA PART 2 Tier 2 Section
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

2.5.3.6 Conclusion

Consistent with the fact that surface deformation is one of the important geologic characteristics and potential hazards for a nuclear power plant site, and it is site specific, the applicant specifies that its design is based on the assumption of no fault displacement potential under the plant structures. The applicant also specified in COL Item 2.5-1 the scope of the information associated with geotechnical characteristics enveloping surface deformation. Based on its review of DCA PART 2 Section 2.5.3, the staff concludes that the applicant has clearly defined the design basis of no fault displacement potential that meets the applicable requirements of 10 CFR 100.23. The applicant specified in COL Item 2.5-1 the need for the COL applicant referencing the NuScale Power Plant DC to describe site-specific geology, seismology, and geotechnical characteristics to include the potential for surface deformation pertaining to Section 2.5.3. The staff concludes that the applicable requirements of 10 CFR 52.47 and 10 CFR 100.23, can be met by addressing this COL information item, and, therefore, the staff finds this acceptable.

2.5.4 Stability of Subsurface Materials and Foundations

2.5.4.1 Introduction

This section documents the staff's review of the stability of subsurface materials and foundations for the NuScale design.

2.5.4.2 Summary of Application

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, provides the following specific site parameters related the subsurface materials and foundation designs:

- minimum soil bearing capacity (Q_{ult}) beneath safety-related structures: 75 ksf.
- lateral soil variability uniform site: (± 20 degree dip).
- soil angle of internal friction: 30 degrees.
- minimum coefficient of static friction (all interfaces between basemat and soil): 0.58.
- minimum shear wave velocity: ≥ 1,000 ft/second at bottom of foundation.

- maximum settlement for the RXB, CRB, and RWB:
  - total settlement: no limit.
  - tilt settlement: 1 in. per 50 ft in any direction.
  - differential settlement (between RXB and CRB): no limit.

DCA PART 2 Tier 2: In addition to the site parameters listed in DCA PART 2 Tier 1, Table 5.0-1, DCA PART 2 Tier 2, Section 2.5.4, "Stability of Subsurface Materials and Foundations," also specifies that there is to be no potential for soil liquefaction under the site-specific safe shutdown earthquake (SSE) condition.

DCA PART 2 Tier 2, Section 2.5.4, states that settlement is not a concern for the NuScale power plant design because there are no rigid safety-related connections between the structures and there are no safety-related connections to other site structures. DCA PART 2 Tier 2, Section 2.5.4, also states that a settlement tilt limit of 1 in. per 50 ft (< 0.1 degree) does not affect the structural analysis.

The applicant stated that characteristics of the subsurface materials are site specific and to be discussed by the COL applicant.

2.5.4.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.47, with respect to requiring DC applicants to provide site parameters postulated for the design and an analysis and evaluation of the design in terms of those site parameters.
- GDC 1, as it requires that SSCs important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.
- 10 CFR Part 50, Appendix S, "Earthquake Engineering Criteria for Nuclear Power Plants," as it applies to the design of nuclear power plant SSCs important to safety to withstand the effects of earthquakes.
- 10 CFR 100.23, as it provides the nature of the investigations required to obtain the geologic and seismic data necessary to determine site suitability and identify geologic and seismic factors required to be taken into account in the siting and design of nuclear power plants.

The guidance in SRP Section 2.5.4 lists the acceptance criteria adequate to meet the above requirements, as well as review interfaces with other SRP sections.

- The staff reviews information presented by the applicant for a DC to determine if the postulated site parameters for the design, with respect to stability of the soil and rock underlying the site, are correctly identified, are representative of a reasonable number of sites that has been or may be considered for a COL application, and are appropriately justified.

The following document provides additional criteria, or guidance, in support of the SRP acceptance criteria to meet the above requirements:

- RG 1.198, “Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites,” issued November 2003.

2.5.4.4 Technical Evaluation

The staff reviewed the design site parameters that are related to the stability of subsurface materials and foundations for seismic Category 1 structures and evaluated the completeness and adequacy of those site parameters.

The staff evaluated the site parameter of minimum ultimate bearing capacity, Q_{ult}, for supporting materials beneath safety-related structures. This foundation-bearing capacity requirement is based on the maximum foundation pressures obtained from structural stability analyses under design loading conditions, including static and dynamic or seismic loadings. The applicant presented the analysis results in DCA PART 2 Tier 2, Section 3.8.5, “Foundations.” The applicant also stated, in DCA PART 2 Tier 2, Section 2.5.4, that the minimum ultimate bearing capacity is sufficient to provide a factor of safety greater than 3.0 for foundations under static loading conditions and greater than 2.0 for dynamic loading conditions. Those factor of safety values are commonly used in industrial standards and provide adequate margin to prevent failure of the support material caused by maximum foundation pressures under design loading conditions.

The applicant specifies that there is no potential for soil liquefaction from the site-specific SSE in DCA PART 2 Section 2.5.4. As soil liquefaction will greatly affect the stability of foundations and structures, no soil liquefaction potential at a site will eliminate the instability of soil underlying plant structures caused by soil liquefaction.

As great uncertainty and variability of subsurface materials exist at any real site, site uniformity requirements need to be defined based on the design assumptions. The applicant specifies that this plant design applies to sites with uniform lateral soil variability and no more than a 20 degree inclination of geologic layers. This site parameter is defined as design basis and poses a requirement for site suitability determination.

The applicant also specifies several soil property-related site parameters, such as a minimum shear wave velocity of 304.8 m/s (1,000 fps) for in situ materials; coefficient of friction of 0.58 at all interfaces between the concrete foundation and soil; coefficient of friction of 0.5 between concrete walls and soil; and 30 degrees of minimum soil angle of internal friction. Those site parameters provide specific soil properties used in this design and are within the range of normal values for soils used in nuclear power plant construction.

The staff noted that, in the structural stability analyses described in DCA PART 2 Tier 2, Sections 3.7 and 3.8, backfill material surrounding structures is presented as one of the components in safety-related structure analysis models. However, this DCA did not specify the properties of the backfill material as design site parameters. Therefore, the staff issued RAI 9049, Question 02.05.04-1 (ADAMS Accession No. ML17230A007), asking the applicant to justify why it did not include the properties of the backfill materials as design site parameters in the DCA PART 2. In its response (ADAMS Accession No. ML17285B465), the applicant stated that the backfill material properties are not included as design site parameters because the COL Items 2.5-1, 3.7-3, 3.7-5, 3.7-6, and 3.8-2 in the DCA PART 2 require the COL applicant that

references the NuScale power plant DC to develop appropriate site-specific soil profiles and perform soil-structure interaction (SSI) and structure-soil-structure interaction (SSSI) analyses to confirm the suitability of the design using a comparison of the site-specific, nonseismic and seismic demands with the certified standard design. Based on the above response, the staff considers that each actual site has its specific characteristics, and the COL applicant will perform SSI and SSSI analyses if the site-specific soil profile, including backfill materials, deviate from the soil profiles used in the NuScale design. The site-specific SSI and SSSI analyses will use the site-specific properties of backfill materials in the analysis models, and the COL applicant will need to provide details on how to ensure that the in-place backfill materials possess the properties as required. The staff concludes that the applicant's response was adequate because the requirements specified in the aforementioned COL Items will be addressed in a future COL application and will ensure proper backfill materials are used during construction; thus, it is acceptable that specific backfill material properties not be included in the site parameters for this design. The staff will be tracking via **Confirmatory Item 3.8-XX** the incorporation of the applicant's proposed changes in the next revision of the DCA.

The staff noted that, for the foundation and structure settlement design requirement, the applicant specifies that the limit for tilt settlement is 2.5 cm (1 in.) per 50 ft (or 1/600). The applicant then states that there is no limit for total settlement for the RXB, CRB, and RWB, and no limit for differential settlement between the RXB and CRB. The staff considered that (1) according to commonly accepted engineering standards and guidelines (e.g., USACE EM 1110-1-1904, 1990), the general allowable total settlement for reinforced mat foundations is 5 cm (2 in.), (2) engineering practices have indicated that the large differential settlement normally associated with a large total settlement (Skempton and McDonald, 1956), and the large differential settlement within a building will have a negative impact on structural integrity and normal operation of the building, and (3) in addition to the tilting of the foundation, another differential settlement measure, the angular distortion from regular settlement, will also affect the stability of the foundation. Based on these considerations, the staff issued RAI 9049, Question 02.05.04-2 (ADAMS Accession No. ML17230A007), asking the applicant to justify why there is no limit established for total settlement and why there are no other differential settlement limits specified for the NuScale structure and foundation designs. In its initial and supplemental responses (ADAMS Accession Nos. ML17285B465 and ML17320B122, respectively), the applicant stated that, as presented in the NuScale response to RAI 8964, Question 03.08.05-1 (ADAMS Accession No. ML17284A859), it revised DCA PART 2 Tier 1, Table 5.0-1; DCA PART 2 Tier 2, Table 2.0-1; and DCA PART 2 Tier 2, Section 2.5.4, to include the limits of total settlement and differential settlement between buildings, as well as the correct limit on differential settlements for the three buildings. The revised settlement limits include maximum allowable total settlement for the RXB, CRB, and RWB: 10 cm (4 in.); maximum allowable differential settlement for the RXB, CRB, and RWB (tilt settlement): 2.5 cm (1 in.) total or 1.25 cm per 15.2 m (½ in. per 50 ft), or 1/1200, in any direction at any point in any of these structures; and maximum allowable differential settlement between the RXB and CRB, and the RXB and RWB: 1.25 cm (½ in.). The staff examined the revised site parameters related to foundation settlements and found, in conjunction with the staff review of DCA PART 2 Tier 2, Section 3.8.5.6, that the revised maximum allowable differential settlement of 2.5 cm (1 in.) total or 1/1200 is well within the commonly accepted engineering standards and guidelines, such as the limits of 1/1250 to 1/600 as specified in USACE EM 1110-1-1904. The specified total settlement of 10 cm (4 in.) for all seismic Category 1 structures is also reasonable because the total settlement in conjunction with specified limitations of differential settlement, both within a structure and between structures, will not have an adverse effect on the normal operation and stability of the structures. Based on the review of applicant's response, the staff

concludes that the specified structure and foundation settlement-related site parameters are consistent with industrial standards and are reasonable. However, as the proposed revisions need to be incorporated in the DCA PART 2 revision, RAI 9049, Question 02.05.04-2, is being tracked as **Confirmatory Item 02.05.04-1**.

Another site parameter related to foundation and structure stability is lateral earth pressure and its distribution along the embedded portion of the foundation, induced by both static and seismic loadings. DCA PART 2 Tier 2, Section 2.5.4, does not include a discussion of lateral earth pressures, and DCA PART 2 Tier 2, Section 3.8.4.3.3, "Earth Pressure (H)," provides only limited discussion. Therefore, the staff issued RAI 9049, Question 02.05.04-3 (ADAMS Accession No. ML17230A007), asking the applicant to adequately describe the lateral earth pressure used in the NuScale structure and foundation designs, as well as associated COL items in the DCA PART 2. In its initial and supplemental responses (ADAMS Accession Nos. ML17285B465 and ML17320B122, respectively), the applicant provided details on how it determined the static soil pressure. The applicant calculated the static lateral soil pressure with the assumption that the soil is completely confined and cannot move, and that the soil is submerged for the whole embedment depth as the water table is designed at near grade level. The embedment depth used in the analysis is 25.9 m (85 ft) for the RXB. The total maximum static lateral soil pressure at a depth (H) was calculated as the sum of the hydrostatic pressure, the effective lateral pressure, and the surcharge lateral pressures. The applicant stated that it computed the seismic soil from the SASSI2010 SSI analysis. The applicant also provided a table that summarized total static soil pressures on the four walls and total overturning moments induced by the soil pressures. The applicant further stated that COL Items 2.5-1, 3.7-3, 3.7-5, 3.7-6, and 3.8-2 specify the site-specific geology and SSI analysis requirements of the NuScale power plants. Finally, the applicant proposed a revision of the FSAR Tier 2, Section 3.8.4.3.3, based on this RAI response. The staff will be tracking via **Confirmatory Item 3.8-XX** the incorporation of the applicant's proposed changes in the next revision of the DCA. The applicant referred to its response to RAI 8971, Question 03.08.04-14, for an evaluation of dynamic (seismic) soil pressure to SSI analysis. RAI 8971, Question 03.08.04-14, asked the applicant to provide the pressure distributions with depth of the bounding dynamic soil pressures considered in the design of the embedded exterior walls of the buildings. In its response (ADAMS Accession No. ML18120A309), the applicant provided detailed information on bounding dynamic soil pressures on the exterior walls of the CRB, RXB, and RWB. DCA PART 2 Figures 3.8.4-28 to 3.8.4-33, and DCA PART 2 Tables 3.8.4-15 through 3.8.4-20, present the results. The applicant used standalone models for each of the buildings to estimate the dynamic soil pressure on the individual building; it also used a triple building (CRB-RXB-RWB) model to consider the interaction among the buildings. The applicant proposed a revision to DCA PART 2 Tier 2, Section 3.8.4, based on this RAI response.

The staff reviewed the RAI responses (SER Section 3.8.4 contains a detailed evaluation of the responses to RAI 8971, Question 03.08.04-14) and finds that the methods and assumptions used in the estimate of total static lateral earth pressure, and the bounding dynamic (seismic) soil pressures for the safety-related buildings are reasonable because the applicant used widely accepted methods in engineering practices, the assumptions are based on the designed site conditions, and the input parameter values used in the calculations are within the normal ranges of those parameters. The staff also noted that DCA PART 2 COL Item 3.7-5 states that "[t]he COL applicant will confirm that the site-specific seismic demands of the standard design for all critical structures, systems, and components in Appendix 3B are bounded by the corresponding design certified seismic demands," which will include comparisons of forces and moments for all critical sections below grade walls under design loading conditions. The staff, therefore,

concludes that the applicant provided adequate information on the static and dynamic lateral earth pressure determinations in the design, which are reasonable and are consistent with industrial standards. The applicant also specified a COL information item in the DCA to ensure that COL applicants referencing this design meet all design requirements. However, as the proposed changes need to be incorporated in the DCA PART 2 revision, RAI 9049, Question 02.05.04-3, is being tracked as **Confirmatory Item 02.05.04-2**.

2.5.4.5 Combined License Information Items

Table 2.5-4 lists COL information item related to the stability of subsurface materials and foundations from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.5-4 NuScale COL Information Items for Section 2.5.4

Item No.	Description	DCA PART 2 Tier 2 Section
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

2.5.4.6 Conclusion

Based on its review of the site parameters related to subsurface material and foundation stability, as presented in the DCA PART 2 and RAI responses, the staff concludes that the applicant provided the necessary site parameters that are used in foundation stability design and analyses. The applicant specified in COL Items 2.5-1, 3.7-3, 3.7-5, 3.7-6, and 3.8-2 the need for the COL applicant referencing the NuScale Power Plant DC to describe site-specific geology, seismology, and geotechnical characteristics to include subsurface material and foundation stability evaluations pertaining to Section 2.5.4. The staff concludes that the applicable requirements of 10 CFR 52.47 and 10 CFR 100.23, can be met by addressing this COL information item, and, therefore, the staff finds this acceptable.

2.5.5 Stability of Slopes

2.5.5.1 Introduction

This section documents the NRC staff's review of stability of slopes for the NuScale plant design.

2.5.5.2 Summary of Application

DCA PART 2 Tier 1: DCA PART 2 Tier 1, Table 5.0-1, specifies that this design assumes there should be no slope failure potential at a site.

DCA PART 2 Tier 2: DCA PART 2 Tier 2, Section 2.5.5, "Stability of Slopes," states that the standard plant layout assumes a uniform, graded site and no slope failure potential as a key design parameter.

Section 2.5.5 also states that the stability of slopes on or near the site is confirmed by the COL applicant and that the analysis may be performed with the site-specific SSE.

2.5.5.3 Regulatory Basis

The following NRC regulations contain the relevant requirements for this review:

- 10 CFR 52.47, with respect to requiring a DC applicant to provide site parameters postulated for the design and an analysis and evaluation of the design in terms of those site parameters.

- 10 CFR Part 50, Appendix S, as it applies to the design of nuclear power plant SSCs important to safety to withstand the effects of earthquakes.

- 10 CFR 100.23, which describes the nature of the investigations required to obtain the geologic and seismic data necessary to determine site suitability and to identify geologic and seismic factors required to be taken into account in the siting and design of nuclear power plants.

The guidance in SRP Section 2.5.5, "Stability of Slopes," lists the acceptance criteria adequate to meet the above requirements, as well as review interfaces with other SRP sections.

- The staff reviews information presented by the applicant for a DC about the postulated site parameters for the design, with respect to the stability of slopes, to ensure they are correctly identified, are representative of a reasonable number of sites that have been or may be considered for a COL application, and are appropriately justified.

The following document provides additional criteria, or guidance, in support of the SRP acceptance criteria to meet the above requirements:

- RG 1.198, "Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites," issued November 2003.

2.5.5.4 Technical Evaluation

Slope stability at a nuclear power plant site will affect the stability of facilities at the site. FSAR Tier 2, Section 2.5.5, specifies that the standard plant layout assumes a uniform, graded site and no slope failure potential as a key design parameter, which will eliminate any potential adverse impact to the plant structures by slope failure at a site. Since the characteristics of a slope, both natural and man-made, are site specific and must be provided and evaluated by ESP, COL, or CP applicants, the DCA PART 2 specifies that detailed surface and subsurface geological, seismological, and geophysical information, including slope characteristics at a site, will be addressed by the COL applicant. COL applicants referencing the NuScale power plant DC are responsible for providing an adequate slope stability evaluation to be bounded by the NuScale design parameters.

2.5.5.5 Combined License Information Items

Table 2.5-5 lists the COL information item related to the stability of slopes from DCA PART 2 Tier 2, Table 1.8-2.

Table 2.5-5 NuScale COL Information Items for Section 2.5.5

Item No.	Description	DCA PART 2 Tier 2 Section
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

2.5.5.6 Conclusion

The failure of slopes at a nuclear power plant site may have an adverse impact on the stability of facilities. The applicant specifies that its design is based on the assumption that there is no potential slope failure at the site. The applicant also specified adequate requirements in COL Item 2.5-1. The applicant specified in COL Item 2.5-1 the need for the COL applicant referencing the NuScale Power Plant DC to describe site-specific geology, seismology, and geotechnical characteristics to include slope stability evaluations pertaining to Section 2.5.5. The staff concludes that the applicable requirements of 10 CFR 52.47, 10 CFR 100.23, and 10 CFR Part 50, Appendix S, can be met by addressing this COL information item, and, therefore, the staff finds this acceptable.