2 SITE CHARACTERISTICS

Chapter 2 of this report describes the U.S. Nuclear Regulatory Commission (NRC) staff review of the United States – Advanced Pressurized Water Reactor (US-APWR) Design Control Document (DCD) Chapter 2, "Site Characteristics" Revision 2. This information is included in US-APWR Final Safety Analysis Report (FSAR), Chapter 2, "Site Characteristics." The review is focused on the site parameters and site-related design characteristics needed to enable the staff to reach a conclusion on safety matters related to siting.

2.0 SITE CHARACTERISTICS

2.0.1 Introduction

This chapter discusses the site envelope for the US-APWR design, focusing 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 Operating License (COL) that references the US-APWR design (COL applicant) will compare site-specific data to the design parameter data identified in the DCD Tier 1, Table 2.1-1 and Tier 2, Table 2.0-1. If the specific data for the site falls within the assumed design parameter data and characteristics in DCD Tier 1, Table 2.1-1 and Tier 2, Table 2.0-1, then the US-APWR standard design is bounding for the site. Should the site parameters or characteristics fall outside the assumed design parameters in DCD Tier 1, Table 2.1-1 and 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. This might be done by reanalyzing or redesigning the proposed facility.

The staff issued Request for Additional Information (RAI) 02-1, to request the applicant to use the terms "site characteristics" and "site parameters" in DCD Tier 2, Section 2.0, in accordance with the definitions provided in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, Paragraph 52.1(a). In its response to Question 02-1, dated February 15, 2010, the applicant stated they believe the use of the terms "site characteristics" and "site parameters" are consistent with the definitions provided in 10 CFR 52.1(a), except in Section 2.1 and Subsection 2.1.4. In both Section 2.1 and Subsection 2.1.4, "parameters" is to be corrected to "characteristics" in the next revision of the DCD. The staff finds the applicant's response to Question 02-1 acceptable, and Question 02-1 is being tracked as a confirmatory item.

2.0.2 Summary of Application

DCD Tier 1: The Tier 1 information associated with this section is found in DCD Tier 1, Section 2.1, Site Parameters. The US-APWR design basis key site parameters are provided in Table 2.1-1 of Section 2.1. The US-APWR certified seismic design response spectra, horizontal and vertical; are provided in Figures 2.1-1 and 2.1-2, respectively, of Tier 1, Section 2.1. A COL applicant's site for construction of a US-APWR will be acceptable if its site-specific design basis values are within the design parameter values shown in Table 2.1-1 and Figures 2.1-1 and 2.1-2.

DCD Tier 2: The applicant has provided a DCD Tier 2 description and summary table identifying design basis parameters for the US-APWR in Section 2.0, summarized here in part, as follows:

> A COL applicant that references the US-APWR Design Certification (DC) will compare site-specific data to the design parameter data in DCD Tier 2, Table 2.0-1. If the specific data for the site falls within the assumed design parameter data and characteristics in DCD Table 2.0-1, then the US-APWR 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 DCD Table 2.0-1, the COL applicant will confirm that the US-APWR 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 US-APWR DCD.

DCD Tier 2, Table 2.0-1 contains the same key site parameter descriptions and parameter values as Tier 1, Table 2.1-1.

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.

COL information or action items: See Section 2.0.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review other than those discussed above.

2.0.3 Regulatory Basis

The relevant requirements of the NRC's regulations for these areas of review, and the associated acceptance criteria, are given in Section 2.0 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," and are summarized below. Review interfaces with other Standard Review Plan (SRP) sections can be found in Section 2.0 of NUREG-0800.

1. 10 CFR 52.47(a)(1), "Contents of Applications; Technical Information," which requires a DC applicant to provide site parameters postulated for the design. However, DC applications do not contain general descriptions of site characteristics because this information is site-specific and is addressed by the COL applicant that references the US-APWR in the COL FSAR.

2. 10 CFR Part 100, as it relates to the siting factors and criteria for determining an acceptable site.

The acceptance criteria adequate to meet the above requirements are provided for information only since they apply to a COL applicant's FSAR Section 2.0:

1. The acceptance criteria associated with specific site characteristics/parameters and site-related design characteristics/parameters are provided in the related Chapter 2 of NUREG-0800 or other referenced SRP sections.

2. 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 provides 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 NRC staff reviewed the DCD using the review procedures described in Section 2.0 of NUREG-0800. The NRC staff based its evaluation of the US-APWR site-related design parameters on a review of the US-APWR DCD Chapter 2, "Site Characteristics". The application addresses 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 evaluation sections. As described more fully below, the staff found that the postulated site parameters of the US-APWR design, as set forth in DCD, Tier 1, Table 2.1-1 and DCD 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

The following is a list of item numbers and descriptions from Table 1.8-2 of the DCD:

Table 2.0-2
US-APWR Combined License Information Items

Item No.	Description	Section	Action Required By COL Applicant	Action Required By COL Holder
	There are none for Section 2.0.			

2.0.6 Conclusions

As set forth above, the NRC 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 more fully below, the staff concludes that the applicant has addressed the site characteristics that establish DC site parameters and thus meets the requirements of 10 CFR 52.47(a)(1).

The applicant has selected the site-related design characteristics and site parameters referenced in Safety Evaluation Report (SER) Section 2.0.2 above for plant design inputs, a subset of which is included as Tier 1 information. The staff agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL application because the staff compared the US-APWR site parameter values to the site characteristic values identified in the site safety analysis reports (SSAR) for the first four docketed early site permit (ESP) applications (i.e., North Anna, Grand Gulf, Clinton, and Vogtle), which have been approved by the NRC staff. Accordingly the staff concludes that, except for the open items listed throughout Chapter 2 of this report, the postulated site parameters meet the requirements of 10 CFR 52.47(a)(1).

2.1 Geography and Demography

2.1.1 Introduction

The site location and description in DCD Section 2.1.1 describes the site location and description information to be provided by a COL applicant concerning the site boundaries and location of the site with respect to prominent natural and manmade features. The COL applicant is to provide information concerning 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) 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 within the “Contents of Application” sections of the applicable Subparts to 10 CFR Part 52.

The exclusion area authority and control in DCD Section 2.1.2 describes the site-specific information to be provided by a COL applicant justifying its legal authority to determine and control activities within the designated exclusion area, as provided in the COL application. The COL applicant is to provide information concerning the following specific areas: (1) 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 in the event of an emergency, (3) establish 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 within the “Contents of Application” sections of the applicable Subparts to 10 CFR Part 52.

The population distribution in DCD Section 2.1.3 describes information concerning the population distribution in the vicinity of the proposed site to be provided by a COL applicant. The COL applicant is to provide information about: (1) population in the site vicinity, including transient populations; (2) population in the exclusion area; (3) whether appropriate protective measures could be taken on behalf of the populace in the specified low-population zone (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 one and one-third 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 given in Regulatory Position C.4 of Regulatory Guide (RG) 4.7; and (6) any additional information requirements prescribed within the "Contents of Application" sections of the applicable Subparts to 10 CFR Part 52.

Since DCD Section 2.1.4, "Combined License Information," only identifies DCD Section 2.1 related COL information items, which are listed in US-APWR DCD Tier 2, Table 1.8-2, "Compilation of All Combined License Applicant Items for Chapters 1-19," no technical evaluation is needed.

2.1.2 Summary of Application

Site Location and Description, DCD Section 2.1.1

DCD Tier 1: There are no DCD Tier 1 entries for this area of review.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the site location and description information required of a COL applicant in Section 2.1.1, summarized here in part, as follows:

> The site location and description in DCD Section 2.1.1 requires that a COL applicant include the following site-specific information in its application: 1) plant and site property lines; 2) location and orientation of principal plant structures within the site area; 3) location of any industrial, military, or transportation facilities and commercial, institutional, recreational, or residential structures within the site area; 4) highways, railroads, and waterways that traverse or are adjacent to the site; and 5) prominent natural and manmade features in the site area.

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

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

COL information or action items: See Section 2.1.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Exclusion Area Authority and Control, DCD Section 2.1.2

DCD Tier 1: There are no DCD Tier 1 entries for this area of review.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the exclusion area authority and control information required of a COL applicant in Section 2.1.2, summarized here in part, as follows:

> The exclusion area authority and control in DCD Section 2.1.2 describes the type of information about the plant exclusion area that COL applicants must provide. The COL applicant's site-specific information on the exclusion area includes the size of the area, and the exclusion area authority and control. Also, non-related plant activities that occur, or could potentially occur, within the exclusion area boundary (EAB), if any, are to be described, and their effects on plant operations and safety evaluated.

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

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

COL information or action items: See Section 2.1.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no other US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no other site interface requirements associated with this area of review.

Population Distribution, DCD Section 2.1.3

DCD Tier 1: There are no DCD Tier 1 entries for this area of review.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the population distribution information required of a COL applicant in Section 2.1.3, summarized here in part, as follows:

> The population distribution information in DCD Section 2.1.3 describes the information that COL applicants are to provide on population in the vicinity of the proposed plant. The COL applicant's site-specific information regarding population distribution is to be based on the latest census data. Also, the population is to be projected through the anticipated life of the plant with the bases of the projections and methodology and sources used to obtain the data provided.

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

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

COL information or action items: See Section 2.1.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

2.1.3 Regulatory Basis

The relevant requirements of the NRC's regulations for these areas of review, and the associated acceptance criteria, are given in Sections 2.1.1, 2.1.2, and 2.1.3 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," and are summarized below. Review interfaces with other SRP sections can be found in Sections 2.1.1, 2.1.2, and 2.1.3 of NUREG-0800.

1. 10 CFR 52.47(a)(1), "Contents of Applications; Technical Information," which requires a DC applicant to provide site parameters postulated for the design. However, DC applications do not contain general descriptions of site characteristics because this information is site-specific and is addressed by the COL applicant that references the US-APWR DC. There are no postulated site parameters for a DC related to Sections 2.1.1, 2.1.2 and 2.1.3 of NUREG-0800.

2. This regulatory basis element is provided for information only since it applies to a COL applicant's FSAR Sections 2.1.1 and 2.1.2: 10 CFR Part 50 and 10 CFR Part 52, as they relate to the inclusion in the COL FSAR of a detailed description and safety assessment of the site on which the facility is to be located, with appropriate attention to features affecting facility design (10 CFR 50.34(a)(1), 10 CFR 52.17(a)(1), and 10 CFR 52.79(a)(1)). (Applies to DCD Sections 2.1.1 and 2.1.2 only.)

3. This regulatory basis element is provided for information only since it applies to a COL applicant's FSAR Section 2.1.1. 10 CFR Part 100, as it relates to the following: (1) defining an exclusion area and setting forth requirements regarding activities in that area (10 CFR 100.3); (2) addressing and evaluating factors that are used in determining the acceptability of the site as identified in 10 CFR100.20(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 identified in 10 CFR 50.34(a)(1), as it relates to 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. (Applies to DCD Section 2.1.1 only.)

4. This regulatory basis element is provided for information only since it applies to a COL applicant's FSAR Section 2.1.2. 10 CFR Part 100, as it relates to the following: (1) defining an exclusion area and setting forth requirements regarding activities in that area (10 CFR 100.3 and 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(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. (Applies to DCD Section 2.1.2 only.)

5. This regulatory basis element is provided for information only since it applies to a COL applicant's FSAR Section 2.1.3. 10 CFR 50.34(a)(1), as it relates to consideration of the site evaluation factors identified in 10 CFR 100.3, 10 CFR Part 100 (including consideration of population density), 10 CFR 52.17, 10 CFR 52.47, and 10 CFR 52.79, as they relate to provision by the applicant in the SAR of the existing and projected future population profile of the area surrounding the site. (Applies to DCD Section 2.1.3 only.)

6. This regulatory basis element is provided for information only since it applies to a COL applicant's FSAR Section 2.1.3. 10 CFR 100.20 and 10 CFR 100.21, as they relate to determining the acceptability of a site for a power reactor. In 10 CFR 100.3, 10 CFR 100.20(a), and 10 CFR 100.21(b), the NRC provides definitions and other requirements for determining an exclusion area, LPZ, and population center distance. (Applies to DCD Section 2.1.2 only.)

Acceptance criteria adequate to meet the above requirements are provided for information only since they apply to a COL applicant's FSAR Sections, as described below:

1. This acceptance criterion is provided for information only since it applies to a COL applicant's FSAR Section 2.1.1. (Applies to DCD Section 2.1.1 only.)

   - Specification of Location: The information submitted by the COL applicant is adequate and meets the requirements of 10 CFR 50.34(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 COL 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 of 10 CFR 50.34(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 (in Sections 2.1.2 and 2.1.3 and Chapter 15 of NUREG-0800) that the applicant has met the requirements of 10 CFR 50.34(a)(1) and 10 CFR Part 100.

2. This acceptance criterion is provided for information only since it applies to a COL applicant's FSAR Section 2.1.2. (Applies to DCD Section 2.1.2 only.)

   - Establishment of Authority: The information submitted by the COL applicant is adequate and meets the requirements of 10 CFR 50.33, 10 CFR 50.34(a)(1), 10 CFR 52.17, 10 CFR 52.47, 10 CFR 52.79, and 10 CFR Part 100 if it provides sufficient detail to enable the staff to evaluate the COL applicant's legal authority within the designated exclusion area.

- Exclusion or Removal of Personnel and Property: The information submitted by the COL applicant is adequate and meets the requirements of 10 CFR 50.33, 10 CFR 50.34(a)(1), 10 CFR 52.17, 10 CFR 52.17, 10 CFR 52.47, 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 COL applicant is adequate and meets the requirements of 10 CFR 50.33, 10 CFR 50.34(a)(1), 10 CFR 52.17, 10 CFR 52.47, 10 CFR 52.79, and 10 CFR Part 100 if it provides sufficient detail to enable the staff to evaluate the COL applicant's legal authority over all activities within the designated exclusion area.

3. This acceptance criterion is provided for information only since it applies to a COL applicant's FSAR Section 2.1.3. (Applies to DCD Section 2.1.3 only.)

   - Population Data: The population data supplied by the COL applicant in the Safety Analysis Report (SAR) is 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 five years thereafter, in the geographical format given in Section 2.1.3 of RG 1.70 and in accordance with DG-1145; (2) the SAR describes the methodology and sources used to obtain the population data, including the projections; (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.

   - LPZ: The specified LPZ is acceptable if it is determined 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 one and one-third times the distance from the reactor to the outer boundary of the LPZ.

   - Population Density: If the population density exceeds the guidelines given in Regulatory Position C.4 of RG 4.7, the applicant must give special attention to the consideration of alternative sites with lower population densities.

2.1.4 Technical Evaluation

Site Location and Description, DCD Section 2.1.1

The applicant stated that a COL applicant referencing the US-APWR DC will address the site-specific information pertaining to the site location and description as a part of COL 2.1(1) information item that includes the following:

- 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 independent evaluations of the exclusion area authority and control (Section 2.1.2 of NUREG-0800), the surrounding population (Section 2.1.3 of NUREG-0800), and nearby manmade hazards (Section 2.2.3 of NUREG-0800), and

- 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 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 on the plant of accidents on these transportation routes (Section 2.2.3 of NUREG-0800.)

However, the DC applications do not include this type of information as this is site-specific and will be addressed by the COL applicant in the COL FSAR as a part of COL 2.1(1) information item.

Exclusion Area Authority and Control, DCD Section 2.1.2

The applicant stated that a COL applicant referencing the US-APWR DC will address the site-specific information pertaining to exclusion area authority and control as a part of COL 2.1(1) information item. The specific criteria acceptable to meet the relevant requirements are addressed in Section 2.1.2 of NUREG-0800, which typically involves reviewing: (1) the COL applicant's legal authority to determine all activities within the designated exclusion area, (2) the COL applicant's authority and control in excluding or removing personnel and property in the event of an emergency, and (3) proposed or permitted activities in the exclusion area unrelated to operation of the reactor to ensure they do not result in a significant hazard to public health and safety.

However, the DC applications do not include this type of information as this is site-specific and will be addressed by the COL applicant in the COL FSAR as part of COL 2.1(1) information item.

Population Distribution, DCD Section 2.1.3

The applicant stated that a COL applicant referencing the US-APWR DC will address the site-specific information pertaining to population distribution as a part of COL 2.1(1) information item. The specific criteria acceptable to meet the relevant requirements are addressed in Section 2.1.3 of NUREG-0800, which typically involves reviewing:

- data about the population in the site vicinity,

- the population in the exclusion area,
- the LPZ to determine if 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 if this boundary is at least one and one-third times the distance from the reactor to the outer boundary of the LPZ, and
- The population density in the site vicinity, including weighted transient population at the time of initial site approval and within five years thereafter, to determine if it exceeds 500 persons per square mile averaged over any radial distance out to 20 miles.

However, the DC applications do not include this type of information as this is site-specific and will be addressed by the COL applicant in the COL FSAR as part of COL 2.1(1) information item.

2.1.5 Combined License Information Items

The following is a list of item numbers and descriptions from Table 1.8-2 of the DCD

Table 2.1-1
US-APWR Combined License Information Items

Item No.	Description	Section	Action Required By COL Applicant	Action Required By COL Holder
2.1(1)	The COL applicant is to describe the site geography and demography including the specified site parameters.	2.1.4	Y	

2.1.6 Conclusions

Site Location and Description, DCD Section 2.1.1

As set forth above, the applicant has stated that the COL applicant that references the US-APWR DC will provide the site-specific information. Since this information is site-specific, the applicant's statement in the DCD that the COL applicant is to supply this site-specific information in accordance with Section 2.1.1 of NUREG-0800 as a part of COL 2.1(1) information item is acceptable. Therefore, the staff, for the reasons given above; concludes that as this information is site-specific it will be addressed by the COL applicant; that references the US-APWR DC; and therefore, would be reviewed at the time of the COL application review. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics of the plant specified in the COL Application fall within the design parameters specified in the DCD. Therefore, the requirement that the COL applicant address these is acceptable.

There are no postulated site parameters for a DC related to this section. The site location and description is site-specific and will be addressed by the COL applicant as a part of COL 21(1) information item.

Exclusion Area Authority and Control, DCD Section 2.1.2

As set forth above, the applicant has stated that the COL applicant will provide the site-specific information. Since this information is site-specific, the applicant's statement in the DCD that the COL applicant is to supply this site-specific information in accordance with Section 2.1.2 of NUREG-0800 as a part of COL 2.1(1) information item is acceptable. Therefore, the staff, for the reasons given above, concludes that as this information is site-specific, it will be addressed by the COL applicant; and therefore, would be reviewed at the time of the COL application review. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics of the plant specified in the COLA fall within the design parameters specified in the DCD. Therefore, the requirement that the COL applicant address these is acceptable.

Exclusion area authority and control is site-specific and will be addressed by the COL applicant as a part of COL 2.1(1) information item.

Population Distribution, DCD Section 2.1.3

As set forth above, the applicant has stated that the COL applicant will provide the site-specific information. Since this information is site-specific, the applicant's statement in the DCD that the COL applicant is to supply this site-specific information in accordance with Section 2.1.3 of NUREG-0800 as a part of COL 2.1(1) information item is acceptable. Therefore, the staff for the reasons given above concludes that as this information is site-specific, it will be addressed by the COL applicant and, therefore, would be reviewed at the time of the COL application review. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics of the plant specified in the COLA fall within the design parameters specified in the DCD. Therefore, the requirement that the COL applicant address these is acceptable.

The population distribution is site-specific and will be addressed by the COL applicant as a part of COL 2.1(1) information item.

2.2 Nearby Industrial, Transportation, and Military Facilities

2.2.1 Introduction

DCD Section 2.2.1 describes the locations and routes information to be collected by a COL applicant regarding site-specific 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 COL applicant is to provide sufficient information concerning the presence and magnitude of potential external hazards so that the reviews and evaluations described in Sections 2.2.3, 3.5.1.5, and 3.5.1.6 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," can be performed. The COL applicant is to provide the following information: (1) the locations of, and separation distances 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 prescribed within the "Contents of Application" sections of the applicable Subparts of 10 CFR Part 52.

DCD Section 2.2.2 describes the site-specific information to be collected by a COL applicant regarding the primary function of each industrial, transportation, and military facility identified in DCD Section 2.2.1 and the nature of the hazards each presents to the proposed plant.

The evaluation of potential accidents in DCD Section 2.2.3 describes the probability analyses of potential accidents involving hazardous materials or activities on site and in the vicinity of the proposed site to be provided by a COL applicant. The COL applicant's evaluation is to cover the following specific areas: (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 (aircraft routes, highways, railways, navigable waters, and pipelines). Each hazard review area includes consideration of the following principal types of hazards: (1) toxic vapors or gases and their potential for incapacitating nuclear plant control room operators; (2) 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 or any other gas) with a potential for ignition and explosion; (3) missile effects attributable to mechanical impacts, such as aircraft impacts, explosion debris, and impacts from waterborne items such as barges; and (4) thermal effects attributable to fires.

Since DCD Section 2.2.4, "Combined License Information," only identifies DCD Section 2.2 related COL information items, which are listed in US-APWR DCD Tier 2, Table 1.8-2, "Compilation of All Combined License Applicant Items for Chapters 1-19," no technical evaluation is needed.

2.2.2 Summary of Application

Locations and Routes, DCD Section 2.2.1

DCD Tier 1: There are no DCD Tier 1 entries for this area of review.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the locations and routes information required of a COL applicant in DCD Section 2.2.1, summarized here in part, as follows:

> DCD Section 2.2.1 describes the site-specific information related to the location and routes for nearby industrial, transportation, and military facilities that COL applicants must provide to identify potential hazards in the site vicinity. The COL applicant is to provide site-specific maps showing the location and distance from the proposed plant to the nearby significant facilities.

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

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

COL information or action items: See Section 2.2.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Descriptions, DCD Section 2.2.2

DCD Tier 1: There are no DCD Tier 1 entries for this area of review.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the nearby industrial, transportation, and military facilities information required of a COL applicant in Section 2.2.2, summarized here in part, as follows:

> The descriptions in DCD Section 2.2.2 describes the type of information about nearby industrial, transportation, and military facilities and the nature of the hazards they present that COL applicants must provide. The facilities are to be described in detail, including their primary function, major products if applicable, and the number of persons employed. Site-specific information with particular emphasis on hazardous materials transportation is to be provided for: 1) any navigable waterways adjacent to the site, 2) nearby major highways or other roadways, and 3) nearby railroads. Detailed information on aircraft activities in the vicinity of the proposed plant site and the associated runway facilities is also to be provided by the COL applicant.

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

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

COL information or action items: See Section 2.2.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Evaluation of Potential Accidents, DCD Section 2.2.3

DCD Tier 1: There are no DCD Tier 1 entries for this area of review.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the evaluation of potential accidents required of a COL applicant in Section 2.2.3, summarized here in part, as follows:

> The evaluation of potential accidents in DCD Section 2.2.3 describes the evaluation that COL applicants are to provide to determine if potential off-site accidents (design basis events [DBEs]) have potential consequences serious enough to affect the safety of the proposed plant.
>
> The determination of DBEs by the COL applicant is to follow a probabilistic and predictive approach to identify a 10^{-7} per year or greater occurrence rate with potential consequences serious enough to affect the safety of the plant. Where data may not be available to permit accurate calculations, a 10^{-6} per year occurrence rate can be utilized when combined with reasonable qualitative arguments. The COL applicant will also perform a site-specific analysis of the effects of DBEs on the safety related structures, systems, and components (SSCs) of the proposed plant.

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

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

COL information or action items: See Section 2.2.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

2.2.3 Regulatory Basis

The relevant requirements of the NRC's regulations for these areas of review, and the associated acceptance criteria, are given in Sections 2.2.1, 2.2.2, and 2.2.3 of NUREG-0800,

the SRP, and are summarized below. Review interfaces with other SRP sections can be found in Sections 2.2.1, 2.2.2, and 2.2.3 of NUREG-0800.

1. 10 CFR 52.47(a)(1), "Contents of Applications; Technical Information," which requires a DC applicant to provide site parameters postulated for the design. However, DC applications do not provide general descriptions of site characteristics because this information is site-specific and is addressed by the COL applicant. There are no postulated site parameters for a DC related to Sections 2.2.1, 2.2.2, and 2.2.3 of NUREG-0800.

2. This regulatory basis element is provided for information only since it applies to a COL applicant's FSAR Sections 2.2.1 and 2.2.2. 10 CFR 100.20(b), which requires that the nature and proximity of man-related hazards (e.g., airports, dams, transportation routes, military and chemical facilities) be evaluated to establish site parameters for use in determining whether plant design can accommodate commonly occurring hazards, and whether the risk of other hazards is very low. (Applies to DCD Sections 2.2.1 and 2.2.2 only.)

3. This regulatory basis element is provided for information only since it applies to a COL applicant's FSAR Sections 2.2.1, 2.2.2, and 2.2.3. 10 CFR 52.79(a)(1)(iv), as it relates 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 of 10 CFR 52.79(a)(1)(vi), as it relates to the compliance with 10 CFR Part 100. (Applies to DCD Sections 2.2.1, 2.2.2 and 2.2.3.)

Acceptance criteria are adequately provided in the following RGs to meet the above requirements:

1. This acceptance criterion is provided for information only since it applies to a COL applicant's FSAR Section 2.2.1. Data in the SAR adequately describe the locations and distances from the plant of nearby industrial, military, and transportation facilities and that such data are in agreement with data obtained from other sources, when available. (Applies to DCD Section 2.2.1 only.)

2. This acceptance criterion is provided for information only since it applies to a COL applicant's FSAR Section 2.2.2. 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 of Sections 2.2.1 and 2.2.2 of NUREG-0800. (Applies to DCD Section 2.2.2 only.)

3. This acceptance criterion is provided for information only since it applies to a COL applicant's FSAR Section 2.2.2. Sufficient statistical data with respect to hazardous materials are provided to establish a basis for evaluating the potential hazards to the plant or plants considered at the site. (Applies to DCD Section 2.2.2 only.)

4. This acceptance criterion is provided for information only since it applies to a COL applicant's FSAR Section 2.2.3. Event Probability: The identification of DBEs resulting from the presence of hazardous materials or activities in the

vicinity of the plant or plants of specified type is acceptable if all postulated types of accidents are included for which the expected rate of occurrence of potential exposures resulting in radiological dose in excess of the 10 CFR 50.34(a)(1) limits as it relates to the requirements of 10 CFR Part 100 is estimated to exceed the NRC staff objective of an order of magnitude of 10^{-7} per year. (Applies to DCD Section 2.2.3 only.)

5. This acceptance criterion is provided for information only since it applies to a COL applicant's FSAR Section 2.2.3. DBEs: The effects of DBEs have been adequately considered, in accordance with 10 CFR 100.20(b), if analyses of the effects of those accidents on the safety-related features of the plant or plants of specified type have been performed and measures have been taken (e.g., hardening, fire protection) to mitigate the consequences of such events. (Applies to DCD Section 2.2.3 only.)

2.2.4 Technical Evaluation

Locations and Routes, DCD Section 2.2.1

The applicant stated that a COL applicant referencing a US-APWR DC will address the site-specific information pertaining to the identification of potential hazards stemming from the nearby industrial, transportation, and military facilities within the site vicinity. The specific criteria acceptable to meet the relevant requirements are addressed in Sections 2.2.1 and 2.2.2 of NUREG-0800, which typically involves reviewing:

- The locations and distances of industrial, military, and transportation facilities in the vicinity of 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, in order to identify possible hazards; and
- Statistical data with respect to hazardous materials in order to establish a basis for evaluating the potential hazard to the plant considered at the site.

However, the DC applications do not include this type of information as this is site-specific and will be addressed by the COL applicant that references the US-APWR DC as a part of COL 2.2(1) information item.

Descriptions, DCD Section 2.2.2

As referred in Section 2.2.1, the industrial, transportation, and military facilities are site-specific information and will be addressed by the COL applicant as a part of COL 2.2(1) information item. This information will describe the primary function of each facility and the nature of the hazards it presents.

Evaluation of Potential Accidents, DCD Section 2.2.3

The applicant stated that a COL applicant referencing a US-APWR DC will address the site-specific information pertaining to the evaluation of potential accidents within the plant vicinity.

The specific information that relates to the evaluation of potential accident situations in the vicinity of the plant stemming from those potential hazards identified in Sections 2.2.1 and 2.2.2 of NUREG-0800 that have a probability of occurrence greater than 10^{-7} per year are:

- 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, or
- release of toxic chemicals.

However, the DC applications do not include this type of information as this is site-specific and will be addressed by the COL applicant that references the US-APWR DC as a part of COL 2.2(1) information item.

2.2.5 Combined License Information Items

The following is a list of item numbers and descriptions from Table 1.8-2 of the DCD:

Table 2.2-1
US-APWR Combined License Information Items

Item No.	Description	Section	Action Required By COL Applicant	Action Required By COL Holder
2.1(1)	The COL applicant is to describe nearby industrial, transportation, and military facilities within five miles of the site, or at greater distances as appropriate based on their significance. The COL applicant is to establish the presence of potential hazards, determine whether these accidents are to be considered as DBEs, and the design parameters related to the accidents determined as DBEs.	2.2.4	Y	

2.2.6 Conclusions

Locations and Routes, DCD Section 2.2.1

As set forth above, the applicant has stated that the COL applicant that references the US-APWR DC will provide the site-specific information in the COL FSAR. Since this information is site-specific, the applicant's statement in the DCD that the COL applicant is to supply this site-specific information in accordance with Sections 2.2.1 and 2.2.2 of NUREG-0800 as a part of COL 2.2(1) information item is acceptable. This information is site-specific, and will be addressed by the COL applicant that references the US-APWR DC in the COL FSAR, and, therefore, would be reviewed at the time of the COL application review. The staff concludes that

the information provided by the applicant is acceptable. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics of the plant specified in the COLA fall within the design parameters specified in the DCD. Therefore, the requirement that the COL applicant address these issues in the COL FSAR is acceptable.

The identification of potential hazards in the site vicinity is site-specific and will be addressed by the COL applicant that references the US-APWR DC as a part of COL 2.2(1) information item.

Descriptions, DCD Section 2.2.2

The identification of potential hazards in the site vicinity is site-specific and will be addressed by the COL applicant that references the US-APWR DC as a part of COL 2.2(1) information item.

Evaluation of Potential Accidents, DCD Section 2.2.3

As set forth above, the applicant's statement in the DCD that the COL applicant that references the US-APWR DC will provide the site-specific information in the COL FSAR in accordance with Section 2.2.3 of NUREG-0800 as a part of COL 2.2(1) information item, is acceptable. The staff concludes that because the required information is site-specific and will be addressed by the COL applicant in the COL FSAR and, therefore, would be reviewed at the time of the COL application review, the applicant's statement is acceptable. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics of the plant specified in the COLA fall within the design parameters specified in the DCD. Therefore, the requirement that the COL applicant address these issues in the COL FSAR is acceptable.

The evaluation of potential accidents is site-specific and will be addressed by the COL applicant that references the US-APWR DC as a part of COL 2.2(1) information item.

2.3 Meteorology

2.3.1 Introduction

DCD Section 2.3.1 describes the regional climatology information to be collected by a COL applicant that references the US-APWR DC during site-specific and regional investigations. The purpose of the required COL application site and regional investigations is to determine the averages and extremes of climatic conditions and regional meteorological phenomena that could affect the safe design and siting of the plant. DCD Section 2.3.1 also provides general information on the design-basis extreme climatic conditions used to design the US-APWR plant to which the COL site-specific and regional extreme climatic conditions will be compared.

DCD Section 2.3.2 describes by reference the site-specific information to be collected by a COL applicant providing local site meteorological characteristics, the assessment of the potential influence of the proposed plant and its facilities on local meteorological conditions, and a topographical description of the site and its surroundings. Site-specific local meteorology is to be based on long-term data from nearby representative locations and shorter-term data from onsite instrumentation.

DCD Section 2.3.3 describes by reference the site-specific requirements for pre-operational and operational programs for meteorological measurements to be provided by a COL applicant. Reference is made to RG 1.23, “Meteorological Monitoring Programs for Nuclear Power Plants,” for guidance on acceptable onsite meteorological programs. The COL applicant may use other sources of meteorological data in determining airflow trajectories from the site to a distance of 50 miles if detailed information on the measurements made, locations and elevations of measurements, exposure of instruments, descriptions of instruments used, and instrument performance specifications is provided.

DCD Section 2.3.4 describes the site-specific, conservative short-term, atmospheric dispersion factor (χ/Q) estimates at the EAB, the outer boundary of the LPZ, the main control room (MCR), and the technical support center (TSC) for postulated design-basis accident, (DBA) radioactive airborne releases that COL applicants are to provide. These estimates are for appropriate time periods up to 30 days after an accident. The COL applicant short-term site-specific χ/Q values will be compared to the US-APWR DCD bounding χ/Q values for acceptability.

DCD Section 2.3.5 describes the site-specific, long-term χ/Q and deposition factor (D/Q) estimates for routine releases of radiological effluents to the atmosphere that COL applicants are to provide. The COL applicant is to characterize the site-specific atmospheric transport and diffusion conditions necessary for estimating radiological consequences of the routine release of radioactive materials to the atmosphere. The COL applicant long-term, site-specific χ/Q and D/Q values will be compared to the US-APWR DCD bounding χ/Q and D/Q values for acceptability.

Since DCD Section 2.3.6, “Combined License Information,” only identifies DCD Section 2.3-related COL information items, which are listed in US-APWR DCD Tier 2, Table 1.8-2, “Compilation of All Combined License Applicant Items for Chapters 1-19,” and are required to be addressed by a COL applicant that references the US-APWR DC, no technical evaluation is needed.

2.3.2 Summary of Application

Regional Climatology, DCD Section 2.3.1

DCD Tier 1: The Tier 1 information associated with this section is found in DCD Tier 1, Section 2.1, Site Parameters. The key site parameters of normal and extreme winter precipitation roof loads, 48-hour probable maximum winter precipitation (PMWP), tornado maximum wind speed and radius of maximum rotational speed, tornado maximum pressure drop and rate of pressure drop, extreme wind speed (other than in tornado), and high and low ambient design air temperatures at zero-, one-, and five-percent exceedance for the US-APWR plant are provided in Table 2.1-1 of Section 2.1. A COL applicant's site for construction of a US-APWR will be acceptable if its site-specific values for the previously listed parameters are within the key site parameter values shown in Table 2.1-1.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the regional climatology information required of a COL applicant that references the US-APWR DC in Section 2.3.1, summarized here in part, as follows:

> DCD Section 2.3.1 describes, by reference to Section 2.3.1 of the SRP, the site-specific regional climatology, including general climate conditions and frequency of severe weather phenomena that COL applicants are to provide to determine the most severe climatic conditions at the site. DCD Section 2.3.1 makes reference to DCD Section 3.3.2.1 for a complete summary of the US-APWR design-basis tornado. The US-APWR non-tornado, design-basis, extreme wind speed is based on criteria described in DCD Section 3.3.1.1. The US-APWR design-basis ambient high and low temperatures with annual exceedance values of zero and one percent are based on the Electric Power Research Institute (EPRI) document, "Advanced Light Water Reactor Utility Requirements Document," March 1999, and conservative estimates of historical high and low values for potential US-APWR sites. The applicant states that the key site parameters bound approximately 75 to 80 percent of the continental United States (U.S.) (excluding Alaska).
>
> DCD Tier 2, Table 2.0-1 provides the US-APWR design basis discussed in DCD Section 2.3.1 and specifies the normal and extreme winter precipitation roof loads, 48 hour PMWP, tornado maximum wind speed and radius of maximum rotational speed, tornado maximum pressure drop and rate of pressure drop, extreme wind speed (other than in tornado), high and low ambient design air temperatures for zero- and one-percent annual exceedance.

For the specific US-APWR key site parameters that are associated with regional climatology, refer to DCD Tier 1, Table 2.1-1 and Tier 2, Table 2.0-1.

No US-APWR ultimate heat sink (UHS) design-basis meteorological conditions are provided since they are dependent on the selection of UHS type as discussed in DCD Section 9.2.5.

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

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

COL information or action items: See Section 2.3.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Local Meteorology, DCD Section 2.3.2

DCD Tier 1: There are no DCD Tier 1 entries for this area of review.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the local meteorology information required of a COL applicant in Section 2.3.2, summarized here in part, as follows:

> The local meteorology in DCD Section 2.3.2 describes by reference to Section 2.3.2 of NUREG-0800, the site-specific information needed on local meteorology, which is based on long-term data from nearby representative locations and shorter-term onsite data that COL applicants are to provide. There are no postulated US-APWR site parameters for DCD Section 2.3.2.

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

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

COL information or action items: See Section 2.3.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Onsite Meteorological Measurements Program, DCD Section 2.3.3

DCD Tier 1: There are no DCD Tier 1 entries for this area of review.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the onsite meteorological measurements program required of a COL applicant in Section 2.3.3, summarized here in part, as follows:

> DCD Section 2.3.3 describes by reference to RG 1.23 the site-specific pre-operational and operational programs for meteorological measurements that COL applicants are to provide. RG 1.23 provides guidance on acceptable onsite meteorological programs. Any deviations from the RG 1.23 guidance are to be identified by the COL applicant and justified on a site-specific basis.

In addition, DCD Section 2.3.3 states the COL applicant is to obtain additional meteorological data from National Weather Service (NWS) stations and other meteorological programs, such as other nuclear facilities, university and private meteorological programs. This data may be used by the COL applicant in determining airflow trajectories from the site to a distance of 50 miles if detailed information on the measurements made, locations and elevations of measurements, exposure of instruments, descriptions of instruments used, and instrument performance specifications is provided.

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

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

COL information or action items: See Section 2.3.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Short-Term Atmospheric Dispersion Estimates for Accidental Releases, DCD Section 2.3.4

DCD Tier 1: The Tier 1 information associated with this section is found in DCD Tier 1 Section 2.1, Site Parameters. The key site parameters [χ/Q values] for short-term atmospheric dispersion estimates for accidental releases for the US-APWR plant are provided in Table 2.1-1 of Section 2.1. A COL applicant's site for construction of a US-APWR will be acceptable if its site-specific χ/Q values are within the χ/Q key site parameter values shown in Table 2.1-1. Table 2.1-1 provides bounding χ/Q parameters at a US-APWR site's EAB, at the outer boundary of the LPZ, and at the MCR and TSC for postulated accidental radioactive airborne releases for time periods up to 30 days after an accident.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the process for determining the short-term atmospheric dispersion estimates for accidental releases required of a COL applicant in Section 2.3.4, summarized here in part, as follows:

DCD Section 2.3.4 describes by reference to Section 2.3.4 of NUREG-0800 how a COL applicant is to provide conservative site-specific short-term χ/Q values at the site's EAB, at the outer boundary of the LPZ, and at the MCR and TSC for postulated accidental radioactive airborne releases. DCD Section 2.3.4 also states that if a COL applicant's site-specific χ/Q values are outside the χ/Q site parameter values, then the COL applicant is to demonstrate how the dose reference values in 10 CFR 52.79(a)(1)(vi) and the control room dose limits in 10 CFR Part 50, Appendix A, general design criteria (GDC) 19 are met using site-specific χ/Q values.

DCD Section 2.3.4 also discusses that the short-term χ/Q key site parameter values provided in DCD Tier 2, Table 2.0-1 are typical of most areas of the U.S. where a US-APWR would be sited. The US-APWR EAB χ/Q key site parameter value was selected to envelope most values at the corresponding EAB distance of 0.8 km (0.5 mi) at many existing plants and the US-APWR LPZ χ/Q key site parameter values were selected to envelope most χ/Q values at many existing plants with LPZ distances of more than 1.6 km (1 mi). The US-APWR 0-8 hour MCR and TSC χ/Q key site parameter values were calculated based on the diffusion equations used in the ARCON96 atmospheric dispersion model (NUREG/CR-6331, Revision 1) assuming F stability and a wind speed of 1.0 meter per second and a multiplier to envelop the MCR and TSC χ/Q values of many existing plants. The US-APWR MCR and TSC χ/Q key site parameter values for the other time intervals (8 - 24 hours, 24 - 96 hours, and 96 - 720 hours) were calculated using the 0 - 8 hour χ/Q values and the long-term averaging correction factors presented in Section 4.4 of RG 1.194.

DCD Tier 2, Table 2.0-1 provides the US-APWR short-term χ/Q key site parameter values discussed in DCD Section 2.3.4 at the site EAB, at the outer boundary of the LPZ, and at the MCR and TSC. The necessary US-APWR data to calculate site-specific MCR and TSC χ/Q values are provided in DCD Tier 2, Tables 2.3-1 through 2.3-3 and Tables 2.3.4-1 through 2.3.4-7.

For the specific US-APWR key site parameters that are associated with short-term atmospheric dispersion estimates for accidental releases, refer to DCD Tier 1, Table 2.1-1 and Tier 2, Table 2.0-1.

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

TS: The TS associated with DCD Tier 2, Section 2.3.4 are given in DCD Tier 2, Chapter 16, Section 5.5.20.

COL information or action items: See Section 2.3.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Long-Term Atmospheric Dispersion Estimates for Routine Releases, DCD Section 2.3.5

DCD Tier 1: The Tier 1 information associated with this section is found in DCD Tier 1, Section 2.1, Site Parameters. The key site parameters [annual average χ/Q values and D/Q values] for long-term atmospheric dispersion estimates for routine releases for the US-APWR plant are provided in Table 2.1-1 of Section 2.1. A COL applicant's site for construction of a US-APWR will be acceptable if its site-specific estimates of annual average χ/Q values and D/Q values are within the long-term χ/Q and D/Q key site parameter values shown in Table 2.1-1.

Table 2.1-1 provides bounding maximum EAB and food production area annual average χ/Q values that are not to be exceeded. The D/Q value is a limit applicable to both EAB and offsite locations for the standard US-APWR plant.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the process for determining the long-term atmospheric dispersion estimates for routine releases required of a COL applicant in Section 2.3.5, summarized here in part, as follows:

> DCD Section 2.3.5 describes by reference to Section 2.3.5 of NUREG-0800 the site-specific atmospheric dispersion and deposition estimates for routine releases of radiological effluents to the atmosphere that COL applicants are to provide. The COL applicant is to characterize the site-specific atmospheric transport and diffusion conditions necessary for estimating radiological consequences of the routine release of radioactive materials to the atmosphere. DCD Section 2.3.5 also discusses that the long-term χ/Q key site parameter values bound approximately 70 percent of the sites with site boundaries located approximately 0.8 kilometers (0.5 miles) from the reactor. The COL applicant long-term site-specific χ/Q and D/Q values will be compared to the US-APWR DCD bounding χ/Q and D/Q values for acceptability.

Mitsubishi Heavy Industries, Inc. (MHI) used these US-APWR key site parameters to calculate: (1) annual average site boundary airborne concentrations to demonstrate compliance with Subpart D to 10 CFR Part 20, and (2) doses from routine airborne releases to demonstrate compliance with Appendix I to 10 CFR Part 50. DCD Tier 2, Section 11.3.3.1, describes these calculations.

DCD Tier 2, Table 2.0-1 provides the US-APWR EAB annual average χ/Q site key parameter value, offsite food production area annual average χ/Q key site parameter value, and the annual average D/Q key site parameter value for EAB and offsite locations.

For the specific US-APWR key site parameters that are associated with long-term atmospheric dispersion estimates for routine releases, refer to DCD Tier 1, Table 2.1-1 and Tier 2, Table 2.0-1.

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

TS: The TS associated with DCD Tier 2, Section 2.3.5 are given in DCD Tier 2, Chapter 16, Sections 5.5.1, 5.5.4, 5.6.1, and 5.6.2.

COL information or action items: See Section 2.5.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

2.3.3 Regulatory Basis

The relevant requirements of the NRC's regulations for these areas of review, and the associated acceptance criteria, are given in Sections 2.3.1, 2.3.2, 2.3.3, 2.3.4, and 2.3.5 of NUREG-0800 and are summarized below. Review interfaces with other SRP sections can be found in Sections 2.3.1, 2.3.2, 2.3.3, 2.3.4, and 2.3.5 of NUREG-0800.

1. 10 CFR 52.47(a)(1), "Contents of Applications; Technical Information," requires a DC applicant to provide site parameters postulated for the design. However, DC applications do not include general descriptions of site characteristics because this information is site-specific and is addressed by the COL applicant that references the DC in the COL FSAR. The postulated site parameters for a DC related to Sections 2.3.1, 2.5.4 and 2.5.5 of NUREG-0800 are to be representative of a reasonable number of sites that may be considered for a COL application and the DC applicant is to provide a basis for the site parameters. (Applies to DCD Sections 2.3.1, 2.3.4, 2.3.5.)

2. 10 CFR 52.47(a)(1), "Contents of Applications; Technical Information," requires a DC applicant to provide site parameters postulated for the design. However, DC applications do not include general descriptions of site characteristics because this information is site-specific and is addressed by the COL applicant in the COL FSAR. There are no postulated site parameters for a DC related to Sections 2.3.2 and 2.3.3 of NUREG-0800. (Applies to DCD Sections 2.3.2 and 2.3.3 only.)

3. 10 CFR Part 50, Appendix A, GDC 2, "Design Bases for Protection Against Natural Phenomena," requires, in part, that SSCs important to safety shall be designed to withstand the effects of natural phenomena, such as tornadoes and hurricanes without loss of capability to perform their safety functions. The design bases for these SSCs shall reflect, in part, appropriate 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. (Applies to DCD Section 2.3.1 only.)

4. Section 2.3.1 of NUREG-0800 states that the regional climatic conditions identified as site parameters for DC applications should include the following:

   - The weight of the 100 year return period snowpack and the weight of the 48 hour PMWP for use in determining the weight of snow and ice on the roofs of safety-related structures.

   - The UHS meteorological conditions resulting in the maximum evaporation and drift loss of water, minimum water cooling, and, if applicable, the potential for water freezing in the UHS water storage facility.

   - The tornado parameters (including maximum wind speed, translational speed, rotational speed, and maximum pressure differential with the associated time interval) to be used in establishing pressure and tornado missile loadings on SSCs important to safety.

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

- Ambient 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, ventilating, and air conditioning systems.

5. Interim staff guidance document COL/DC-ISG-7, "Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures," was issued subsequent to the publication of Section 2.3.1 of NUREG-0800 to clarify the staff's position on identifying winter precipitation events as site characteristics and site parameters for determining normal and extreme winter precipitation loads on the roofs of seismic Category I structures. (Applies to DCD Section 2.3.1 only.)

6. 10 CFR Part 50, Appendix A, GDC 19, "Control Room," with respect to the meteorological considerations used to evaluate the personnel exposures inside the control room during radiological and airborne hazardous material accident conditions. (Applies to DCD Section 2.3.4 only.)

7. 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. (Applies to DCD Section 2.3.4 only.)

8. Section 2.3.4 of NUREG-0800 states that the DC applicant should include EAB, LPZ, and MCR χ/Q values for the appropriate time periods in the list of site parameters. The DC application should also include figures and tables showing the design features that would be used by the COL applicant to generate MCR χ/Q values (e.g., intake heights, release heights, building cross-sectional areas, and distances to receptors).

9. 10 CFR Part 20, Subpart D, with respect to the atmospheric dispersion parameters used in demonstrating compliance with dose limits for individual members of the public. (Applies to DCD Section 2.3.5 only.)

10. 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 of Appendix I to 10 CFR Part 50, with respect to the atmospheric dispersion parameters used in determining that the numerical guides for design objectives and limiting conditions for operation meet the requirements that radioactive material in effluents released to unrestricted areas be kept as low as is reasonably achievable. (Applies to DCD Section 2.3.5 only.)

11. Section 2.3.5 of NUREG-0800 states that the DC applicant should include the maximum long-term (annual average) site boundary χ/Q and D/Q values in the list of site parameters.

Acceptance criteria adequate to meet the above requirements are explained in the following RGs:

1. RG 1.145, “Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants,” presents criteria for characterizing atmospheric dispersion conditions for evaluating the consequences of radiological releases to the EAB and LPZ. (Applies to DCD Section 2.3.4 only.)

2. RG 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants.” The tornado parameters should be based on RG 1.76. Any deviations from RG 1.76 should be identified by the applicant. (Applies to DCD Section 2.3.1 only.)

3. RG 1.194, “Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants,” presents criteria for characterizing atmospheric dispersion conditions for evaluating the consequences of radiological releases to the control room. RG 1.194 states that the ARCON96 atmospheric dispersion model (NUREG/CR-6331, Revision 1) is an acceptable methodology for assessing control room χ/Q values for use in MCR design-basis accident radiological analyses, subject to the provisions in RG 1.194. (Applies to DCD Section 2.3.4 only.)

4. RG 1.111, “Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors,” presents criteria for characterizing atmospheric dispersion and deposition conditions for evaluating the consequences of routine releases. (Applies to DCD Section 2.3.5 only.)

2.3.4 Technical Evaluation

Regional Climatology DCD Section 2.3.1

The staff reviewed the DCD in accordance with the guidance provided in Section 2.3.1 of NUREG-0800 to determine whether: (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 has been provided for each site parameter.

a. Winter Precipitation (for roof loading).

Revision 0 to DCD Tier 1, Table 2.1-1 and Tier 2, Table 2.0-1 presented two key site parameters related to winter precipitation: (1) 100 year snowpack maximum snow weight (roof) of 2.39 kPa (50 lbf/ft^2), and (2) weight of 48 hour PMWP of 2.39 kPa (50 lbf/ft^2). In RAI 02.03.01-16, the staff asked the applicant to identify the normal and extreme liquid and frozen precipitation events used in the design of roofs of safety-related structures in accordance with COL/DC-ISG-7. In response to RAI 02.03.01-16, dated September 10, 2008, the applicant provided revised winter precipitation key site parameters in DCD Tier 1, Table 2.1-1 and Tier 2, Table 2.0-1 as follows:

- a normal winter precipitation roof load of 2.39 kPa (50 lbf/ft^2),

- an extreme precipitation roof load (100 year snowpack maximum snow weight including contributing portion of either extreme frozen winter precipitation event or extreme liquid winter precipitation event) of 3.59 kPa (75 lbf/ft^2), and

- a 48 hour PMWP of 91.4 cm (36 inches).

The applicant also added footnotes to DCD Tier 1, Table 2.1-1 and Tier 2, Table 2.0-1 which state, in part:

- Footnote 11: The normal winter precipitation roof load is determined by converting ground snow load to a roof load based on the highest ground-level weight of the 100 year return period snowpack, the historical maximum snowpack, the 100 year return period snowfall, or the historical maximum snowfall event.

- Footnote 12: The extreme winter precipitation roof load is based on the sum of the normal ground level winter precipitation plus the highest weight at ground level resulting from either the extreme frozen winter precipitation event or the extreme liquid winter precipitation event.

- Footnote 13: The 48 hour PMWP is based on interpolation of 24-hour probable maximum precipitation (PMP) and 72 hour PMP data for the month of March.

The staff evaluated the applicant's response to RAI 02.03.01-16 and determined that the RAI is closed but there are two issues that remained unresolved. To address these issues, staff issued follow-up questions, RAI 02.03.01-17 and RAI 02.03.01-18.

In RAI 02.03.01-17, the staff noted that Footnote 12 is a more accurate description of the extreme winter precipitation roof load site parameter than that provided within the parenthesis of the parameter description provided in Tier 1 Table 2.1-1 and Tier 2 Table 2.0-1. Consequently, the staff asked the applicant to consider deleting the information within the parenthesis of the extreme winter precipitation roof load site parameter descriptions provided in Tier 1 Table 2.1-1 and Tier 2 Table 2.0-1. In its response to RAI 02.03.01-17, dated April 14, 2010, the applicant agreed to the changes suggested by the staff. Consequently, the response to RAI 02.03.01-17 is being tracked as a confirmatory item.

In RAI 02.03.01-18, the staff noted that Footnote 13 to DCD Tier 1, Table 2.1-1, and Footnote 13 to DCD Tier 2, Table 2.0-1 both state that the 48 hour PMWP is based on interpolation of 24 hour PMP and 72 hour PMP data for the month of March. Providing this information in the footnotes of these two tables could be interpreted by COL applicants that they should also define their 48 hour PMWP site characteristic values using data for the month of March, whereas the month of March may not be bounding for all sites. Consequently, the staff asked the applicant to consider deleting Footnote 13 from both tables and moving the information contained in the footnote to DCD Tier 2, Section 2.3.1. In its response to RAI 02.03.01-18, dated April 14, 2010, the applicant agreed to the changes suggested by the staff. The response to RAI 02.03.01-18 is being tracked as a confirmatory item.

COL/DC-ISG-7 states the normal winter precipitation roof load should be a function of the highest ground-level weight of either the 100 year return period snowpack, the historical maximum snowpack, the 100 year return period snowfall event, or the historical maximum

snowfall event. In order to determine whether the US-APWR normal winter precipitation roof load of 2.39 kPa (50 lbf/ft^2) bounds a reasonable number of sites that may be considered within a COL application, the staff compared this value against the maximum observed ground snow load recorded at 204 NWS locations throughout the contiguous U.S. as reported in Table C7-1 of American Society of Civil Engineers and Structural Engineering Institute (ASCE/SEI) Standard 7-05, "Minimum Design Loads for Buildings and Other Structures." The staff found that approximately five percent had maximum observed ground snow loads exceeding 2.39 kPa (50 lbf/ft^2). Consequently, the staff finds that the applicant has provided a normal winter precipitation roof load key site parameter value that should bound a reasonable number of sites that may be considered within a COL application and is, therefore, acceptable.

COL/DC-ISG-7 also states that the extreme precipitation roof load is based on the sum of the roof load due to the normal winter precipitation event (such as the maximum snowpack as discussed above) plus the roof load due to the highest weight resulting from either the extreme frozen winter precipitation event or the extreme liquid winter precipitation event. The extreme frozen winter precipitation event is assumed to accumulate on the roof on top of the antecedent normal winter precipitation event. The extreme liquid precipitation event may or may not accumulate on the roof, depending on the geometry of the roof and the type of drainage provided.

COL/DC-ISG-7 defines the extreme frozen winter precipitation event as the higher ground-level weight of either the 100 year return period two-day snowfall event or the historical maximum two-day snowfall event. Because the difference between the normal winter precipitation roof load [2.39 kPa (50 lbf/ft^2)] and the extreme precipitation roof load [3.59 kPa (75 lbf/ft^2)] key site parameters is 1.2 kPa (25 lbf/ft^2), an acceptable extreme frozen winter precipitation event could result in an additional roof load of approximately 1.2 kPa (25 lbf/ft^2). In order to determine whether an extreme frozen winter precipitation event of 1.2 kPa (25 lbf/ft^2) bounds a reasonable number of sites that may be considered within a COL application, the staff compared the 1.2 kPa (25 lbf/ft^2) value against the two-day record snowfall events at over 9000 NWS locations throughout the contiguous U.S. as reported by the National Climatic Data Center (NCDC) Snow Climatology website (http://www.ncdc.noaa.gov/ussc/index.jsp, (accessed October 20, 2008). The staff found that approximately five percent had maximum observed two-day record snowfall events, which were estimated by the staff to result in ground snow loads exceeding 1.2 kPa (25 lbf/ft^2). Consequently, the staff finds that the applicant has provided an extreme winter precipitation roof load key site parameter value that should bound a reasonable number of sites that may be considered within a COL application and is, therefore, acceptable.

In its response to RAI 02.03.01-16, dated September 10, 2008, the applicant stated that it's 48 PMWP key site parameter value of 91.4 cm (36 inches) was determined based on interpolation of 24 hour PMP and 72 hour PMP data for the month of March from HMR-53 (NUREG/CR-1486). COL/DC-ISG-7 identifies HMR-53 as an appropriate source for PMWP data and the staff finds the applicant's chosen value of 91.44 cm (36 inches) bounds values derived from other cool season months (i.e., December, January, and February) for most of the contiguous U.S. Consequently, the staff finds that the applicant has provided an extreme winter precipitation roof load key site parameter value that should bound a reasonable number of sites that may be considered within a COL application and is, therefore, acceptable.

DCD Tier 2, Sections 3.4.1 and 3.8.4 discuss how the roof design handles the winter precipitation roof loads.

b. Tornado Wind Speed and Pressure Drop.

The tornado site parameters proposed by the applicant (i.e., tornado maximum wind speed and radius of maximum rotational speed, tornado maximum pressure drop and rate of pressure drop) are the same as the Region I design basis tornado characteristics specified in RG 1.76, Revision 1. Region I of RG 1.76, Revision 1, represents the central portion of the U.S. where the most severe tornadoes frequently occur and corresponds to the most severe design-basis tornado characteristics. Therefore, the tornado site parameters provided by the applicant bound a reasonable number of potential COL sites and the staff finds that the applicant has provided an adequate basis for the tornado site parameters.

c. Extreme Wind Speed (other than in tornado).

DCD Tier 2, Section 3.3.1.1 clarifies that the design wind has a basic speed of 249 km/h (155 mph), corresponding to a 3-second gust at 10 meters (33 feet) above ground for exposure category C (open terrain). The basic wind speed is multiplied by an importance factor of 1.15 correlating to essential facilities in hurricane-prone regions as defined in ASCE/SEI 7-05. ASCE/SEI 7-05 defines the mean recurrence interval for the basic wind speed with an importance factor of 1.15 as 100 years.

Section 2.3.1 of NUREG-0800 recommends that the basic (straight-line) 100 year return period 3 second gust wind speed should be based on appropriate standards, such as ASCE/SEI 7-05. Since this standard was the basis for the applicant's extreme wind site parameter, the staff finds that the applicant has provided an adequate basis for this site parameter.

Because the applicant based its extreme wind site parameter on ASCE/SEI 7-05, the staff finds the applicant's extreme wind site parameter of 249 km/h (155 mph) bounds the entire Continental U.S.. Thus, the staff finds that the applicant has provided a wind speed value which bounds a reasonable number of potential COL sites.

d. Ambient Design Air Temperatures.

Zero-percent-exceedance

DCD Tier 1, Table 2.1-1 and Tier 2, Table 2.0-1 state that the zero-percent-exceedance temperature site parameters should be based on the historical limit excluding peaks of less than two hours. The staff believes the COL site characteristic values to be compared with the US-APWR zero-percent-exceedance should be either 100 year return period or historic extreme values, whichever is bounding. 10 CFR 52.79(a)(1)(iii) states, in part, that COL applicants must identify the meteorological 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. Temperatures based on a 100-year return period are considered to provide margin for the limited accuracy, quantity, and period of time in which historical data have been accumulated as required by the regulation.

For the purpose of this review, the staff relied on one-hour historical peaks, which would result in slightly higher maximums and slightly lower minimums (i.e., more conservative values), to ensure that the proposed site parameters are representative of a reasonable number of potential COL sites.

To consider if the applicant's zero-percent-exceedance, maximum and minimum ambient, dry-bulb temperatures are representative of a reasonable number of potential COL sites, the staff reviewed 100 year return period dry-bulb temperature data from the American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc. (ASHRAE). In accordance with Section 2.3.1 of NUREG-0800, the staff used ASHRAE's "Weather Data Viewer," Version 3.0, to obtain dry-bulb and wet-bulb temperature data for over 650 weather stations throughout the contiguous U.S..

The ASHRAE Weather Data Viewer provides a calculated 100-year return period maximum dry-bulb temperature for each station. The staff found that only eight percent of the weather stations had a calculated 100 year return period maximum dry-bulb temperature greater than 46.1 degrees C (115 degrees F). Because the applicant's zero-percent, maximum dry-bulb temperature has not been exceeded at 92 percent of the stations throughout the contiguous U.S., the staff accepts the applicant's zero-percent, maximum dry-bulb temperature as bounding a reasonable number of potential COL sites.

The ASHRAE Weather Data Viewer also provides a calculated 100 year return period minimum dry-bulb temperature for each station. The staff also found that 13 percent of the weather stations had a calculated 100 year return period minimum dry-bulb temperature of less than -40 degrees C (-40 degrees F). The primary areas where the applicant's minimum dry-bulb site parameter value was not bounded were the upper Midwest and the upper High Plains regions. A COL applicant referencing the US-APWR in these regions, especially in Minnesota, Montana, North Dakota, and Wyoming, may need to consider the possibility of the zero-percent, minimum dry-bulb temperature being exceeded for a particular site. Nonetheless, because the applicant's zero-percent, minimum dry-bulb temperature has not been exceeded at 87 percent of the stations throughout the contiguous U.S., the staff accepts the applicant's zero-percent, minimum dry-bulb temperature as bounding a reasonable number of potential COL sites.

To consider if the applicant's zero-percent-exceedance, coincident, wet-bulb temperature of 26.7 degrees C (80 degrees F) is representative of a reasonable number of potential COL sites, the staff considered temperature and humidity data from the NCDC's Solar and Meteorological Surface Observational Network (1961-1990). Based on temperature, dew point, and pressure, the staff derived hourly wet-bulb temperatures for 75 observation stations located along the Gulf Coast and East Coast of the contiguous U.S.. The staff primarily considered locations near the coast because these are areas where atmospheric moisture content is typically highest, which would result in the highest wet-bulb temperatures. For all 75 locations, the staff determined the highest recorded dry-bulb temperatures, all of which fell below 46.1 degrees C (115 degrees F). The coincident, wet-bulb temperature was derived for the corresponding hour with the highest recorded dry-bulb temperatures. The applicant's proposed site parameter of 26.7 degrees C (80 degrees F) was exceeded only at one location (New Orleans, Louisiana). Thus, the staff accepts the applicant's zero-percent-exceedance, coincident, wet-bulb temperature as representative of a reasonable number of potential COL sites.

To consider if the applicant's zero-percent-exceedance, non-coincident, wet-bulb temperature of 30 degrees C (86 degrees F) is representative of a reasonable number of potential COL sites, the staff considered wet-bulb temperature data from the ASHRAE Weather Data Viewer. The ASHRAE Weather Data Viewer provides an extreme annual wet-bulb temperature for each station. The staff found the applicant's proposed zero-percent-exceedance, non-coincident, wet-bulb temperature site parameter value of 30 degrees C (86 degrees F) was exceeded at approximately 21 percent of the weather stations, primarily in the Southeast. A COL applicant referencing the US-APWR in this region, especially in Alabama, Florida, Louisiana, and

Mississippi, may need to consider the possibility of the zero-percent, non-coincident, wet-bulb temperature being exceeded for a particular site. Nonetheless, because the applicant's zero-percent, non-coincident, wet-bulb temperature has not been exceeded at 79 percent of the stations throughout the contiguous U.S., the staff accepts the applicant's zero-percent, non-coincident, wet-bulb temperature as bounding a reasonable number of potential COL sites.

One-Percent Exceedance

To consider the applicant's one-percent-exceedance, maximum dry-bulb temperature, one-percent-exceedance, coincident, wet-bulb temperature, one-percent-exceedance, maximum non-coincident, wet-bulb temperature, and one-percent-exceedance, minimum dry-bulb temperature, the staff used meteorological data from the ASHRAE Weather Data Viewer. The staff used this data source because it is recommended by Section 2.3.1 of NUREG-0800 and one-percent annual exceedance dry-bulb and wet-bulb temperature data are readily available for over 650 weather stations throughout the contiguous U.S..

The staff found that the one-percent-exceedance temperatures proposed by the applicant bound a reasonable number of sites and are therefore acceptable. The one-percent-exceedance, maximum dry-bulb temperature of 37.8 degrees C (100 degrees F) was exceeded at four percent of the weather stations throughout the contiguous U.S. and the one-percent-exceedance, coincident, wet-bulb temperature of 25 degrees C (77 degrees F) was exceeded at nine percent of the weather stations throughout the contiguous U.S.. Therefore, a total of 13 percent of the weather stations exceeded the one-percent-exceedance, dry-bulb temperature or the one-percent-exceedance, coincident, wet-bulb temperature or both. The one-percent-exceedance, non-coincident, maximum wet-bulb temperature of 27.2 degrees C (81 degrees F) was exceeded at only one percent of the weather stations throughout the contiguous U.S.. Finally, the one-percent-exceedance, minimum dry-bulb temperature of -23.3 degrees C (-10 degrees F) was exceeded at 10 percent of the weather stations throughout the contiguous U.S..

Five-Percent Exceedance

In RAI 02.03.01-19, the staff noted that a new set of Tier 1 ambient design air temperature site parameters (five-percent-exceedance maximum and minimum values) were added to Tier 1 Table 2.1-1 in DCD Revision 2. The staff asked the applicant to revise the DCD to clarify the definition of the maximum and minimum five-percent-exceedance ambient design temperature site parameters and provide a technical basis for how these site parameter values were chosen. In its response to RAI 02.03.01-19, dated April 14, 2010, the applicant stated that the DCD will be revised deleting the maximum and minimum five-percent-exceedance ambient design temperature values as site parameters because these site parameters were considered to be extraneous information. The staff finds the applicant's April 14, 2010 response to RAI 02.03.01-19 acceptable and RAI 02.03.01-19 is being tracked as a confirmatory item.

Local Meteorology, DCD Section 2.3.2

There are no postulated site parameters for the US-APWR DCD related to local meteorology. A description of the anticipated local meteorology 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 due to plant operation) are site-specific and should be presented by a COL applicant referencing the US-APWR DCD. Thus, the staff finds the applicant's statements in DCD Tier 2, Section 2.3.2 and COL Information Item 2.3(1) that a COL applicant is to supply site-specific information regarding local meteorology are acceptable.

Onsite Meteorological Measurements Program, DCD Section 2.3.3

There are no postulated site parameters for the US-APWR DCD related to onsite meteorological measurement programs. A description of the pre-operational and operational programs for meteorological measurements is site-specific and should be presented by a COL applicant referencing the US-APWR DCD. Thus, the staff finds the applicant's statements in DCD Tier 2, Section 2.3.3 and COL Information Item 2.3(1) that a COL applicant is to supply site-specific information regarding its meteorological monitoring program are acceptable.

Short-term Atmospheric Dispersion Estimates for Accident Releases, DCD Section 2.3.4

The staff reviewed the DCD in accordance with the guidance provided in Section 2.3.4 of NUREG-0800 by ensuring: (1) the DCD included EAB, LPZ, and MCR χ/Q values in the list of key site parameters; (2) the DCD included figures and tables describing the design features that would be used by the COL applicant to generate MCR χ/Q values; (3) the EAB, LPZ, and MCR key site parameter χ/Q values are representative of a reasonable number of sites that may be considered within a COL application; and (4) a basis has been provided for each of the EAB, LPZ, and MCR key site parameter χ/Q values. The staff also reviewed the radiological consequence analyses presented in DCD Tier 2, Section 11.3 and Chapter 15 and RAI responses to ensure the assumed fission product transport to the environment for each modeled postulated accident and anticipated operational occurrence (AOO) was compatible with the χ/Q values used to model the release pathway.

Offsite χ/Q Values

The offsite (EAB and LPZ) key site parameter χ/Q values are used to predict the EAB and LPZ radiological consequences for the bounding postulated accidents discussed in DCD Tier 2, Chapter 15 (i.e., loss-of-coolant accident (LOCA), steam generator tube rupture, steam system piping failure, reactor coolant pump rotor seizure, rod ejection accident, fuel handling accident) and the bounding AOOs discussed in DCD Tier 2 Chapter 11 (i.e., gaseous waste management system (GWMS) leak or failure) and Chapter 15 (i.e., failure of small lines carrying primary coolant outside containment).

Revision 0 of DCD Tier 2, Section 2.3.4 stated that the short-term χ/Q values listed as key site parameters are bounding factors for a typical US-APWR sited in most areas of the U.S. DCD Tier 2, Sections 15.0.3.3 and 15A.1.5 state that the offsite χ/Q were determined by representative values at the corresponding EAB and LPZ distance selected from site boundary dispersion values of a reasonable number of existing sites. The staff asked the applicant in RAI 02.03.04-4 to revise the DCD to discuss in greater detail the methodology used to select the EAB and LPZ χ/Q values listed as key site parameters to ensure the resulting χ/Q values bound a reasonable number of sites that have been or may be considered for a COL application. In response to RAI 02.03.04-4, the applicant revised Revision 2 to DCD Tier 2, Section 2.3.4 to state that the US-APWR EAB χ/Q key site parameter value was selected to envelope most values at the corresponding EAB distance of 0.8 km (0.5 mi) at many existing plants and the US-APWR LPZ χ/Q key site parameter values were selected to envelope most χ/Q values at many existing plants with LPZ distances of more than 1.6 km (1 mi). The staff finds this response to be satisfactory and considers RAI 02.03.04-4 to be resolved.

In order to determine whether the US-APWR EAB and LPZ key site parameter χ/Q values bound a reasonable number of sites that may be considered within a COL application, the staff compared the US-APWR EAB and LPZ key site parameter χ/Q values to the EAB and LPZ site characteristic χ/Q values identified in the site safety analysis reports (SSAR) for the first four docketed ESP applications (i.e., North Anna, Grand Gulf, Clinton, and Vogtle). The EAB and LPZ χ/Q values presented in these ESP applications were developed in accordance with current regulatory guidance and have been approved by the NRC staff. The staff found that: (1) the US-APWR EAB χ/Q values bounded three out of the four ESP sites, and (2) US-APWR LPZ χ/Q values bounded all four ESP sites.[1] Consequently, the staff finds that the applicant has provided EAB and LPZ key site parameter χ/Q values that should bound a reasonable number of sites that may be considered within a COL application and are, therefore, acceptable.

Control Room χ/Q Values

The habitability system design for the MCR is presented in DCD Tier 2, Section 6.4.2. In normal operation mode, the MCR heating, ventilation, and air conditioning (HVAC) system draws in outside air through either of two intakes and the majority of the MCR ventilation air flow recirculates. The emergency pressurization mode protects the MCR operators and staff from some of the design-basis postulated accidents described in DCD Tier 2 Chapter 15 and is initiated automatically by the MCR isolation signal (e.g., emergency core cooling system actuation signal or high MCR outside air intake radiation signal). The emergency pressurization mode establishes a control room envelope pressure higher than that of adjacent areas by drawing outside air through either of the two intakes and shutting down and isolating exhaust fans.

In Revision 0 to the DCD, the MCR key site parameter χ/Q values used to predict the control room radiological consequences of the bounding postulated accident were discussed in DCD Tier 2 Chapter 15 (i.e., LOCA). Tables 15A-18 through 15A-23 in Revision 0 to DCD Tier 2, Appendix 15A provided the horizontal and vertical distances between the source and bounding receptors for each accident and Figure 15A-1 in Revision 0 to DCD Tier 2, Appendix 15A presented a site plan showing release and MCR intake and inleakage locations.

The applicant stated in Revision 0 to DCD Tier 2, Section 15.6.5.5.1.3 that the dose calculation model used to evaluate MCR habitability for the LOCA (including source term, transport, and release assumptions) was also used to evaluate the TSC habitability for the same event. The applicant also stated that the distances from release points to receptors are almost the same between the TSC and MCR; therefore, the radiological consequences in the TSC are represented by those in the MCR.

In order to verify the applicant's statement that the distances from release points to receptors are almost the same between the TSC and MRC, the staff asked the applicant in RAI 02.03.04-1 to revise the site plan shown in DCD Tier 2, Figure 15A-1 to: (1) indicate plant north, and (2) add the TSC intake and inleakage locations. In its initial response to RAI 02.03.04-1, dated September 10, 2008, the applicant provided a revised DCD Tier 2,

[1] The US-APWR site parameter χ/Q values bound the ESP site characteristic χ/Q values if the US-APWR χ/Q values are higher than the ESP χ/Q values. Smaller χ/Q values are associated with greater dilution capability, resulting in lower radiological doses. When comparing the US-APWR site parameter χ/Q values with the ESP site characteristic χ/Q values, the ESP sites are acceptable for the design if the ESP χ/Q values are smaller than the US-APWR χ/Q values. Such a comparison shows that the ESP sites have better dispersion characteristics than that required by the US-APWR reactor design.

Figure 15A-1 showing the TSC intake and in-leakage locations and stated that the revised Figure 15A-1 will be incorporated into a future revision to the DCD.

In its initial response to RAI 02.03.04-1, the applicant also provided tables for each accident presenting horizontal, vertical, and straight (slant) distances between each combination of sources and bounding (i.e., closest) receptors. The applicant provided some of this same information in its response to RAI 15.00.05-17, dated August 22, 2008. The applicant also stated in its initial response to RAI 02.03.04-1 that the TSC HVAC intake is located on the roof of the auxiliary building (A/B) and since the access building in which the TSC is located does not have any exterior doors, the TSC in-leakage location for all design-basis accidents, except for the failure of small lines carrying primary coolant outside of the containment, is assumed to be equal to the TSC intake. In the failure of small lines carrying primary coolant outside of the containment, the TSC χ/Q values were based on the assumption that radioactive materials leaked in the A/B are transferred directly to the TSC through the access building interior door. The staff reviewed the response to RAI 02.03.04-1 and determined that the RAI is closed but there are two issues that remain unresolved. To address these issues, the staff has issued follow-up questions Open Item 02.03.04-1 and Open Item 02.03.04-2.

The staff issued Open Item 02.03.04-1 requesting that the applicant further justify the methodology used to evaluate doses to the MRC and TSC for the failure-of-small-lines-carrying-primary-coolant-outside-containment accident. In particular, the staff asked the applicant to justify the use of the ARCON96 computer code to generate TSC χ/Q values if the TSC χ/Q values are based on the assumption that radioactive materials leaked into the A/B are transferred directly to the TSC through the access building interior door. The ARCON96 atmospheric dispersion model accounts for atmospheric turbulence as effluents travel outdoors and is not appropriate for modeling “indoor” transport and dispersion. In its response to Open Item 02.03.04-1 dated June 4, 2009, the applicant stated the release point to the atmosphere for the failure-of-small-lines-carrying-primary-coolant-outside-containment accident would be changed to the plant vent. The applicant implemented this change in Revision 2 to DCD Tier 2, Tables 2.3.4-4 and 15A-21. The staff finds Open Item 02.03.04-1 to be resolved because it is reasonable to assume for this accident that the reactor coolant spilled in the AB is discharged to the atmosphere from the plant vent and is transferred to the TSC via the TSC ventilation system.

Section 2.3.4 of NUREG-0800 states that the DC applicant should include figures and tables showing the design features that would be used by the COL applicant to generate MCR χ/Q values (e.g., intake heights, release heights, building cross-sectional areas, and distances to receptors). Because Revision 0 to the DCD did not include all the information needed by COL applicants to generate MCR χ/Q values, the staff asked the applicant to add the missing information to the DCD in RAI 02.03.04-2. In its initial response to RAI 02.03.04-2, dated September 10, 2008, the applicant provided tables showing data for use by COL applicants in calculating site specific MCR and TSC χ/Q values. The applicant agreed to add theses tables to Tier 2, Section 2.3 of the DCD. The staff reviewed the response to RAI 02.03.04-2 and determined that the RAI is closed but there are several issues that remain unresolved. To address these issues, staff issued follow-up questions Open Item 02.03.04-2 through Open Item 02.03.04-5.

The staff issued Open Item 02.03.04-2 requesting that the applicant address several apparent discrepancies between (1) the information presented in the revised site plan provided in the response to RAI 02.03.04-1 showing release and intake locations and (2) the information presented in the tables provided in the response to RAI 02.03.04-2 which provided release and

receptor data (e.g., release and intake heights, distances and directions between sources and receptors). In responding to Open Item 02.03.04-2, the applicant addressed the apparent discrepancies by providing in DCD Revision 2 (1) a revised site plan showing all release and intake locations (Tier 2, Figures 2.3-2 and 15A-1) and (2) a revised set of tables providing release and receptor data for all source/receptor combinations (Tier 2, Tables 2.3-1 through 2.3-3 and Tables 2.3.4-1 through 2.3.4-7). Therefore, the staff finds Open Item 02.03.04-2 to be resolved.

The staff issued Open Item 02.03.04-3 requesting that the applicant address several specific questions regarding the release and receptor data provided in the response to RAI 02.03.04-2. In its response to Open Item 02.03.04-3 dated June 4, 2009, the applicant provided the following information:

- The initial lateral and vertical diffusion coefficients for the containment leakage pathway were determined by the area of the containment vessel (CV) projecting above the roof of the reactor building (RB). Because the CV is a circular shape, the cross-sectional area of the CV is common for all receptors, even if they are located in different downwind directions from the CV. The width and height of the CV area source was determined from an equivalent rectangular area to the cross-section area of the CV. The initial and vertical diffusion coefficients were then determined in accordance with RG 1.194 by dividing the width and height of the area source by six.

- The release height for the one area source, the CV, was set to the vertical center of the area source in accordance with RG 1.194.

- All receptors (i.e., the MCR intakes, the RB door, the Class 1E electrical room HVAC intakes, the auxiliary building HVAC intake, and the TSC intake) were assumed to be rectangular and the corner nearest to the source was selected as the receptor height. This meant that a given receptor could be assigned different receptor heights, depending on whether the source being considered was located at an elevation below or above the receptor.

Because the methodology described above follows guidance provided in RG 1.194, the staff considers Open Item 02.03.04-3 to be resolved. The applicant incorporated the information described above into Tier 2, Table 2.3-3 and Tier 2, Figure 2.3-1 of DCD Revision 2.

The staff issued Open Item 02.03.04-4 requesting that the applicant address a statement it made in its initial response to RAI 02.03.04-2 concerning the basis for the MCR χ/Q key site parameter values. The applicant stated in the proposed FSAR Tier 2, Table 2.3-2, that the MCR χ/Q key site parameter values were calculated using the diffusion equations described in ARCON96 assuming a "conservative" meteorological condition of F stability (moderately stable) with a wind speed of 1.0 m/s (2.2 mph). The staff noted in Open Item 02.03.04-4 that ARCON96 produces higher (more conservative) χ/Q values with wind speeds around 3 to 4 m/s (6.7 to 8.9 mph). In its response to Open Item 02.03.04-4 dated June 4, 2009, the applicant stated that although F stability with a wind speed of 1.0 m/s (2.2 mph) is not a conservative meteorological condition for the ARCON96 dispersion model, the MCR χ/Q key site parameter values were determined by multiplying the resulting ARCON96 F stability and 1.0 m/s (2.2 mph) χ/Q values by a factor of two. The applicant claimed that the resulting χ/Q key site parameter values envelope most existing plant χ/Q values in the U.S.. The applicant updated DCD Tier 2, Section 2.3.4, to include this information. The staff finds the applicant's response concerning

the basis for the MCR χ/Q key site parameter values to be acceptable and considers Open Item 02.03.04-4 to be resolved.

The staff issued Open Item 02.03.04-5 requesting that the applicant clarify the applicant's expectations regarding the site-specific calculation of TSC χ/Q values. The staff noted that the necessary data for COL applicants to calculate TSC χ/Q values are presented in the proposed DCD Tier 2, Tables 2.3-1, 2.3-3, and 2.3-4 provided in the applicant's initial response to RAI 02.03.04-2. However, there is no combined license information item specifying that COL applicants calculate TSC χ/Q values and there are no TSC χ/Q values listed as key site parameter values in the DCD. In response to Open Item 02.03.04-5, the applicant added TSC χ/Q values as key site parameters in Revision 2 to DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1. The staff finds the applicant's response to be acceptable and considers Open Item 02.03.04-5 to be resolved.

Revision 0 to DCD Tier 2, Tables 15A-18 through 15A-23, identified MCR intake and in-leakage locations for a number of postulated accidents and AOOs. The staff asked the applicant in RAI 02.03.04-3 to justify the MCR intake and in-leakage locations selected for each postulated accident and AOO listed in these DCD tables. In its initial response to RAI 02.03.04-3, dated September 10, 2008, the applicant stated that the MCR HVAC intake is selected as an intake location, while an in-leakage location is selected from among the following three locations:

- The R/B door, which communicates with the pathway in front of the MCR.
- The Class 1E electrical room HVAC intake, since external air drawn in by the Class 1E electrical room HVAC may leak through negative pressure sections of the MCR HVAC equipment.
- The A/B HVAC intake, since external air drawn in by the A/B is fed to the pathway in front of the MCR.

Generally the in-leakage location chosen for each release pathway has the shortest distance to that release pathway. The staff reviewed the response to RAI 02.03.04-3 and determined that the RAI is closed but there is one issue that remains unresolved. To address this issue, staff issued follow-up question Open Item 02.03.04-6.

The staff had a concern that χ/Q values can vary as a function of downwind direction as well as downwind distance because wind direction frequency can vary from site to site. Consequently, Open Item 02.03.04-6 was issued requesting that COL applicants be directed to evaluate χ/Q values for each inleakage location for each accident release point and compare the resulting bounding χ/Q values with the corresponding key site parameter values listed in DCD Tier 1, Table 2.1-1, and DCD Tier 2, Table 2.0-1, unless an inleakage location is not feasible for a particular accident scenario. In response to Open Item 02.03.04-6, the applicant provided source/receptor information for all combinations of sources and receptors in Revision 2 to DCD Tier 2, Tables 2.3.4-1 through 2.3.4-7. The staff finds the applicant's response to be acceptable and considers Open Item 02.03.04-6 to be resolved.

Revision 0 of DCD Tier 2, Section 2.3.4.2, stated that the short-term χ/Q values listed as key site parameters are bounding factors for a typical US-APWR sited in most areas of the U.S.. The staff asked the applicant in RAI 02.03.04-4 to revise the DCD to discuss in greater detail the methodology used to select the MCR χ/Q values listed as key site parameters to ensure the

resulting χ/Q values bound a reasonable number of sites that have been or may be considered for a COL application.

In its initial response to RAI 02.03.04-4, dated September 10, 2008, the applicant agreed to revise the DCD to state the MCR 0-8 hour key site parameter χ/Q values were calculated based, in part, on the diffusion equations used in the ARCON96 atmospheric dispersion model and conservative meteorological conditions (e.g., F stability and 1.0 m/s wind speed). The other time interval (8 - 24 hours, 24 - 96 hours, and 96 - 720 hours) MCR key site parameter χ/Q values were calculated using time interval factors described in Section 4.4 of RG 1.194. The staff reviewed the response to RAI 02.03.04-4 and determined that the RAI is closed because Revision 2 to the DCD was revised to discuss in greater detail the methodology used to select the MCR and TSC χ/Q values listed as key site parameters; however, there is one issue that remains unresolved. To address this issue, staff issued follow-up question Open Item 02.03.04-7.

The applicant was asked in Open Item 02.03.04-7 to correct the statement that F stability with a wind speed of 1.0 m/s is a conservative meteorological condition for the ARCON96 atmospheric dispersion model. Although ARCON96 uses a simple Gaussian dispersion model, the concentrations predicted by ARCON96 do not vary inversely with wind speed for all wind speeds because the building wake correction algorithm is not a linear function of wind speed. Conservative ARCON96 χ/Q values are associated with wind speeds of 3 to 4 m/s.

In its response to Open Item 02.03.04-7 dated June 4, 2009, the applicant stated that it did not use the ARCON96 model results directly in calculating the US-APWR MCR and TSC χ/Q site parameter values; instead it used the ARCON96 methodology with a multiplier for conservatism so that the US-APWR site parameter values envelope most existing plant MCR and TSC χ/Q values. The applicant updated DCD Tier 2, Section 2.3.4, to include this information in DCD Revision 2. The staff finds the applicant's response to be acceptable because the applicant did not just rely on F stability/1.0 m/s to derive the X/Q values, but also used a multiplier for conservatism, and considers Open Item 02.03.04-7 to be resolved.

The list of χ/Q key site parameters shown in Revision 2 to DCD Tier 1, Table 2.1-1 (sheet 4 of 7) and Tier 2, Table 2.0-1 (Sheet 3 of 8) include ground-level containment releases to the Class 1E electrical room HVAC intake for MCR inleakage. The staff asked the applicant in Open Item 02.03.04-8 to explain why there are no χ/Q key site parameter values provided for ground-level containment releases to the other MCR inleakage locations (i.e., reactor building door and auxiliary building intake). Open Item 02.03.04-8 remains unresolved.

Revision 2 to DCD Tier 2, Tables 15A-18 through 15A-24 present the atmospheric dispersion (χ/Q) values used to evaluate MCR and TSC dose consequences from a number of different design basis accident events. The information presented in Table 15A-18 (sheet 1 of 2) includes the horizontal and vertical distances between the source and receptors for the steam system piping failure analysis. This type of information is not presented in Tables 15A-19 through 15A-24 for the other design basis accident events. Instead, the information necessary to calculate MCR and TSC χ/Q values (include source-receptor distances) is provided in DCD Tier 2, Tables 2.3-1 through 2.3-4. Consequently, the staff asked the applicant in Open Item 02.03.04-9 to consider deleting the source/receptor horizontal and vertical distance information from Table 15A-18 (Sheet 1 of 2). Open Item 02.03.04-9 remains unresolved.

Revision 2 to DCD Tier 2, Table 2.3-3, presents receptor height data for use by COL applicants in generating site-specific MCR and TSC χ/Q values. Different values for the heights to the

lower and upper limits are presented for two sets of receptors: the reactor building door (west) and the auxiliary building/TSC HVAC intake (north and south). The staff asked the applicant in Open Item 02.03.04-10 to explain why the heights to the lower limit are higher than the heights to the upper limit for these two sets of receptors. Open Item 02.03.04-10 remains unresolved.

Revision 2 to DCD Tier 2, Section 2.3.4 states that (1) the 0-8 hour MCR and TSC χ/Q values were calculated, in part, based on the diffusion equations contained in the ARCON96 atmospheric dispersion model and (2) the 8 - 24 hour, 24 - 96 hour, and 96 - 720 hour MCR and TSC χ/Q values were derived from the 0-8 hour χ/Q values by adjusting for long-term meteorological averaging of wind speed and wind direction as described in Section C.4.4 of RG 1.194. The long-term meteorological averaging was generally accomplished by multiplying the 0 - 8 hour χ/Q values by a combined wind speed and wind direction correction factor of (1) 0.59 to obtain the 8 - 24 hour χ/Q values, (2) 0.38 to obtain the 24 - 96 hour χ/Q values, and (3) 0.17 to obtain the 96 - 720 hour χ/Q values.

In order to confirm that the US-APWR MCR and TSC χ/Q values listed as key site parameters in DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1 are representative of a reasonable number of sites that have been or may be considered for a COL application, the staff generated a set of site-specific MCR and TSC χ/Q values using hourly meteorological data provided in support of the four docketed ESP applications (North Anna, Clinton, Grand Gulf, and Vogtle). The staff executed the ARCON96 computer code with a subset of the source/receptor information presented in DCD Tier 2, Tables 2.3.4-1 through 2.3.4-7 assuming the US-APWR plant north was aligned to true north at each site. The staff found that the US-APWR 0 - 8 hour, 8 - 24 hour, and 1 - 4 day χ/Q values were bounding in all cases, but the US-APWR 4 - 30 day χ/Q values were not bounding for three out of the four ESP sites. This implies to the staff that the use of a 96 - 720 hour combined wind speed and wind direction correction factor of 0.17 with the ARCON96 diffusion equations does not produce appropriate results. The staff consequently issued Open Item 02.03.04-11 asking the applicant to consider increasing the 96-720 hour MCR and TSC χ/Q values listed as key site parameters in DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1 so that they bound a reasonable number of sites that have been or may be considered for a COL application. Open Item 02.03.04-11 remains unresolved.

Long-Term Atmospheric Dispersion Estimates for Routine Releases, DCD Section 2.3.5

The US-APWR GWMS monitors, controls, collects, processes, handles, stores, and disposes of gaseous radioactive waste generated as the result of normal operation, including AOOs. The GWMS is described in DCD Tier 2, Section 11.3.

The GWMS release point to the environment is the vent stack. The vent stack runs along the containment with the release point above the top of the containment. DCD Tier 2, Sections 11.3.2 states that the height of the release point is the same height as the top of the containment and the COL applicant is responsible for including the site-specific vent stack design (COL Information Item 11.3(3)).

The staff reviewed the DCD in accordance with the guidance provided in Section 2.3.5 of NUREG-0800 by ensuring: (1) the DCD included the maximum annual average site boundary χ/Q and D/Q values in the list of key site parameters, (2) the annual average key site parameter χ/Q and D/Q values are representative of a reasonable number of sites that may be considered within a COL application, and (3) a basis was provided for each of the annual average key site parameter χ/Q and D/Q values.

Annual average EAB χ/Q and D/Q values are provided as key site parameters in DCD Tier 1, Table 2.1-1 and DCD Tier 2, Table 2.0-1. In addition, an annual average χ/Q value for the offsite food production area is provided as a key site parameter. Note that the annual average EAB D/Q value is assumed to apply to the offsite food production area for the Appendix I calculations presented in DCD Tier 2, Section 11.3.3.1.

The staff asked the applicant in RAI 02.03.05-1 to revise the DCD to discuss the methodology used to select the annual average EAB and food production area χ/Q and D/Q values presented as key site parameters to ensure that the selected key site parameter values bound a reasonable number of sites that have been or may be considered for a COL application. In response to RAI 02.03.05-1, the applicant revised revision 2 to DCD Tier 2, Section 2.3.5, to state that the chosen site parameter values bound approximately 70 percent of the sites with site boundaries located approximately 0.8 km (0.5 miles) from the reactor.

To determine whether the US-APWR annual average χ/Q and D/Q site parameters bound a reasonable number of sites that may be considered within a COL application, the staff compared the US-APWR annual χ/Q and D/Q site parameters to the annual average EAB χ/Q and D/Q site characteristics identified in the SSARs for the first four docketed ESP applications (i.e., North Anna, Grand Gulf, Clinton, and Vogtle). The annual average χ/Q and D/Q values presented in these ESP applications were developed in accordance with current regulatory guidance and have been accepted by the NRC staff. The staff found that the US-APWR annual average χ/Q and D/Q values bounded all four ESP sites[2]. Because the US-APWR DCD annual average χ/Q and D/Q values bounded the four site-specific ESP annual average χ/Q and D/Q values, the staff concludes that the US-APWR annual average χ/Q and D/Q key site parameters should bound a reasonable number of sites that may be considered within a COL application and are, therefore, acceptable. Therefore the staff considers RAI 02.03.05-1 to be resolved. Note that all four ESP applicants used bounding conservative assumptions in generating their annual average atmospheric dispersion χ/Q and D/Q site characteristic values (e.g., all four ESP applicants assumed ground-level releases), whereas, the US-APWR vent stack design may qualify as a mixed-mode (part-time ground, part-time elevated) release pursuant to RG 1.111 if the vent stack release height is at the level of or above the height of adjacent solid structures. Mixed-mode releases typically result in lower χ/Q and D/Q site characteristic values as compared to ground-level releases.

2.3.5 Combined License Information Items

SER Table 2.3-4 provides a list of item numbers and descriptions from Table 1.8-2 of the DCD.

[2] The US-APWR site parameter χ/Q and D/Q values bound the ESP site characteristic χ/Q and D/Q values if the US-APWR χ/Q and D/Q values are higher than the ESP χ/Q and D/Q values. Smaller χ/Q and D/Q values are associated with greater dilution capability, resulting in lower radiological doses. When comparing the US-APWR site parameter χ/Q and D/Q values with the ESP site characteristic χ/Q and D/Q values, the ESP sites are acceptable for the design if the ESP site characteristic χ/Q and D/Q values are smaller than the US-APWR site parameter χ/Q and D/Q values. Such a comparison shows that the ESP sites have better dispersion characteristics than that required by the US-APWR reactor design.

Table 2.3-4
US-APWR Combined License Information Items

Item No.	Description	Section	Action Required By COL Applicant	Action Required By COL Holder
2.3(1)	The COL applicant is to provide site-specific pre-operational and operational programs for meteorological measurements, and is to verify the site-specific regional climatology and local meteorology are bounded by the site parameters for the standard US-APWR design or demonstrate by some other means that the proposed facility and associated site-specific characteristics are acceptable at the proposed site.	2.3.6	Y	
2.3(2)	The COL applicant is to provide conservative factors as described in Section 2.3.4 of NUREG-0800. If a selected site will cause excess to the bounding χ/Q values, then the COL applicant is to demonstrate how the dose reference values in 10 CFR 52.79(a)(1)(vi) and the control room dose limits in 10 CFR Part 50, Appendix A, GDC 19 are met using site-specific χ/Q values.	2.3.6	Y	
2.3(3)	The COL applicant is to characterize the atmospheric transport and diffusion conditions necessary for estimating radiological consequences of the routine release of radioactive materials to the atmosphere, and provide realistic estimates of annual average χ/Q values and D/Q values as described in Section 2.3.5 of NUREG-0800.	2.3.6	Y	

2.3.6 Conclusions

Regional Climatology, DCD Section 2.3.1

For the reasons set forth above, the applicant's responses to RAIs items 02.03.01-17, 02.03.01-18, and 02.03.01-19 and other information in the applicant's DCD provide US-APWR climatic standard design parameters which are acceptable to the NRC staff. The applicant has committed to including the design parameters provided in response to RAIs items 02.03.01-17, 02.03.01-18, and 02.03.01-19 in the next revision of the DCD and the staff is tracking this commitment as confirmatory items 02.03.01-17, 02.03.01-18, and 02.03.01-19. The staff finds that the applicant has selected the regional climatology key site parameters referenced in SER Summary of Application, Section 2.3.2 above for plant design inputs (a subset of which is included as Tier 1 information). The staff agrees that these site parameters should be representative of a reasonable number of sites that have been or may be considered for a COL application. The regional climatology characteristics are site-specific and will be addressed by the COL applicant. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics of the plant specified in the COLA fall within the design parameters specified in the DCD. The staff finds the applicant's statements in DCD Tier 2, Section 2.3.1 and COL Information Item 2.3(1) that a COL applicant is to supply site-specific information regarding regional climatology are acceptable.

Local Meteorology DCD Section 2.3.2

There are no postulated site parameters for a DC related to local meteorology. Local meteorological conditions are site-specific and will be addressed by a COL applicant referencing the US-APWR. The COL applicant referencing the US-APWR should include the provision of information sufficient to demonstrate that the actual site characteristics fall within the values of the site parameters specified in the US-APWR DCD. The staff finds the applicant's statements in DCD Tier 2, Section 2.3.2 and COL Information Item 2.3(1) that a COL applicant is to supply site-specific information regarding local meteorology are acceptable.

Onsite Meteorological Measurements Program, DCD Section 2.3.3

There are no postulated site parameters for a DC related to this section. The onsite meteorological monitoring program and the resulting data are site-specific and will be addressed by a COL applicant referencing the US-APWR DCD. The staff finds the applicant's statements in DCD Tier 2, Section 2.3.3 and COL Information Item 2.3(1) that a COL applicant is to supply site-specific information regarding its meteorological monitoring program are acceptable.

Short-Term Atmospheric Dispersion Estimates for Accident Releases, DCD Section 2.3.4

The applicant has selected the short-term (post-accident) key site parameters referenced in SER Summary of Application, Section 2.3.2 above for plant design inputs. Due to the open items that remain to be resolved, the staff is unable to finalize its conclusion regarding acceptability.

Long-Term Atmospheric Dispersion Estimates for Routine Releases, DCD Section 2.3.5

The applicant has selected the annual average (long-term) key site parameters referenced in SER Summary of Application, Section 2.3.2 above for plant design inputs (a subset of which is included as Tier 1 information). The staff agrees that these site parameters should be representative of a reasonable number of sites that have been or may be considered for a COL application. The annual average atmospheric dispersion and deposition characteristics are site-specific and will be addressed by the COL applicant. The COL applicant must provide information sufficient to demonstrate that the actual site characteristics fall within the values of the site parameters specified in the US-APWR DCD. The staff finds the applicant's statements in DCD Tier 2, Section 2.3.5 and COL Information Item 2.3(3) that a COL applicant is to supply site-specific information regarding its long-term atmospheric dispersion estimates are acceptable.

2.4 Hydrologic Engineering

2.4.1 Introduction

In this section, the applicant provides information to allow an independent hydrologic engineering review of all hydrology related design bases for the safe operation of structures, systems, and components important to safety, to be conducted consistent with the guidance found in the SRP. The review areas include: Hydrological description, Floods, Probable Maximum Flood (PMF) on Streams and Rivers, Potential Dam Failures, Probable Maximum Surge and Seiche Flooding, Probable Maximum Tsunami (PMT) Flooding, Ice Effects, Cooling Water Channels and Reservoirs, Channel Diversion, Flooding Protection Requirements, Low Water Considerations, Groundwater, Accidental Releases of Liquid Radioactive Effluents in Ground and Surface Waters, and Technical Specification and Emergency Operation Requirements. For the US-APWR DC review, site-specific issues will be referred to the COL applicant. Hydrological parameters that constitute the US-APWR Standard Plant design bases for siting suitability by a COL applicant under 10 CFR Part 52 are reviewed here.

The applicant has provided design parameters for maximum flooding level, maximum groundwater level, and maximum rainfall intensity. The staff's review will determine whether SSCs important to safety are located at or above the plant grade level for the case of flooding and that the rainfall intensity is representative of the rainfall magnitudes over the majority of the continental U.S.. The sections of the DCD where flooding and flood causing mechanisms are considered include 2.4.2 Floods, 2.4.3 PMF on Streams and Rivers, 2.4.4 Potential Dam Failures, 2.4.5 Probable Maximum Surge and Seiche Flooding, 2.4.6 Probable Maximum Tsunami Flooding and 2.4.7 Ice Effects. The flooding related sections will be reviewed to determine the maximum flood level provided in the DCD. Staff will also review the maximum groundwater level to make sure that there is enough depth below grade to enable activation of mitigation measures should the level rise above the specified maximum value. Section 2.4.12 of the FSAR and the SER are the relevant sections that require consideration of the maximum groundwater level.

DCD Section 2.4.1 describes the site-specific hydrologic information that a COL applicant must consider for safe operation of the plant. Both surface and subsurface water sources must be considered. The COL applicant is to describe the interface of the proposed plant with the hydrosphere, which includes site location, major hydrologic features in the site vicinity, surface- and ground-water-related characteristics, and the proposed water supply to the plant. The descriptions should include summarized quantitative information on the major hydrologic features, such as record high and low flows and other hydrologic anomalies on record.

DCD Section 2.4.2 describes historical flooding (defined as occurrences of abnormally high water stage or overflow from a stream, floodway, lake, or coastal area) information to be collected and analyzed by a COL applicant at the proposed site or in the region of the site. The site-specific design of flood protection for safety-related SSCs is based on consideration of a variety of flood causing mechanisms which result in the highest calculated flood water elevations and flood wave effects.

PMF information is in DCD Section 2.4.3. This section prescribes a hydrometeorological design basis to be developed by a COL applicant to estimate PMF and determine the extent of any flood protection required for those SSCs necessary to ensure the capability to shut down the reactor and maintain it in a safe condition. The COL applicant's site-specific flood analysis is

also to include the translation of the estimated peak flood discharge into a site elevation using applicable site profile and precipitation data.

Potential dam failure information is in DCD Section 2.4.4. This section prescribes a hydrological design basis to be developed by a COL applicant to ensure that any potential hazard to the safety-related facilities due to the failure of onsite, upstream, and downstream water control structures are considered in the plant design.

Probable maximum surge and seiche flooding information is in DCD Section 2.4.5. This section prescribes a hydrometeorological design basis to be developed by a COL applicant to ensure that any potential hazard to the safety-related facilities due to the effects of probable maximum surge and seiche are considered in the plant design.

Probable maximum tsunami hazards information is in DCD Section 2.4.6. This section prescribes a geohydrologic design basis to be developed by a COL applicant to ensure that any potential hazard to the SSCs important to safety due to the effects of probable maximum tsunami are considered in the plant design.

Ice effects information is in DCD Section 2.4.7. This section prescribes a hydrometeorological design basis to be developed by a COL applicant to ensure that safety-related facilities and water supplies are not affected by ice-induced hazards.

Cooling water canal and reservoir information is in DCD Section 2.4.8. This section prescribes a hydraulic design basis to be developed by a COL applicant for site-specific canals and reservoirs used to transport and impound water supplied to SSCs important to safety.

Channel diversion information is in DCD Section 2.4.9. This section prescribes a geohydrologic design basis to be developed by a COL applicant to ensure that the plant and essential water supplies will not be adversely affected. The COL applicant's review is to include stream channel diversions away from the site (which may lead to loss of safety-related water) and stream channel diversions towards the site (which may lead to flooding). If these events could occur, the COL applicant needs to demonstrate that alternate water supplies are available for safety-related equipment.

The flooding protection requirements in DCD Section 2.4.10 prescribe that a COL applicant provide the site-specific locations and elevations of safety-related facilities and also of structures and components required for protection of those safety-related facilities. The information is then to be compared to design-basis flood conditions to determine if flood effects need to be considered in plant design or in emergency procedures.

Low-water considerations in DCD Section 2.4.11 call for a COL applicant to identify natural events that may reduce or limit the available safety-related cooling water supply. The applicant is to ensure that an adequate water supply will still exist to shut down the plant under conditions requiring safety-related cooling.

DCD Section 2.4.12 calls for a COL applicant to evaluate the hydrogeological characteristics of the site to determine the effects of groundwater on plant foundations. The COL applicant is also to describe the reliability of safety-related water supplies and dewatering systems. Critical ground water pathways are to be evaluated for the potential to contaminate nearby ground water users and water bodies such as springs, lakes, or streams from a liquid effluent release.

Information on accidental releases of radioactive liquid effluents in ground and surface waters is in DCD Section 2.4.13. This section calls for a COL applicant to evaluate the hydrogeological characteristics of the site to determine the effects of accidental releases of radioactive liquid effluents in ground and surface waters on existing uses and known likely future uses of ground and surface water resources.

TS and emergency operation requirements are in DCD Section 2.4.14. This section calls for a COL applicant to identify the bases for TS and emergency procedures that are required to implement protection against floods for safety-related plant facilities and to ensure that an adequate supply of water is available for shutdown and cooldown purposes.

Since DCD Section 2.4.15, "Combined License Information," only identifies DCD Section 2.4 related COL information items, which are listed in US-APWR DCD Tier 2, Table 1.8-2, "Compilation of All Combined License Applicant Items for Chapters 1-19," no technical evaluation is needed.

2.4.2 Summary of Application

Hydrologic Description, DCD Section 2.4.1

The applicant postulated the following three site parameters: maximum rainfall rate, maximum groundwater level, and maximum flood level. The DCD Tier 1 and 2 information provided by the applicant is presented in this section. Detailed site-specific hydrologic analysis and data are to be provided by the COL applicant.

DCD Tier 1: The Tier 1 information associated with this section is found in DCD Tier 1, Section 2.1, Site Parameters. The design basis hydrologic engineering parameters of maximum flood (or tsunami) level, maximum rainfall rate (hourly), maximum rainfall rate (short-term) and maximum groundwater level for the US-APWR plant are provided in Table 2.1-1 of Section 2.1. A COL applicant's site for construction of a US-APWR will be acceptable if its site-specific values for the previously listed parameters are within the design parameter values shown in Table 2.1-1.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the hydrologic information required of a COL applicant in Section 2.4.1, summarized here in part, as follows:

> DCD Section 2.4.1 describes the site-specific surface and subsurface external hydrologic information that COL applicants must provide. COL applicants must describe the location, size, shape, and other hydrologic characteristics of streams, lakes, shore regions, and ground water environments influencing plant siting, and include a description of existing and proposed water control structures, both upstream and downstream, that may influence conditions at the site.
>
> DCD Tier 2, Table 2.0-1 also provides the US-APWR site design parameters for hydrologic engineering.
>
> The US-APWR design basis parameters provided in DCD Tier 1, Table 2.1-1 and Tier 2, Table 2.0-1 that are associated with hydrologic engineering are as follows:

Table 2.4-1
US-APWR Hydrologic Engineering Key Site Parameters

Parameter Description	Parameter Value
Maximum flood (or tsunami) level	1 ft below plant grade
Maximum rainfall rate (hourly)	19.4 in/hour for seismic Category I/II structures
Maximum rainfall rate (short-term)	6.3 in/5 min for seismic Category I/II structures
Maximum groundwater level	1 ft below plant grade

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Floods, DCD Section 2.4.2

DCD Tier 1: There are no DCD Tier 1 entries for this area of review. However, reference the hydrologic engineering key site parameters in the hydrologic description section above.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the flood information required of a COL applicant in Section 2.4.2, summarized here in part, as follows:

> DCD Section 2.4.2 describes the site-specific highest calculated flood water level elevations and flood wave effects resulting from analyses of different hypothetical causes that COL applicants must provide. COL applicants must also demonstrate the capability of site-specific drainage facilities to prevent flooding of safety-related structures from local PMP.

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

PMF on Streams and Rivers, DCD Section 2.4.3

DCD Tier 1: There are no DCD Tier 1 entries for this area of review. However, reference the hydrologic engineering key site parameters in the hydrologic description section above.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the PMF on streams and rivers evaluation required of a COL applicant in Section 2.4.3, summarized here in part, as follows:

> DCD Section 2.4.3 describes the site-specific flood analysis to determine the PMF levels on streams and rivers that COL applicants must provide. The flood analysis must also include the translation of the estimated peak flood discharge to elevation using the site profile and precipitation data.

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Potential Dam Failures, DCD Section 2.4.4

DCD Tier 1: There are no DCD Tier 1 entries for this area of review. However, reference the hydrologic engineering key site parameters in the hydrologic description section above.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the potential Dam failures evaluation required of a COL applicant in Section 2.4.4, summarized here in part, as follows:

> DCD Section 2.4.4 describes the site-specific evaluation that COL applicants must provide of potential hazards to the plant's safety-related facilities as a result of plausible failures of onsite, upstream, and downstream water control structures (.e.g., dams). A source list of hazards is provided for which the COL applicant must consider in its evaluation.

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Probable Maximum Surge and Seiche Flooding, DCD Section 2.4.5

DCD Tier 1: There are no DCD Tier 1 entries for this area of review. However, reference the hydrologic engineering key site parameters in the hydrologic description section above.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the probable maximum surge and seiche flooding evaluation required of a COL applicant in Section 2.4.5, summarized here in part, as follows:

> DCD Section 2.4.5 describes the site-specific evaluation and data that COL applicants must provide related to probably maximum surges and seiches. If applicable, the data includes the effects of seismic and non-seismic information on the postulated design basis, and how the data relates to surge and seiche in the vicinity of the site and site region. The data will include the largest breaking wave height, setup, runup, and the effect of overtopping in relation to each safety-related facility or the protection provided for the facility.

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Probable Maximum Tsunami Hazards, DCD Section 2.4.6

DCD Tier 1: There are no DCD Tier 1 entries for this area of review. However, reference the hydrologic engineering key site parameters in the hydrologic description section above.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the probable maximum tsunami hazard evaluation required of a COL applicant in Section 2.4.6, summarized here in part, as follows:

> DCD Section 2.4.6 describes the site-specific information that COL applicants must provide related to probably maximum tsunami hazards. COL applicant sites subject to tsunami or tsunami like waves must consider historic recorded tsunami or translated and inferred tsunami in determining the probable maximum water levels at the site.

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Ice Effects, DCD Section 2.4.7

DCD Tier 1: There are no DCD Tier 1 entries for this area of review. However, reference the hydrologic engineering key site parameters in the hydrologic description section above.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the ice effects evaluation required of a COL applicant in Section 2.4.7, summarized here in part, as follows:

> DCD Section 2.4.7 describes the site-specific information that COL applicants must provide related to the effects of potential icing. COL applicant sites subject to potential icing must consider the most severe ice sheets, ice jam flood, wind-driven ice ridges, or other ice produced effects and forces that are reasonably possible and could affect safety-related facilities. COL applicants need to consider the effects of ice induced reduction in the capacity of water storage facilities as it affects safety-related SSCs.
>
> The US-APWR DCD includes a discussion regarding design features of the UHS in Section 9.2.5. The DCD states that the UHS is capable of dissipating the maximum heat load including a LOCA under the worst combination of adverse environmental conditions including freezing.

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Cooling Water Canals and Reservoirs, DCD Section 2.4.8

DCD Tier 1: There are no DCD Tier 1 entries for this area of review. However, reference the hydrologic engineering key site parameters in the hydrologic description section above.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the cooling water canals and reservoirs evaluation required of a COL applicant in Section 2.4.8, summarized here in part, as follows:

> DCD Section 2.4.8 describes the site-specific cooling-water canal and reservoir information that COL applicants must provide related to the effects on safety-related cooling water due to low-water conditions caused by low streamflow and low water level resulting from draw down caused by hurricanes, seiches, and tsunamis.
>
> DCD Section 9.2.1 describes the essential service water system (ESWS) which provides cooling water to remove heat from the components cooling water heat exchangers and the essential chiller units. DCD Section 9.2.5 states that the UHS consists of an assured source of water with associated safety-related structures designed to dissipate the heat rejected from the ESWS during normal and accident conditions.
>
> DCD Section 2.4.8 states that if the water source for the UHS or other safety-related structures depends on cooling water canals that rely on nearby bodies of water such as oceans, lakes, streams, and reservoirs, then availability of water might be affected by low-water conditions. These low water conditions could be the results of low streamflow and low water level resulting from drawdown caused by hurricanes, seiches, and tsunamis.
>
> The COL applicant is also to provide the design bases for the capacity and operating plan for safety-related cooling water canals and reservoirs considering low-water conditions.

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Channel Diversions, DCD Section 2.4.9

DCD Tier 1: There are no DCD Tier 1 entries for this area of review. However, reference the hydrologic engineering key site parameters in the hydrologic description section above.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the channel diversions evaluation required of a COL applicant in Section 2.4.9, summarized here in part, as follows:

> The channel diversions information in DCD Section 2.4.9 describes the site-specific evaluation that COL applicants must provide related to the potential for upstream diversion or rerouting of the source of cooling water. The COL applicant is to consider upstream diversion or rerouting of the source of cooling water with respect to site-specific seismic, topographical, geologic, and thermal evidence in the region.

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Flooding Protection Requirements, DCD Section 2.4.10

DCD Tier 1: There are no DCD Tier 1 entries for this area of review. However, reference the hydrologic engineering key site parameters in the hydrologic description section above.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the flooding protection requirements evaluation required of a COL applicant in Section 2.4.10, summarized here in part, as follows:

> The flooding protection requirements in DCD Section 2.4.10 describe the site-specific evaluation that COL applicants must provide related to the static and dynamic consequences of any type of flooding on each pertinent safety-related facility. The COL

applicant is referred to DCD Section 3.4 for information relating to flood design, and DCD Section 3.8 for information relating to the qualification of buildings and structures subjected to flooding loads.

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Low Water Considerations, DCD Section 2.4.11

DCD Tier 1: There are no DCD Tier 1 entries for this area of review. However, reference the hydrologic engineering key site parameters in the hydrologic description section above.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the low water considerations required of a COL applicant in Section 2.4.11, summarized here in part, as follows:

> The low water considerations in DCD Section 2.4.11 describe the site-specific evaluation that COL applicants must provide related to how the minimum cooling water volume requirement following a safe-shutdown earthquake (SSE) shutdown will be available for safety basis events. The COL applicant is to provide a site-specific summary that includes the minimum safety-related cooling water flow, the sump invert elevation and configuration, the minimum design operating level, pump submergence elevations (operating heads), and design bases for effluent submergence, mixing, and dispersion. The cooling water pumps are to maintain a sufficient water supply during periods of low water resulting from a 100-year drought. The COL applicant may reference DCD Sections 9.2.1, 9.2.5, and 10.4.5 where applicable. The site-specific analysis is also to consider other uses of water drawn from the UHS, such as fire water or system charging requirements.
>
> DCD Section 2.4.11 also refers to DCD Table 2.4-1 for normal system water demands during normal plant operation. The information provided in Tier 2, Table 2.4-1 is as follows:

Table 2.4-2
US-APWR Normal Operation Water Demands

System	Water Demand [(1)]
Circulating Water System	Approximately 121,133 liters per minute (3.2×10^4 gpm)
ESWS	Note 2

Notes:
[1] These values depend on site condition, and are for reference only. The COL applicant is responsible for verifying water demands and sources.

[2] Water demands depend on type of UHS.

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

Groundwater, DCD Section 2.4.12

DCD Tier 1: There are no DCD Tier 1 entries for this area of review. However, reference the hydrologic engineering key site parameters in the hydrologic description section above.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the groundwater evaluation required of a COL applicant in Section 2.4.12, summarized here in part, as follows:

> DCD Section 2.4.12 describes the evaluation that COL applicants must provide related to the site-specific ground water conditions and issues. The COL applicant's analysis includes critical ground water pathways for a liquid effluent release at the site and an evaluation (where applicable) of the dispersion, ion-exchange, and dilution capability of the ground water environment with respect to present and projected users. The potential to contaminate nearby ground water users and water bodies such as springs, lakes, or streams is evaluated.
>
> Also, the maximum site-specific operational ground water level is to be determined for groundwater induced hydrostatic loadings on subsurface portions of safety-related SSCs. If site dewatering is required during construction, a complete description of the method and any hydrostatic loadings is to be provided.

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

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

DCD Tier 1: There are no DCD Tier 1 entries for this area of review. However, reference the hydrologic engineering key site parameters in the hydrologic description section above.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the accidental releases of radioactive liquid effluents in ground and surface waters evaluation required of a COL applicant in Section 2.4.13, summarized here in part, as follows:

> The information regarding accidental releases of radioactive liquid effluents in ground and surface waters in DCD Section 2.4.13 describes the evaluation that COL applicants must provide of the ability of the ground and surface water environment to delay, disperse, dilute, or concentrate liquid effluents, as related to existing or potential future water users. The COL applicant is to adequately describe dilution factors, dispersion coefficients, flow velocities, travel times, adsorption, and pathways of liquid contaminants.

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

TS and Emergency Operation Requirements, DCD Section 2.4.14

DCD Tier 1: There are no DCD Tier 1 entries for this area of review. However, reference the hydrologic engineering key site parameters in the hydrologic description section above.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the TS and emergency operation requirements required of a COL applicant in Section 2.4.11, summarized here in part, as follows:

> The TS and emergency operation requirements in DCD Section 2.4.14 prescribe that COL applicants describe any site-specific emergency protective measures designed to minimize the impact of adverse hydrology-related events on safety-related facilities. The COL applicant will evaluate the need for any TS for plant shutdown to minimize the consequences of an accident resulting from hydrologic phenomena such as floods or the degradation of the UHS. The potential effects of seismic and non-seismic information on proposed TS and emergency procedures are to be considered. If emergency procedures are used to meet safety requirements associated with hydrologic events, the event is to be identified, and appropriate water levels and lead times available are to be provided.

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

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

COL information or action items: See Section 2.4.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Site Interface Requirements identified in the DCD: There are no site interface requirements associated with this area of review.

2.4.3 Regulatory Basis

The relevant requirements of the NRC's regulations for these areas of review, and the associated acceptance criteria, are given in Sections 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13 and 2.4.14 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," and are summarized below. Review interfaces with other SRP sections can be found in Sections 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13 and 2.4.14 of NUREG-0800.

1. 10 CFR 52.47(a)(1), "Contents of Applications; Technical Information," which requires a DC applicant to provide site parameters postulated for the design. However, DC applications do not include general descriptions of site characteristics because this information is site-specific and is addressed by the COL applicant. The postulated site parameters for a DC related to Section 2.4.1 of NUREG-0800 must be representative of a reasonable number of sites that

may be considered for a COL application and the DC applicant must provide a basis for the site parameters. (Applies to DCD Section 2.4.1 only).

2. 10 CFR 52.47(a)(1), "Contents of Applications; Technical Information," which requires a DC applicant to provide site parameters postulated for the design. However, DC applications do not include general descriptions of site characteristics because this information is site-specific and is addressed by the COL applicant. There are no direct postulated site parameters for the US-APWR DC related to Sections 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13 and 2.4.14 of NUREG-0800. (Applies to DCD Sections 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13 and 2.4.14 only.)

3. This regulatory basis element is provided for information only since it applies to a COL applicant's FSAR, Sections 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13 and 2.4.14. Appendix A to 10 CFR Part 50, GDC 2, "Design Bases for Protection Against Natural Phenomena," requires, in part, that SSCs important to safety shall be designed to withstand the effects of natural phenomena such as tornadoes and hurricanes without loss of capability to perform their safety functions. The design bases for these SSCs shall reflect, in part, appropriate 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. (Applies to DCD Sections 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13 and 2.4.14.)

4. This regulatory basis element is provided for information only since it applies to a COL applicant's FSAR, Sections 2.4.4, 2.4.5, 2.4.8, 2.4.9, 2.4.10, 2.4.11, and 2.4.12. 10 CFR Part 50, Appendix A, GDC 44, "Cooling Water," as it relates to providing a UHS for normal operating and accident conditions. (Applies to DCD Sections 2.4.4, 2.4.5, 2.4.8, 2.4.9, 2.4.10, 2.4.11, and 2.4.12 only.)

5. 10 CFR 50.36, as it relates to identifying limiting conditions in TS for safe operation of the plant. (Applies to DCD Section 2.4.14 only).

6. This regulatory basis element is provided for information only since it applies to a COL applicant's FSAR Sections 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13 and 2.4.14. Paragraph (a)(1)(iii) of 10 CFR 52.79 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. (Applies to DCD Sections 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13 and 2.4.14.)

7. This regulatory basis element is provided for information only since it applies to a COL applicant's FSAR Sections 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13 and 2.4.14. 10 CFR 100.23(d), sets forth the criteria to determine the siting factors for plant design bases with respect to seismically

induced floods and water waves at the site. (Applies to DCD Sections 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13 and 2.4.14.)

8. This regulatory basis element is provided for information only since it applies to a COL applicant's FSAR Sections 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13 and 2.4.14. 10 CFR 100.20(c), as it relates to identifying and evaluating hydrologic features of the site. The requirements to consider physical site characteristics in site evaluations are specified. (Applies to DCD Sections 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, 2.4.11, 2.4.12, 2.4.13, and 2.4.14.)

9. 10 CFR 20.1406, states that applications shall describe how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable, the generation of radioactive waste.

Acceptance criteria adequate to meet the above requirements are discussed and explained in the following RGs:

1. This RG is provided for information only since it primarily applies to COL applications. RG 1.59, "Flood Design Basis for Nuclear Power Plants," as supplemented by best current practices, provides guidance for developing the hydrometeorological design bases. (Applies to DCD Sections 2.4.1, 2.4.2, 2.4.3, 2.4.4, 2.4.5, 2.4.6, 2.4.7, 2.4.8, 2.4.9, 2.4.10, and 2.4.14 only.)

2. This RG is provided for information only since it primarily applies to COL applications. RG 1.125, "Physical Models for Design and Operation of Hydraulic Structures and Systems for Nuclear Power Plants," provides guidance in the use and evaluation of physical models for design and operation of hydraulic structures and systems for nuclear power plants. (Applies to DCD Section 2.4.8 only.)

2.4.4 Technical Evaluation

Hydrologic Description, DCD Section 2.4.1

The applicant has provided design envelope parameters that are necessary for a design certification. The DC applicant is not expected to have site-specific information for COL applications that may reference the DC during the standard plant design stage. Furthermore, the applicant has clearly stated that the provision of all site-specific design information is the responsibility of COL applicant that references the US-APWR DC. The general hydrologic description requirements stated in this section of the US-APWR DCD are also in agreement with the EPRI advanced light-water reactor (ALWR) utility requirement document, which is widely used by the industry. Section 2.4.1 of the US-APWR DCD also satisfies the site-specific hydrologic description needs by providing enveloping parameters specific to the US-APWR design and requiring the prospective COL applicant to provide the detailed site-specific hydrologic analysis and demonstrate that the site falls within the parameters specific to the US-APWR design. The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1

- Chapter 2, Section 2.1, “Site Parameters,” and Table 2.1-1, “Key Site Parameters”

- Tier 2
  - Chapter 1, Section 1.2.1.6, “Site Characteristics”
  - Chapter 1, Section 1.2.2, “Combined License Information”
  - Chapter 1, Section 1.8, “Interfaces for Standard Design”
  - Chapter 1, Section 1.9, “Conformance with Regulatory Criteria”
  - Chapter 2, Section 2.0, “Site Characteristics,” and Table 2.0-1, “Key Site Parameters”
  - Chapter 2, Section 2.4, “Hydrologic Engineering”
  - Chapter 2, Table 2.4-1, “Normal Operation Water Demands”

Site hydrology descriptions are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC must provide sufficient information to demonstrate that the site falls within the site parameters specified in the design certification document. COL Action Item 2.4-1 DCD Tier 1, Table 2.1-1, requires that the COL applicant provide the site-specific information used to satisfy the requirements of 10 CFR Part 52 and 10 CFR Part 100, which form the basis of the hydrologic engineering design. COL Action Item 2.4-1 DCD Tier 1, Table 2.1-1, captures this basic design-basis site parameter. The staff finds the applicant’s requirement that the COL applicant provide this information acceptable.

The applicant postulated the following three site parameters: maximum rainfall rate, maximum groundwater level, and maximum flood level.

The applicant specified a value of 19.4 in/h for the maximum rainfall rate. This value is used frequently for bounding analysis and is found in NOAA Hydrometeorological Report 52 (HMR-52) which is referenced in NUREG-0800 and SRP section 2.4. Staff accepts this maximum rainfall rate to be reasonable.

The applicant specified a value of 1 foot below finished grade for the maximum flood level and a value of 1 foot below finished grade for the maximum groundwater level. Staff determined that both of these values are close to those specified in the EPRI Utility Requirements Document and NUREG-1242 “NRC Review of Electric Power Research Institute’s Advanced Light Water Reactor Utility Requirements Document”, and also the safety related structures systems and components important to safety are located at or above plant grade level. Based on those evaluations staff finds the specified enveloping parameter values to be reasonable.

Floods, DCD Section 2.4.2

The applicant has provided design envelope parameters that are necessary for design certification. For the flood analysis, the review is based on maximum flood levels, not on the events that might generate the flood, which are addressed in the following sections. To determine the maximum flood level, the applicant must consider the various flood-causing

mechanisms, such as surge, seiche, tsunami, and flooding from dam breach and probable maximum precipitation. The applicant must look at combined events that would produce the worst-case scenario for flooding. The applicant specified a value of 1 foot below finished grade for the maximum flood level. Staff determined that both of these values are close to those specified in the EPRI Utility Requirements Document and NUREG-1242 "NRC Review of Electric Power Research Institute's Advanced Light Water Reactor Utility Requirements Document", and also the safety related structures systems and components important to safety are located at or above plant grade level. Based on those evaluations staff finds the specified enveloping parameter values to be reasonable.

The applicant is not expected to have detailed site-specific information for COL applications that may reference the DC during the standard plant design stage. Furthermore, the applicant has clearly stated that it is the responsibility of the COL applicant that references the US-APWR DC to provide all site-specific design information and demonstrate that the site falls within the site parameters specified in the design certification document. The general hydrologic description requirements stated in this section of the US-APWR are also in agreement with the EPRI ALWR utility requirement document, which is widely used by the industry as a standard. Section 2.4.2 of the US-APWR DCD also satisfies the site-specific floods needs by providing enveloping parameters specific to the US-APWR design and requiring the prospective COL applicant to provide the detailed site-specific hydrologic analysis to demonstrate that the site is suitable for the US-APWR design. The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1
  - Chapter 2, Section 2.1, "Site Parameters," and Table 2.1-1, "Key Site Parameters"

- Tier 2
  - Chapter 1, Section 1.2.1.6, "Site Characteristics"
  - Chapter 1, Section 1.2.2, "Combined License Information"
  - Chapter 1, Section 1.8, "Interfaces for Standard Design"
  - Chapter 1, Section 1.9, "Conformance with Regulatory Criteria"
  - Chapter 2, Section 2.0, "Site Characteristics," and Table 2.0-1, "Key Site Parameters"
  - Chapter 2, Section 2.4, "Hydrologic Engineering"
  - Chapter 2, Table 2.4-1, "Normal Operation Water Demands"

Site flood descriptions are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the site falls within the site parameters specified in the design certification document. COL Action Item 2.4-1 DCD Tier 1, Table 2.1-1, requires that the COL applicant provide the site-specific information used to satisfy the requirements of 10 CFR Part 52 and 10 CFR Part 100, which form the basis of the hydrologic engineering design. COL Action Item 2.4-1 DCD Tier 1, Table 2.1-1, captures this basic design-basis site parameter. The staff finds the applicant's requirement that the COL applicant provide this information acceptable.

PMF on Streams and Rivers, DCD Section 2.4.3

The applicant has provided design envelope parameters that are necessary for design certification. This parameter focuses on PMF from probable maximum precipitation. The applicant specified a value of 1 ft below finished grade for the maximum flood level. Staff determined that both of these values are close to those specified in the EPRI Utility Requirements Document and NUREG-1242 "NRC Review of Electric Power Research Institute's Advanced Light Water Reactor Utility Requirements Document", and also the safety related structures systems and components important to safety are located at or above plant grade level. Based on those evaluations staff finds the specified enveloping parameter values to be reasonable.

The applicant is not expected to have detailed site-specific information for COL applications that may reference the DC during the standard plant design stage. Furthermore, the applicant has clearly stated that it is the responsibility of the COL applicant to provide all site-specific design information and demonstrate that the site falls within the site parameters specified in the design certification documents. The general hydrologic description requirements stated in this section of the US-APWR DCD are also in agreement with the EPRI ALWR utility requirement document, which is widely used by the industry as a standard. Section 2.4.3 of the US-APWR also satisfies the site-specific PMF on streams and rivers needs by providing enveloping parameters specific to the US-APWR design and requiring the prospective COL applicant to provide the detailed site-specific hydrologic analysis and demonstrate that the site is suitable for the US-APWR design. The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1
  - Chapter 2, Section 2.1, "Site Parameters," and Table 2.1-1, "Key Site Parameters"

- Tier 2
  - Chapter 1, Section 1.2.1.6, "Site Characteristics"
  - Chapter 1, Section 1.2.2, "Combined License Information"
  - Chapter 1, Section 1.8, "Interfaces for Standard Design"
  - Chapter 1, Section 1.9, "Conformance with Regulatory Criteria"
  - Chapter 2, Section 2.0, "Site Characteristics," and Table 2.0-1, "Key Site Parameters"
  - Chapter 2, Section 2.4, "Hydrologic Engineering"
  - Chapter 2, Table 2.4-1, "Normal Operation Water Demands"

Site PMF on streams and rivers descriptions are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR should provide sufficient information to demonstrate that the site falls within the site parameters specified in the design certification document. COL Action Item 2.4-1 DCD Tier 1, Table 2.1-1, requires that the COL applicant provide the site-specific information used to satisfy the requirements of

10 CFR Part 52 and 10 CFR Part 100, which form the basis of the hydrologic engineering design. COL Action Item 2.4-1 DCD Tier 1, Table 2.1-1, captures this basic design-basis site parameter. The staff finds the applicant's requirement that the COL applicant provide this information acceptable.

Potential Dam Failures, DCD Section 2.4.4

The applicant has provided design envelope parameters that are necessary for design certification. Potential dam failures are one of the components of the flood analysis described in Section 2.4.2 above. The applicant specified a value of 1 ft below finished grade for the maximum flood level. The staff determined that both of these values are close to those specified in the EPRI Utility Requirements Document and NUREG-1242 "NRC Review of Electric Power Research Institute's Advanced Light Water Reactor Utility Requirements Document", and also the safety related structures systems and components important to safety are located at or above plant grade level. Based on those evaluations staff finds the specified enveloping parameter values to be reasonable.

The applicant is not expected to have detailed site-specific information for COL applications that may reference the DC during the standard plant design stage. Furthermore, the applicant has clearly stated that it is the responsibility of the COL applicant to provide all site-specific design information and demonstrate that the site falls within the site parameters specified in the design certification document. The general hydrologic description requirements stated in this section of the US-APWR DCD are also in agreement with the EPRI ALWR utility requirement document, which is widely used by the industry as a standard. Section 2.4.4 of the US-APWR DCD also satisfies the site-specific potential Dam failures description needs by providing enveloping parameters specific to the US-APWR design and requiring the prospective COL applicant to provide the detailed site-specific hydrologic analysis and demonstrate that the site is suitable for the US-APWR design. The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1
  - Chapter 2, Section 2.1, "Site Parameters," and Table 2.1-1, "Key Site Parameters"
- Tier 2
  - Chapter 1, Section 1.2.1.6, "Site Characteristics"
  - Chapter 1, Section 1.2.2, "Combined License Information"
  - Chapter 1, Section 1.8, "Interfaces for Standard Design"
  - Chapter 1, Section 1.9, "Conformance with Regulatory Criteria"
  - Chapter 2, Section 2.0, "Site Characteristics," and Table 2.0-1, "Key Site Parameters"
  - Chapter 2, Section 2.4, "Hydrologic Engineering"
  - Chapter 2, Table 2.4-1, "Normal Operation Water Demands"

Site potential Dam failures descriptions are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient

information to demonstrate that the site falls within the site parameters specified in the design certification document. COL Action Item 2.4-1 DCD Tier 1, Table 2.1-1, requires that the COL applicant provide the site-specific information used to satisfy the requirements of 10 CFR Part 52 and 10 CFR Part 100, which form the basis of the hydrologic engineering design. COL Action Item 2.4-1 DCD Tier 1, Table 2.1-1, captures this basic design-basis site parameter. The staff finds the applicant's requirement that the COL applicant provide this information acceptable.

Probable Maximum Surge and Seiche Flooding, DCD Section 2.4.5

The applicant has provided design envelope parameters that are necessary for .design certification. Probable maximum surges and seiches are one of the components of the flood analysis described in Section 2.4.2 above. The applicant specified a value of 1 ft below finished grade for the maximum flood level. The staff determined that both of these values are close to those specified in the EPRI Utility Requirements Document and NUREG-1242 "NRC Review of Electric Power Research Institute's Advanced Light Water Reactor Utility Requirements Document", and also the safety related structures systems and components important to safety are located at or above plant grade level. Based on those evaluations staff finds the specified enveloping parameter values to be reasonable.

The applicant is not expected to have site-specific information for COL applications that may reference the DC during the standard plant design stage. Furthermore, the applicant has clearly stated that it is the responsibility of the COL applicant to provide all site-specific design information and demonstrate that the site falls within the site parameters specified in the design certification document. The general hydrologic description requirements stated in this section of the US-APWR DCD are also in agreement with the EPRI ALWR utility requirement document, which is widely used by the industry as a standard. Section 2.4.5 of the US-APWR DCD also satisfies the requirements of Section 2.4.5 of NUREG-0800 by describing the components of a probable maximum surge and seiche flooding analysis that the COL applicant that references the US-APWR DC must provide in the COL FSAR. The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1
  - Chapter 2, Section 2.1, "Site Parameters," and Table 2.1-1, "Key Site Parameters"
- Tier 2
  - Chapter 1, Section 1.2.1.6, "Site Characteristics"
  - Chapter 1, Section 1.2.2, "Combined License Information"
  - Chapter 1, Section 1.8, "Interfaces for Standard Design"
  - Chapter 1, Section 1.9, "Conformance with Regulatory Criteria"
  - Chapter 2, Section 2.0, "Site Characteristics," and Table 2.0-1, "Key Site Parameters"
  - Chapter 2, Section 2.4, "Hydrologic Engineering"
  - Chapter 2, Table 2.4-1, "Normal Operation Water Demands"

Site probable maximum surge and seiche flooding descriptions are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the site falls within the site parameters specified in the design certification document. COL Action Item 2.4.1 DCD Tier 1, Table 2.1-1, requires that the COL applicant provide the site-specific information used to satisfy the requirements of 10 CFR Part 52 and 10 CFR Part 100, which form the basis of the hydrologic engineering design. COL Action Item 2.4.1 DCD Tier 1, Table 2.1-1, captures this basic design-basis site parameter. The staff finds the applicant's requirement that the COL applicant provide this information acceptable.

Probable Maximum Tsunami Hazards, DCD Section 2.4.6

The applicant has provided design envelope parameters that are necessary for design certification. Tsunamis are one of the components of the flood analysis described in Section 2.4.2 above. The applicant specified a value of 1 ft below finished grade for the maximum flood level. Staff determined that both of these values are close to those specified in the EPRI Utility Requirements Document and NUREG-1242 "NRC Review of Electric Power Research Institute's Advanced Light Water Reactor Utility Requirements Document", and also the safety related structures systems and components important to safety are located at or above plant grade level. Based on those evaluations staff finds the specified enveloping parameter values to be reasonable.

The applicant is not expected to have detailed site-specific information for COL applications that may reference the DC during the standard plant design stage. Furthermore, the applicant has clearly stated that it is the responsibility of the COL applicant to provide all site-specific design information and demonstrate that the site falls within the site parameters specified in the design certification document. The general hydrologic description requirements stated in this section of the US-APWR DCD are also in agreement with the EPRI ALWR utility requirement document, which is widely used by the industry as a standard. Section 2.4.6 of the US-APWR DCD also satisfies the requirements of Section 2.4.6 of NUREG-0800 by describing the components of a probable maximum tsunami hazards analysis that a COL applicant that references the US-APWR DC must provide in the COL FSAR. The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1
  - Chapter 2, Section 2.1, "Site Parameters," and Table 2.1-1, "Key Site Parameters"
- Tier 2
  - Chapter 1, Section 1.2.1.6, "Site Characteristics"
  - Chapter 1, Section 1.2.2, "Combined License Information"
  - Chapter 1, Section 1.8, "Interfaces for Standard Design"
  - Chapter 1, Section 1.9, "Conformance with Regulatory Criteria"
  - Chapter 2, Section 2.0, "Site Characteristics," and Table 2.0-1, "Key Site Parameters"

- Chapter 2, Section 2.4, “Hydrologic Engineering”
- Chapter 2, Table 2.4-1, “Normal Operation Water Demands”

Site probable maximum tsunami hazards descriptions are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters in the DCD. COL Action Item 2.4-1 DCD Tier 1, Table 2.1-1, requires that the COL applicant provide the site-specific information used to satisfy the requirements of 10 CFR Part 52 and 10 CFR Part 100, which form the basis of the hydrologic engineering design. COL Action Item 2.4-1 DCD Tier 1, Table 2.1-1, captures this basic design-basis site parameter. The staff finds the applicant’s requirement that the COL applicant provide this information acceptable.

Ice Effects, DCD Section 2.4.7

Ice might accumulate and obstruct waterways and potentially impact SSCs important to safety, and must therefore be analyzed as part of the flood analysis in Section 2.4.2 above. When there is potential obstruction of the flow of waterways, as there is when ice accumulates, there is also the possibility for flooding. The applicant specified a value of 1 ft below finished grade for the maximum flood level. Staff determined that both of these values are close to those specified in the EPRI Utility Requirements Document and NUREG-1242 “NRC Review of Electric Power Research Institute’s Advanced Light Water Reactor Utility Requirements Document”, and also the safety related structures systems and components important to safety are located at or above plant grade level. Based on those evaluations staff finds the specified enveloping parameter values to be reasonable.

The applicant is not expected to have site-specific information for COL applications that may reference the DC during the standard plant design stage. Furthermore, the applicant has clearly stated that the provision of all site-specific design information is the responsibility of the COL applicant that references the US-APWR DC. The general hydrologic description requirements stated in this section of the US-APWR DCD are also in agreement with the EPRI ALWR utility requirement document, which is a document widely used by the industry as a standard. Section 2.4.7 of the US-APWR FSAR also satisfies the requirements of Section 2.4.7 of NUREG-0800 by describing the components of a potential ice and freezing effects analysis that must be provided by a COL applicant that references the US-APWR DC. The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1
  - Chapter 2, Section 2.1, “Site Parameters,” and Table 2.1-1, “Key Site Parameters”
- Tier 2
  - Chapter 1, Section 1.2.1.6, “Site Characteristics”
  - Chapter 1, Section 1.2.2, “Combined License Information”
  - Chapter 1, Section 1.8, “Interfaces for Standard Design”
  - Chapter 1, Section 1.9, “Conformance with Regulatory Criteria”

- Chapter 2, Section 2.0, “Site Characteristics,” and Table 2.0-1, “Key Site Parameters”
- Chapter 2, Section 2.4, “Hydrologic Engineering”
- Chapter 2, Table 2.4-1, “Normal Operation Water Demands”

Site ice effects descriptions are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters in the DCD. COL Action Item 2.4-1 DCD Tier 1, Table 2.1-1, requires that the COL applicant provide the site-specific information used to satisfy the requirements of 10 CFR Part 52 and 10 CFR Part 100, which form the basis of the hydrologic engineering design. COL Action Item 2.4-1 DCD Tier 1, Table 2.1-1, captures this basic design-basis site parameter. The staff finds the applicant’s requirement that the COL applicant provide this information acceptable.

Cooling Water Canals and Reservoirs, DCD Section 2.4.8

There is no postulated parameter for cooling water canals and reservoirs because this information is purely site-specific and is not available to the applicant. If any canals or reservoirs are part of the safety-related water conveyance system, the applicant would be required to address them in the DCD. The applicant is not expected to have site-specific information for COL applications that may reference the DC during the standard plant design stage. Furthermore, the applicant has clearly stated that it is the responsibility of the COL applicant to provide all site-specific design information and demonstrate that the site falls within the site parameters specified in the design certification document. The general hydrologic description requirements stated in this section of the US-APWR DCD are in agreement with the EPRI ALWR utility requirement document, which is widely used by the industry as a standard. Section 2.4.8 of the US-APWR DCD also satisfies the requirements of Section 2.4.8 of NUREG-0800 by describing the components of the analysis for design basis capacity and operating plan for safety-related cooling water canals and reservoirs that must be provided by a COL applicant that references the US-APWR DC. The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1
  - Chapter 2, Section 2.1, “Site Parameters,” and Table 2.1-1, “Key Site Parameters”
- Tier 2
  - Chapter 1, Section 1.2.1.6, “Site Characteristics”
  - Chapter 1, Section 1.2.2, “Combined License Information”
  - Chapter 1, Section 1.8, “Interfaces for Standard Design”
  - Chapter 1, Section 1.9, “Conformance with Regulatory Criteria”
  - Chapter 2, Section 2.0, “Site Characteristics,” and Table 2.0-1, “Key Site Parameters”

- Chapter 2, Section 2.4, “Hydrologic Engineering”
- Chapter 2, Table 2.4-1, “Normal Operation Water Demands”

Site cooling water canals and reservoirs descriptions are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the design certification document. COL Action Item 2.4-1 requires the COL applicant to provide the site-specific information used to satisfy the requirements of 10 CFR Part 52 and 10 CFR Part 100 and to demonstrate that the capacities of cooling water canals and reservoirs are adequate. This information is site-specific and is not available to the DC applicant. The staff evaluated COL Action Item 2.4-1 in view of the relevant requirements of GDC 1, GDC 2, and 10 CFR Part 100, and the regulations regarding safety-related service water systems that require transport and impoundment of plant cooling water. The staff finds the applicant’s inclusion of COL Action Item 2.4-1, which ensures that the site-specific information pertaining to site cooling water canals and reservoirs will be presented by the COL applicant and analyzed in review of the COL application, acceptable.

Channel Diversions, DCD Section 2.4.9

There is no postulated parameter for channel diversions because this information is purely site-specific and is not available to the applicant. The applicant is not expected to have site-specific information for COL applications that may reference the DC during the standard plant design stage. Furthermore, the applicant has clearly stated that it is the responsibility of the COL applicant to provide all site-specific design information and demonstrate that the site falls within the site parameters specified in the design certification document. The general hydrologic description requirements stated in this section of the US-APWR DCD are also in agreement with the EPRI ALWR utility requirement document, which is widely used by the industry as a standard. Section 2.4.9 of the US-APWR DCD also satisfies the requirements of Section 2.4.9 of NUREG-0800 by describing the components of an analysis for a potential diversion or re-routing of the cooling water source upstream of the plant that must be provided by a COL applicant that references the US-APWR DC. The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1
  - Chapter 2, Section 2.1, “Site Parameters,” and Table 2.1-1, “Key Site Parameters”
- Tier 2
  - Chapter 1, Section 1.2.1.6, “Site Characteristics”
  - Chapter 1, Section 1.2.2, “Combined License Information”
  - Chapter 1, Section 1.8, “Interfaces for Standard Design”
  - Chapter 1, Section 1.9, “Conformance with Regulatory Criteria”
  - Chapter 2, Section 2.0, “Site Characteristics,” and Table 2.0-1, “Key Site Parameters”

- Chapter 2, Section 2.4, “Hydrologic Engineering”
- Chapter 2, Table 2.4-1, “Normal Operation Water Demands”

Channel diversions might affect existing water conveyance systems and river channels. Site channel diversions descriptions are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the DCD. Site-specific information related to channel diversion is not available at the DC stage. The applicant has included COL Action Item 2.4-1, which requires the COL applicant to provide the site-specific information used to satisfy the requirements of 10 CFR Part 52 and 10 CFR Part 100 and to demonstrate that the potential for channel migration or diversion has been addressed at the site. The staff considered the relevant requirements of GDC 1, GDC 2, and 10 CFR Part 100 in its reviewed of the DCD and COL Action Item 2.4-1, and also considered the fact that the regulations regarding safety-related service water systems require transport and impoundment of plant cooling water. The staff finds the applicant’s inclusion of COL Action Item 2.4-1, which requires the COL applicant to provide detailed site-specific analysis and data including historical information on channel migration, acceptable.

Flood Protection Requirements, DCD Section 2.4.10

Flood protection requirements vary depending on whether the site is wet or dry. There is no postulated design parameter for flood protection requirements because this information is purely site-specific and is not available to the applicant. The applicant is not expected to have site-specific information for COL applications that may reference the DC during the standard plant design stage. Furthermore, the applicant has clearly stated that it is the responsibility of the COL applicant to provide all site-specific design information and demonstrate that the site meets the general hydrologic description requirements for the US-APWR. The general hydrologic description requirements stated in this section of the DCD are also in agreement with the EPRI ALWR utility requirement document, which is widely used by the industry as a standard. Section 2.4.10 of the US-APWR DCD also satisfies the requirements of Section 2.4.10 of NUREG-0800 by stating that static and dynamic flooding and its consequences must be considered and that flooding protection and emergency requirements must be implemented by the COL applicant that references the US-APWR DC. The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1
  - Chapter 2, Section 2.1, “Site Parameters,” and Table 2.1-1, “Key Site Parameters”
- Tier 2
  - Chapter 1, Section 1.2.1.6, “Site Characteristics”
  - Chapter 1, Section 1.2.2, “Combined License Information”
  - Chapter 1, Section 1.8, “Interfaces for Standard Design”
  - Chapter 1, Section 1.9, “Conformance with Regulatory Criteria”
  - Chapter 2, Section 2.0, “Site Characteristics,” and Table 2.0-1, “Key Site Parameters”

- Chapter 2, Section 2.4, “Hydrologic Engineering”
- Chapter 2, Table 2.4-1, “Normal Operation Water Demands”

Site flood protection requirements descriptions are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the design certification document. Information related to flood protection requirements is site-specific and depends on whether the site is going to be a wet or dry site and this type of information is not available at the DC stage. COL Action Item 2.4-1 requires that the COL applicant provide the site-specific information used to satisfy the requirements of 10 CFR Part 52 and 10 CFR Part 100 and to demonstrate static and dynamic consequences of any type of flooding were considered on each safety-related facility. The staff reviewed the DCD and COL Action Item 2.4-1 in view of the relevant requirements of GDC 1, GDC 2, and 10 CFR Part 100, and considered the fact that the regulations regarding safety-related service water systems require transport and impoundment of plant cooling water. The staff finds that the applicant’s requirement in COL Action Item 2.4-1 that the COL applicant provide the detailed site-specific analysis and information regarding flood protection acceptable.

Low Water Considerations, DCD Section 2.4.11

The US-APWR is a passive design that stores water for safe shutdown and does not require water withdrawal from a water body directly into a safety-related system for cooling purposes. For this reason, there is no postulated parameter for low water considerations. The general hydrologic description requirements stated in this section of the US-APWR DCD are in agreement with the EPRI ALWR utility requirement document, which is widely used by the industry as a standard. Section 2.4.11 of the US-APWR DCD also satisfies the requirements of Section 2.4.11 of NUREG-0800 by stating that the US-APWR has an average cooling water volume requirement for 30 days following SSE shutdown of 8,000,000 gallons. The US-APWR DCD also states that as part of the site-specific hydrologic engineering evaluation, low water conditions are to be described and how this volume of cooling water will be available for safety basis events by the prospective COL applicant. The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1
  - Chapter 2, Section 2.1, “Site Parameters,” and Table 2.1-1, “Key Site Parameters”
- Tier 2
  - Chapter 1, Section 1.2.1.6, “Site Characteristics”
  - Chapter 1, Section 1.2.2, “Combined License Information”
  - Chapter 1, Section 1.8, “Interfaces for Standard Design”
  - Chapter 1, Section 1.9, “Conformance with Regulatory Criteria”
  - Chapter 2, Section 2.0, “Site Characteristics,” and Table 2.0-1, “Key Site Parameters”

- Chapter 2, Section 2.4, “Hydrologic Engineering”
- Chapter 2, Table 2.4-1, “Normal Operation Water Demands”

Information related to low water conditions and water availability during low water conditions is site-specific and information is not available at the DC stage. Descriptions of site-specific low water considerations will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the DCD. COL Action Item 2.4-1 requires that the COL applicant provide the site-specific information used to satisfy the requirements of 10 CFR Part 52 and 10 CFR Part 100 and to demonstrate that low water conditions will not impact the safe operation of the US-APWR. The staff reviewed the DCD and COL Action Item 2.4-1 in light of the regulations regarding safety-related service water systems, which require transport and impoundment of plant cooling water. The staff finds the applicant’s inclusion of COL Action Item 2.4-1, which requires that the COL applicant will provide a detailed site-specific analysis and information related to low water conditions and water availability during low water conditions acceptable.

Groundwater, DCD Section 2.4.12

The applicant has provided design envelope parameters that are necessary for design certification. The applicant specified a value of 1 ft below finished grade for the maximum groundwater level. The staff determined that both of these values are close to those specified in the EPRI Utility Requirements Document and NUREG-1242 “NRC Review of Electric Power Research Institute’s Advanced Light Water Reactor Utility Requirements Document”, and also the safety related structures systems and components important to safety are located at or above plant grade level. Based on those evaluations staff finds the specified enveloping parameter values to be reasonable.

The applicant is not expected to have site-specific information for COL applications that may reference the US-APWR DC during the standard plant design stage. Furthermore, the applicant has clearly stated that the provision of all site-specific design information is the responsibility of the COL applicant that references the US-APWR DC. The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1
  - Chapter 2, Section 2.1, “Site Parameters,” and Table 2.1-1, “Key Site Parameters”
- Tier 2
  - Chapter 1, Section 1.2.1.6, “Site Characteristics”
  - Chapter 1, Section 1.2.2, “Combined License Information”
  - Chapter 1, Section 1.8, “Interfaces for Standard Design”
  - Chapter 1, Section 1.9, “Conformance with Regulatory Criteria”
  - Chapter 2, Section 2.0, “Site Characteristics,” and Table 2.0-1, “Key Site Parameters”

- Chapter 2, Section 2.4, “Hydrologic Engineering”
- Chapter 2, Table 2.4-1, “Normal Operation Water Demands”

Groundwater descriptions are site-specific and will be addressed by the COL applicant. COL Action Item 2.4-1 requires that the COL applicant provide the site-specific information used to satisfy the requirements of 10 CFR Part 52 and 10 CFR Part 100 and to demonstrate that groundwater conditions will not impact the safe operation of the US-APWR. The staff finds the applicant’s requirement in COL Action Item 2.4-1, that the COL applicant provide sufficient information concerning groundwater to demonstrate that the design of the plant falls within the site parameters specified by the design certification document, acceptable.

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

There is no postulated parameter for accidental releases of radioactive liquid effluents in ground and surface waters because this category of releases is based on a failure scenario that is specific to the site and takes into account actual water receptors. Section 2.4.13 of the US-APWR DCD states that the analysis of accidental releases of liquid radioactive effluents into surface and groundwaters is to be provided by the COL applicant and that the accidental releases analysis must describe sources, pathways, radionuclide transport characterization, and receiving water body information. The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1
  - Chapter 2, Section 2.1, “Site Parameters,” and Table 2.1-1, “Key Site Parameters”
- Tier 2
  - Chapter 1, Section 1.2.1.6, “Site Characteristics”
  - Chapter 1, Section 1.2.2, “Combined License Information”
  - Chapter 1, Section 1.8, “Interfaces for Standard Design”
  - Chapter 1, Section 1.9, “Conformance with Regulatory Criteria”
  - Chapter 2, Section 2.0, “Site Characteristics,” and Table 2.0-1, “Key Site Parameters”
  - Chapter 2, Section 2.4 “Hydrologic Engineering”
  - Chapter 2, Table 2.4-1 “Normal Operation Water Demands”

Detailed analysis and identification of pathways, receiving water bodies, transport of radioactive effluents at a site and determination of effluent concentration in water bodies is site-specific and this information is not available at the DC stage. Site accidental releases of radioactive liquid effluents in ground and surface waters descriptions are site-specific and will be addressed by the COL applicant. The applicant has included COL Action Item 2.4-1, which requires that the COL applicant provide the site-specific information used to satisfy the requirements of

10 CFR Part 52 and 10 CFR Part 100 and to characterize the groundwater and surface water environment and describe its capacity to delay, disperse, dilute, or concentrate accidental radioactive liquid effluent releases. The staff finds the applicant's requirement in COL Action Item 2.4-1that the COL applicant provide detailed analysis and identification of pathways, receiving water bodies, transport of radioactive effluents at a site and determination of effluent concentration in water bodies acceptable.

TS and Emergency Operation Requirements, DCD Section 2.4.14

There is no postulated parameter for TS and emergency operation requirements because the analysis of these aspects of the plant design is based on adverse hydrologic events that result in emergency situations, and emergency requirements are site-specific and are determined after careful consideration and analysis of site-specific adverse hydrologic phenomena.
Section 2.4.14 of the US-APWR DCD satisfies the applicable regulations which are also referenced in requirements Section 2.4.14 of NUREG-0800 by stating that the COL applicant must provide descriptions of any emergency protective measures designed to minimize the impact of adverse hydrology-related events on safety-related facilities.
The NRC staff reviewed the following US-APWR DCD sections:

- Tier 1
  - Chapter 2, Section 2.1, "Site Parameters," and Table 2.1-1, "Key Site Parameters"

- Tier 2
  - Chapter 1, Section 1.2.1.6, "Site Characteristics"
  - Chapter 1, Section 1.2.2, "Combined License Information"
  - Chapter 1, Section 1.8, "Interfaces for Standard Design"
  - Chapter 1, Section 1.9, "Conformance with Regulatory Criteria"
  - Chapter 2, Section 2.0, "Site Characteristics," and Table 2.0-1, "Key Site Parameters"
  - Chapter 2, Section 2.4, "Hydrologic Engineering"
  - Chapter 2, Table 2.4-1, "Normal Operation Water Demands"

Site TS and emergency operations requirements descriptions are site-specific and will be addressed by the COL applicant. This information is not available to the DC applicant because the emergency requirements are site-specific and are determined after careful consideration and analysis of site-specific adverse hydrologic phenomena. To satisfy the requirements of 10 CFR Part 52 and 10 CFR Part 100, to require a description of the site-specific emergency measures that will be implemented, and to require appropriate TS for plant shutdown in a manner that will minimize the consequences of an accident resulting from adverse hydrologic phenomena, the applicant included a requirement in COL Action Item 2.4-1 that the COL applicant must provide this detailed, site-specific information. The staff has reviewed COL Action Item 2.4-1 and finds that it is acceptable.

2.4.5 Combined License Information Items

The following is the COL information item number and description pertinent to DCD Tier 2, Section 2.4, from Table 1.8-2 of the DCD:

Table 2.3-4
US-APWR Combined License Information Items

Item No.	Description	Section	Action Required By COL Applicant	Action Required By COL Holder
2.4-(1	The COL applicant is to provide sufficient information to verify that hydrologic-related events will not affect the safety-basis for the US-APWR.	2.4.15	Y	

2.4.6 Conclusions

Hydrologic Description, DCD Section 2.4.1

The NRC staff has reviewed the applicant's site parameters referenced in SER Summary of Application, Section 2.4.2 above for plant design inputs (a subset of which is included as Tier 1 information), and finds that they are representative of a reasonable number of sites that have been or may be considered for a COL application. Site hydrology descriptions are site-specific and will be addressed by the COL applicant that references the US-APWR DC. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the DCD.

The applicant has properly identified and described the responsibility of the COL applicant that references the US-APWR DC to provide site-specific information and analyses and demonstrate that the site is suitable for the US-APWR. The hydrologic description found in this section of the US-APWR DC is considered adequate and meets the requirements of 10 CFR Parts 20, 50, and 52. The information requirements discussed in Section 2.4.1 of the US-APWR DCD set commitments for the COL applicant that references the US-APWR DC to provide detailed site characteristic and hydrologic information. The requirement that the COL applicant provide this site specific information conforms with the guidance in RG 1.206. Therefore, the staff finds this section adequate in terms of satisfying the pertinent regulatory requirements for design certification.

Floods, DCD Section 2.4.2

The NRC staff has reviewed the applicant's hydrologic engineering site parameters referenced in SER Summary of Application, Section 2.4.2, above for plant design inputs (a subset of which is included as Tier 1 information), and finds that they are representative of a reasonable number of sites that have been or may be considered for a COL application. The local intense precipitation, flooding causal mechanisms, and the controlling flooding mechanism are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant

falls within the site parameters specified in the design certification document. The COL applicant should provide information sufficient to demonstrate that the actual site characteristics of the plant specified in the COLA fall within the design parameters specified in the DCD. Therefore, the DCD applicant's requirement that the COL applicant that references the US-APWR DC address these issues in the COLACOL FSAR is acceptable.

PMF on Streams and Rivers, DCD Section 2.4.3

The NRC staff has reviewed the applicant's hydrologic engineering site parameters referenced in SER Summary of Application, Section 2.4.2, above for plant design inputs (a subset of which is included as Tier 1 information), and agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL application. PMF on streams and rivers and flooding of site drainage are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the DCD. Therefore, the DCD applicant's requirement that the COL applicant that references the US-APWR DC address these issues in the COLA FSAR is acceptable.

Potential Dam Failures, DCD Section 2.4.4

The NRC staff acknowledges that the applicant has selected the hydrologic engineering site parameters referenced in SER Summary of Application, Section 2.4.2 above for plant design inputs (a subset of which is included as Tier 1 information), and agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL application. Dam failures are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the DCD review. Therefore, the DCD applicant's requirement that the COL applicant that references the US-APWR DC address these issues in the COLA FSAR is acceptable.

Probable Maximum Surge and Seiche Flooding, DCD Section 2.4.5

The NRC staff acknowledges that the applicant has selected the hydrologic engineering site parameters referenced in SER Summary of Application, Section 2.4.2 above for plant design inputs (a subset of which is included as Tier 1 information), and agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL application. Surge and seiche are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the DCD. Therefore, the DCD applicant's requirement that the COL applicant that references the US-APWR DC address these issues in the COLA FSAR is acceptable.

Probable Maximum Tsunami Hazards, DCD Section 2.4.6

The NRC staff acknowledges that the applicant has selected the hydrologic engineering site parameters referenced in SER Summary of Application Section 2.4.2 above for plant design inputs (a subset of which is included as Tier 1 information), and agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL application. Probable maximum tsunami hazards are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient

information to demonstrate that the design of the plant falls within the site parameters specified in the DCD. Therefore, the DC applicant's requirement that the COL applicant address these issues is acceptable.

Ice Effects DCD Section 2.4.7

The NRC staff acknowledges that the applicant has selected the hydrologic engineering site parameters referenced in SER Summary of Application Section 2.4.2 above for plant design inputs (a subset of which is included as Tier 1 information), and agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL application. Icing effects, including information related to flooding or low water conditions from ice effects, are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the DCD. Therefore, the DCD applicant's requirement that the COL applicant that references the US-APWR DC address these issues in the COLA FSAR is acceptable.

Cooling Water Canals and Reservoirs, DCD Section 2.4.8

The NRC staff acknowledges that the applicant has selected the hydrologic engineering site parameters referenced in SER Summary of Application, Section 2.4.2 above for plant design inputs (a subset of which is included as Tier 1 information), and agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL application. Cooling water canals and reservoir design and capacities are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the DCD. Therefore, the DCD applicant's requirement that the COL applicant that references the US-APWR DC address these issues in the COLA FSAR is acceptable.

Channel Diversions, DCD Section 2.4.9

The NRC staff acknowledges that the applicant has selected the hydrologic engineering site parameters referenced in SER Summary of Application, Section 2.4.2 above for plant design inputs (a subset of which is included as Tier 1 information), and agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL application. Channel diversion effects are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the DCD. Therefore, the DCD applicant's requirement that the COL applicant that references the US-APWR DC address these issues in the COLA FSAR is acceptable.

Flood Protection Requirements, DCD Section 2.4.10

The NRC staff acknowledges that the applicant has selected the hydrologic engineering site parameters referenced in SER Summary of Application, Section 2.4.2 above for plant design inputs (a subset of which is included as Tier 1 information), and agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL application. Flood protection measures are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient

information to demonstrate that the design of the plant falls within the site parameters specified in the DCD. Therefore, the DCD applicant's requirement that the COL applicant that references the US-APWR DC address these issues in the COLA FSAR is acceptable.

Low Water Considerations, DCD Section 2.4.11

The NRC staff acknowledges that the applicant has selected the hydrologic engineering site parameters referenced in SER Summary of Application, Section 2.4.2 above for plant design inputs (a subset of which is included as Tier 1 information), and agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL application. Low water effects are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the DCD. Therefore, the DCD applicant's requirement that the COL applicant that references the US-APWR DC address these issues in the COLA FSAR is acceptable.

Groundwater, DCD Section 2.4.12

The NRC staff acknowledges that the applicant has selected the hydrologic engineering site parameters referenced in SER Summary of Application, Section 2.4.2 above for plant design inputs (a subset of which is included as Tier 1 information), and agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL application. Effects of groundwater in the vicinity of the site are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the DCD. Therefore, the DCD applicant's requirement that the COL applicant that references the US-APWR DC address these issues in the COLA FSAR is acceptable.

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

The NRC staff acknowledges that the applicant has selected the hydrologic engineering site parameters referenced in SER Summary of Application, Section 2.4.2 above for plant design inputs (a subset of which is included as Tier 1 information), and agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL application. Effects of accidental releases of radioactive liquid effluents in ground and surface waters on existing users and known and likely future users of ground and surface water resources in the vicinity of the site are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should include the provision of information sufficient to demonstrate that the design of the plant falls within the site parameters specified in the DCD. Therefore, the DCD applicant's requirement that the COL applicant that references the US-APWR DC address these issues in the COLA FSAR is acceptable.

TS and Emergency Operation Requirements, DCD Section 2.4.14

The NRC staff acknowledges that the applicant has selected the hydrologic engineering site parameters referenced in SER Summary of Application, Section 2.4.2 above for plant design inputs (a subset of which is included as Tier 1 information), and agrees that they are representative of a reasonable number of sites that have been or may be considered for a COL

application. TS and emergency operations are site-specific and will be addressed by the COL applicant. The COL applicant that references the US-APWR DC should provide sufficient information to demonstrate that the design of the plant falls within the site parameters specified in the DCD. Therefore, the DCD applicant's requirement that the COL applicant that references the US-APWR DC address these issues in the COLA FSAR is acceptable.

2.5 Geology, Seismology, and Geotechnical Engineering

2.5.1 Introduction

DCD Section 2.5.1 describes the regional and site geologic and seismic information to be collected by a COL applicant during site-specific and regional investigations. The purpose of the required COL application site investigations is to determine geologic and seismic suitability of the site, the basis for plant design, and determine whether there is significant new tectonic or ground motion information that could impact the seismic design bases.

DCD Section 2.5.2 describes the design-basis peak ground acceleration and design response spectra of the design vibratory ground motion for the US-APWR plant. The section also describes the seismological, geological, geophysical, and geotechnical investigations that COL applicants must perform to determine the site-specific ground motion response spectrum (GMRS), the foundation input response spectra (FIRS), and the SSE ground motion for the site. The development of the GMRS is based upon a detailed evaluation of earthquake potential at the COL applicant site, taking into account the regional and local geology, quaternary tectonics, seismicity, and site-specific geotechnical engineering characteristics of the site subsurface material.

DCD Section 2.5.3 describes the site-specific information related to surface deformation due to faulting to be collected by a COL applicant during site characterization investigations. The purpose of these investigations is to determine site suitability with regard to whether there is a possibility of a capable fault that could have an adverse impact on the seismic design bases. The US-APWR standard plant design is based on the premise that there is no potential for surface tectonic deformation within the EAB.

DCD Section 2.5.4 describes the site-specific geotechnical and geophysical information and investigations that COL applicants must provide to determine the properties and the stability of subsurface materials and foundations that could affect the safe design and siting of the plant. The US-APWR standard plant design specifies key site parameters related to the stability of subsurface materials and foundations that were used as design bases.

DCD Section 2.5.5 describes the type of site-specific geologic and geotechnical information and investigations that the COL applicant must provide to determine the stability of all slopes, both natural and manmade, whose failure, under any of the conditions to which they could be exposed during the life of the plant, could adversely affect the safety of the plant. The US-APWR standard plant design is based on the premise that there is no site-specific potential for slope failure that could jeopardize safety-related SSCs.

DCD Section 2.5.6, “Combined License Information,” only identifies DCD Section 2.5-related COL information items, which are listed in US-APWR DCD Tier 2, Table 1.8-2, “Compilation of All Combined License Applicant Items for Chapters 1-19;” therefore, no technical evaluation is needed for this section.

2.5.2 Summary of Application

Basic Geologic and Seismic Information, DCD Section 2.5.1

DCD Tier 1: There are no DCD Tier 1 entries for this area of review.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the basic geologic and seismic information required of a COL applicant in Section 2.5.1, summarized here in part, as follows:

> DCD Section 2.5.1 describes the basic, site-specific geologic, seismic, and geophysical information that COL applicants must provide through investigations that they must conduct to estimate the potential for strong earthquake ground motions and surface deformation at the site. Other topics described in DCD Section 2.5.1 are non-tectonic geologic hazards and conditions caused by human activities. There are no postulated US-APWR site parameters for DCD Section 2.5.1.

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

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

COL information or action items: See Section 2.5.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Vibratory Ground Motion, DCD Section 2.5.2

DCD Tier 1: The Tier 1 information associated with this section is found in DCD Tier 1, Section 2.1, Site Parameters. The design-basis parameters of peak ground acceleration (PGA) and horizontal and vertical certified seismic design response spectra (CSDRS) for the US-APWR plant are provided in Table 2.1-1, "Key Site Parameters," and Figures 2.1-1 and 2.1-2 of Section 2.1. A PGA value of 0.3 g for the SSE ground motion is specified in Table 2.1-1. In addition, Table 2.1-1 states that the CSDRS are based on RG 1.60 and are enhanced in the high-frequency range. A COL applicant's site for construction of a US-APWR will be acceptable if its seismic characteristics are within the design parameters shown in Table 2.1-1 and the two figures.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the US-APWR DCD design basis vibratory ground motion and the process for determining the site-specific design basis vibratory ground motion required of a COL applicant in Section 2.5.2, summarized here in part, as follows:

> DCD Section 2.5.2 briefly describes the geologic, seismic, geophysical, and geotechnical investigations that COL applicants must provide to determine the site-specific vibratory ground motion information and SSE for their site. As described in RG 1.208, the site-specific GMRS is equivalent to the SSE for the COL site. DCD Section 2.5.2 also describes the design spectra for the US-APWR. Similar to the DCD Tier 1, Table 2.1-1, Table 2.0-1 of Tier 2, Section 2.5.2 also defines a PGA value of 0.3 g for the SSE.

The SSE represents the design earthquake ground motion at the site and is the vibratory ground motion for which certain SSCs are designed to remain functional. COL applicants base the SSE determination on a detailed evaluation of the regional and local earthquake potential, ground motion attenuation, and the site-specific characterization of the local subsurface soil and rock properties. DCD Section 3.7.1.1 discusses the seismic design basis for the US-APWR. Also, as shown in DCD Tier 2, Figures 3.7.1-1 and 3.7.1-2, the DC applicant anchored the US-APWR CSDRS at a 0.3 g PGA design ground motion.

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

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

COL information or action items: See Section 2.5.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Surface Faulting, DCD Section 2.5.3

DCD Tier 1: The Tier 1 information associated with this section is found in DCD Tier 1, Section 2.1, Site Parameters. The design basis parameter of potential for surface tectonic deformation for the US-APWR plant is provided in Table 2.1-1 of Section 2.1. A COL applicant's site for construction of a US-APWR will be acceptable if its potential for surface faulting is within the design parameter shown in Table 2.1-1, which specifies no tectonic deformation to be present within the EAB.

DCD Tier 2: The applicant has provided a DCD Tier 2 description of the process for determining the site-specific design basis surface faulting potential required of a COL applicant in Section 2.5.3, summarized here in part, as follows:

DCD Section 2.5.3 describes the site-specific geologic and seismic information that COL applicants must provide through investigations that they must conduct to determine the potential for surface deformation at the site.

DCD Tier 2, Table 2.0-1 also provides the US-APWR site design parameters and specifies that the US-APWR design assumes no tectonic deformation to be present within the EAB.

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

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

COL information or action items: See Section 2.5.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Stability of Subsurface Materials and Foundations DCD Section 2.5.4

DCD Tier 1: The Tier 1 information associated with this section is found in DCD Revision 2 Tier 1, Section 2.1, "Site Parameters." The design-basis parameters of subsurface stability for minimum static and minimum dynamic bearing capacity, shear wave velocities for different site conditions and liquefaction potential for the US-APWR plant are provided in Table 2.1-1 of Section 2.1. A COL applicant's site for construction of a US-APWR will be acceptable if it's static and dynamic bearing capacities are greater than or equal to the design parameters shown in Table 2.1-1. A COL applicant's site for construction of a US-APWR will also be acceptable if its subsurface liquefaction potential is less than or equal to the design parameter shown in Table 2.1-1. The design-basis parameters of maximum slope for foundation bearing stratum for the US-APWR plant are also provided in Table 2.1-1 of Section 2.1. A COL applicant's site for construction of a US-APWR will be acceptable if its maximum slope for foundation bearing stratum is less than or equal to 20 degrees from horizontal in untruncated strata as shown in Table 2.1-1. The design-basis parameters of total settlement of the reactor building complex foundation, differential settlement across the reactor building complex foundation, maximum differential settlement between buildings, and maximum tilt of the reactor building complex foundation generated during the operational life of the plant for the US-APWR plant are also provided in Table 2.1-1 of Section 2.1. If a COL applicant's site for construction of a US-APWR meets the settlement parameters shown in Table 2.1-1, no further evaluation will be needed.

DCD Tier 2: The applicant has provided a DCD Revision 2 Tier 2 description of the process for determining the site-specific design basis subsurface material stability information required of a COL applicant in Section 2.5.4, summarized here in part, as follows:

> The US-APWR requirements for stability of subsurface materials and foundations are in DCD Section 2.5.4. This section describes the site-specific geotechnical and geophysical information that COL applicants must provide through investigations that they must conduct to determine the properties of all soils and rock, which may affect the nuclear power plant facilities under both static and dynamic conditions including the vibratory ground motions associated with the SSE.
>
> The DCD applicant stated that the COL applicant would need to verify whether the site soil materials properties are consistent with those assumed in DCD Revision 2 Tier 2, Section 3.7.2. Section 3.8.5.4 of the DCD discusses the analyses of settlement for the US-APWR standard plant design.

DCD Tier 2, Table 2.0-1, which also provides the US-APWR site design parameters, specifies that the minimum allowable static bearing capacity for the US-APWR design is 718 kilopascals ([kPa] (15,000 pounds per square foot [psf]) and the minimum allowable dynamic bearing capacity is 2.873 MPa (60,000 psf). DCD Tier 2, Table 2.0-1 also specifies the minimum shear-wave velocity (Vs) at SSE input at ground surface as 304.8 meters per second (m/s) (1,000 feet per second (ft/s)); Vs for defining firm rock is 1,066.8 m/s (3,500 ft/s), Vs for defining firm to hard rock is 1,981.2 m/s (6,500 ft/s); and Vs for defining hard rock is 2,438.4 m/s (8,000 ft/s). Tier 2, Table 2.0-1 also specifies a maximum slope of 20 degrees from the horizontal in untruncated foundation-bearing strata, and no liquefaction potential for seismic Category I structures. In

addition, Tier 2, Table 2.0-1 specifies a total settlement of the reactor building complex foundation of 6.0 inches, a differential settlement across the reactor building complex foundation of 2.0 inches, a maximum differential settlement between buildings of .5 inches, and a maximum tilt of the reactor building complex foundation generated during the operational life of the plant of 1/2000.

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

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

COL information or action items: See Section 2.5.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

Stability of Slopes, DCD Section 2.5.5

DCD Tier 1: There are no DCD Tier 1 entries for this area of review.

DCD Tier 2: The applicant has stated a DCD Tier 2 request for information concerning the stability of slopes at the COL applicant's specific site in Section 2.5.5, summarized here in part, as follows:

> The stability of slopes in DCD Section 2.5.5 states that site-specific information must be provided by COL applicants addressing the static and dynamic stability of all natural and manmade earth or rock slopes (such as cuts, fills, embankments, and dams) for which failure due to the conditions which they will be exposed to during the plant life could affect the facility's safety-related structures. The US-APWR standard design is based on the premise that there is no site-specific potential for slope failure that could jeopardize safety-related SSCs.

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

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

COL information or action items: See Section 2.5.5 below.

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

Topical Reports: There are no topical reports associated with this area of review.

US-APWR Interface Issues identified in the DCD: There are no US-APWR interface issues associated with this area of review.

2.5.3 Regulatory Basis

The relevant requirements of the NRC's regulations for these areas of review, and the associated acceptance criteria, are given in Sections 2.5.1, 2.5.2, 2.5.3, 2.5.4, and 2.5.5 of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," and are summarized below. Review interfaces with other SRP sections can be found in Sections 2.5.1, 2.5.2, 2.5.3, 2.5.4, and 2.5.5 of NUREG-0800.

1) 10 CFR 52.47(a)(1), "Contents of Applications; Technical Information," which requires a DC applicant to provide site parameters postulated for the design. However, DC applications do not include general descriptions of site characteristics because this information is site-specific and is addressed by the COL applicant. There are no postulated site parameters for a DC related to Sections 2.5.1 and 2.5.5 of NUREG-0800. (Applies to DCD Sections 2.5.1 and 2.5.5 only.)

2) 10 CFR 52.47(a)(1), "Contents of Applications; Technical Information," which requires a DC applicant to provide site parameters postulated for the design. However, DC applications do not include general descriptions of site characteristics because this information is site-specific and is addressed by the COL applicant. The postulated site parameters for a DC related to Sections 2.5.2, 2.5.3, and 2.5.4 of NUREG-0800 must be representative of a reasonable number of sites that may be considered for a COL application and the DC applicant must provide a basis for the site parameters. (Applies to DCD Sections 2.5.2, 2.5.3, and 2.5.4.)

3) 10 CFR Part 50, Appendix A, 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.

4) 10 CFR Part 100, Section 100.23, "Geologic and Seismic Siting Criteria," for evaluating suitability of a proposed site based on consideration of geologic, geotechnical, geophysical, and seismic characteristics of the proposed site. Geologic and seismic siting factors must include the SSE for the site; and the potential for surface tectonic and non-tectonic deformation. The site-specific GMRS satisfies requirements of 10 CFR 100.23 with respect to the development of the SSE.

5) 10 CFR Part 50, Appendix S, "Earthquake Engineering Criteria for Nuclear Power Plants," with respect to the design of nuclear plant SSCs important to safety to withstand the effects of earthquakes and as it relates to the minimum requirement for FIRS.

In addition, the geologic characteristics should be consistent with appropriate sections from: RG 1.160, "Design Response Spectra for Seismic Design of Nuclear Power Plants," RG 1.165, "Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion," RG 1.208, "A Performance-Based Approach to Define Site-specific Earthquake Ground Motion," RG 1.132, "Site Investigations for Foundations of Nuclear Power Plants," RG 1.138, "Laboratory Investigations of Soils for Engineering Analysis and Design of Nuclear Power Plants," RG 1.198, "Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites," and RG 4.7, "General Site Suitability Criteria for

Nuclear Power Stations," and RG 1.206, "Combined License Applications for Nuclear Power Plants - LWR Edition."

2.5.4 Technical Evaluation

Basic Geologic and Seismic Information DCD Section 2.5.1

The staff reviewed the regulatory guidance and the basic geologic and seismic information requirements provided in DCD Tier 2, Section 2.5.1 for COL applicants referencing the US-APWR DCD. The staff finds that the applicant provided adequate description of the necessary geologic and seismic information and investigations and the applicable regulations and RGs that potential COL applicants must address when submitting a COL application. Although this information is not required for design certification and is entirely site-specific, the applicant needs to provide it in order to ensure that the relevant requirements of GDC 2 and 10 CFR Part 100.23 can be met by COL applicants referencing the US-APWR DCD, therefore the staff concludes that Section 2.5.1 of the US-APWR DCD is acceptable.

COL Action Item 2.5-1 requires that a COL applicant that references the US-APWR certified design must provide sufficient information regarding the basic geologic and seismic characteristic of the site and region surrounding the site to ensure that the relevant requirements of GDC 2 and 10 CFR Part 100.23 can be met.

Vibratory Ground Motion DCD Section 2.5.2

The staff reviewed the regulatory guidance and the geologic, seismic, geophysical, and geotechnical information and investigations requirements provided in DCD Tier 2, Section 2.5.2, for COL applicants referencing the US-APWR DCD. The purpose of the staff's review of DCD Tier 2, Section 2.5.2 was to determine the adequacy of the requirements for determinations of the site-specific GMRS and the FIRS. The staff reviewed the SSE parameters specified in DCD Tier 1 Section 2.1, Table 2.1-1. "Key Site Parameters" to determine whether the certified seismic design ground response spectra meet the regulatory requirements

The applicant stated that the CSDRS is anchored at PGA of 0.3g for the US-APWR, and the design spectra are described in Section 3.7.1 and shown on Figures 3.7.1-1 and 3.7.1-2. The US-APWR design response spectra used a modified high frequency approach to RG 1.60, Revision 1, spectra. The staff focused its review on the applicant's description of the GMRS and FIRS. The GMRS is a site-specific GMRS, which is specified as a free-field motion either on the ground or on the uppermost in-situ competent material surface level; thus, its control point location may vary from site to site. The FIRS is the site-specific GMRS at the foundation level, and, for the US-APWR, the CSDRS are site-independent seismic design response spectra scaled to a PGA value of 0.3 g. In RAI 2.5.2-1, the staff asked the applicant to provide additional clarification regarding: (1) the location of the GMRS control point; (2) how the site-specific FIRS are determined, whether the FIRS must be enveloped by the CSDRS, and how a COL applicant will meet the minimum requirement for the FIRS from Appendix S to 10 CFR Part 50; and (3) what the requirements are for a site where the FIRS are not enveloped by the CSDRS.

In its response to RAI 2.5.2-1 dated December 3, 2008, the applicant provided the following additional information:

1) The location of the GMRS control point is determined on a site-specific basis for each plant site based on the in-situ conditions. The GMRS defines the site-specific SSE free-field outcrop motions at a control point located at plant grade (ground surface) when in-situ competent material is present. For purposes of the US-APWR, competent material must have a Vs of 304.8 m/s (1,000 ft/s) or greater;

2) The FIRS define the horizontal and vertical components of the site-specific SSE outcrop motions for free-field conditions at the bottom elevations of seismic Category I and II foundations. The seismic design of the US-APWR standard plant is applicable for a particular site only if all of the site-specific FIRS are enveloped by the site-independent CSDRS. To meet the minimum requirement stipulated in Appendix S (IV)(a)(1)(i) of 10 CFR Part 50, for all US-APWR plant sites, it is required that the COL applicant must confirm that the horizontal component of the FIRS envelopes, at all frequencies, the minimum design earthquake response spectra which has the shape of the horizontal US-APWR CSDRS and a PGA value of 0.1g; and

3) If the site-specific FIRS exceeds the CSDRS at any frequency, or the results of the verification analysis, described in DCD Section 3.7.2.4, indicate that the site-independent seismic design may be inadequate for a particular site; applicants must perform a scoping re-design analysis of the affected SSCs using a site-specific SSE defined by the site-specific FIRS. Re-design or modification of the affected portions of the plant would be required in cases where a scoping analysis determines that the standard seismic design is not suitable for the site-specific seismic conditions.

In response to RAI 2.5.2-1, the applicant stated that because a detailed description regarding the determination of GMRS is provided in US-APWR DCD Section 3.7, it would add "Further discussion of the GMRS is provided in Subsection 3.7.1.1" at the end of Section 2.5.2.6 of the DCD.

The staff reviewed the applicant's response to RAI 2.5.2-1 and finds that the applicant provided adequate description of the GMRS control point location, which is consistent with the guidance provided in RG 1.208. The staff finds that the applicant provided detailed description regarding the determination of the FIRS, and its comparison with the CSDRS, and compliance with the minimum requirements of Appendix S to 10 CFR Part 50. In addition, the applicant specified procedures for a COL applicant to follow when the site-specific FIRS exceed the CSDRS, or verification analyses results indicate that the seismic design may be inadequate for a particular site, thus, the staff finds that the applicant's response to RAI 2.5.2-1 is adequate and this RAI is resolved.

After reviewing the information provided in the US-APWR DCD, including the applicant's response to RAI 2.5.2-1, the staff finds that the applicant adequately described the GMRS and FIRS as well as the necessary geologic, seismic, geophysical, and geotechnical information and investigations required of a COL applicant referencing the US-APWR DCD. In addition, the staff confirms that all proposed changes to the DCD by the applicant are incorporated in revision 2 of the US-APWR DCD; therefore, the staff considers RAI 2.5.2-1 to be resolved.

Based on its review of US-APWR Tier 1 Section 2.1, Table 2.1-1 and Tier 2 Section 2.5.2, and the responses of related RAIs from the applicant, the staff concludes that the US-APWR CSDRS is determined by following the guidelines of RG 1.60, Revision 1, with enhanced spectra in high frequency range, and considered potential nuclear power plants sites in the U.S.. The applicant adequately described the geologic, seismic, geophysical, and geotechnical information and investigations, which the COL applicant needs to perform for detailed site-specific analyses. The applicant also adequately specified the re-design or modification requirement that the COL applicant must meet when the site-specific FIRS exceeds the CSDRS or verification analyses results indicate that the seismic design may be inadequate for a particular site in order to meet the relevant requirements of GDC 2 and 10 CFR Part 100.23. Accordingly, the staff concludes that Section 2.5.2 of the US-APWR DCD is acceptable.

COL Action Item 2.5-1 requires that a COL applicant that references the US-APWR DC review and investigate the site-specific seismic, geophysical, geological, and geotechnical information to develop the site-specific GMRS and determine the SSE and FIRS for the site. The COL applicant must compare the FIRS to the CSDRS and verify that the site-specific seismic parameters are enveloped by the CSDRS.

Surface Faulting, DCD Section 2.5.3

The staff reviewed the regulatory guidance and the descriptions provided in US-APWR DCD Tier 1, Table 2.1-1 and Tier 2, Section 2.5.3 on the site-specific geologic and seismic information and investigations requirements necessary for potential COL applicants referring the US-APWR DCD to determine the potential of surface deformation. The staff finds that the applicant clearly specified that there should be no potential for surface tectonic deformation within the EAB at the site. The applicant also adequately described the site-specific geologic and seismic information and investigations necessary for a COL applicant to determine the potential for surface deformation and to ensure there is no surface faulting at the site that could have adverse impact on the structural integrity of safety-related SSCs. Accordingly, the staff concludes that the applicant adequately used no potential for surface tectonic deformation within the EAB for any site as the design basis, as well as provided the requirements that a COL applicant referring the US-APWR DCD must meet to ensure there is no surface faulting at the site. Since the no surface tectonic deformation design basis will ensure the structural integrity of safety-related SSCs meet the relevant requirements of GDC 2 and 10 CFR 100.23, and, since

there are many sites in the U.S. where capable faults are not present, the staff finds that this is a reasonable basis for design and concludes that US-APWR DCD Section 2.5.3 is acceptable.

COL Action Item 2.5-1 requires that a COL applicant that references the US-APWR certified design must demonstrate that no capable faults exist at the site in accordance with the requirements of 10 CFR 100.23 and of 10 CFR 50, Appendix S, and demonstrate that any surface deformation will have no adverse impact on the structural integrity of safety-related SSCs.

Stability of Subsurface Materials and Foundations, DCD Section 2.5.4

The staff reviewed the regulatory guidance, the US-APWR standard design site parameters and the description, provided in DCD Tier 2, Section 2.5.4, of the site-specific geotechnical and geophysical information and investigations that COL applicants must provide to determine the properties and stability of soil and rock under both static and dynamic loading conditions. The staff reviewed this information to ensure that the US-APWR DCD met the requirements of GDC 1, 2 and 44 as well as Appendix S to 10 CFR Part 50, and 10 CFR Part 100.

The staff focused its review on the US-APWR DCD Revision 1 standard design site parameters. In RAI 2.5.4-1, the staff asked the applicant to provide the following information related to Tier 1, Table 2.1-1 and Tier 2, Table 2.0-1, “Key Site Parameters”:

a) An explanation regarding the use of the average static and dynamic bearing capacity rather that the required minimum and details regarding how the dynamic bearing pressure was determined.

b) An explanation as to why settlement was only mentioned in Section 3.8.5.4 and was not specified as a Tier 1 parameter and described in Tier 2, Section 2.5.4.

c) Additional details regarding the soil liquefaction restrictions.

In its response to RAI 2.5.4-1 dated December 3, 2008, the applicant stated the following:

(a) Static and dynamic bearing loads and seismic effects were calculated using a finite grid evaluation process. Since static or dynamic bearing capacities within the area of a basemat footprint are likely to vary based on minor differences in localized geology and in sampling tool response, a statistical average is a valid approach to estimating the area static and dynamic bearing capacity.

(b) The maximum foundation subsidence or differential settlement is 50 mm (2 inches), which is stated in Section 3.8.5.4.4. Because this is considered to be a conservative allowance that may not be applicable to all plant sites, subsidence and differential displacement may be reduced to less than 50 mm (2 inches) if justified by the COL applicant based on site-specific soil properties. Therefore, no parameter value for settlement is specifically stated in Tier 1 or Tier 2, Section 2.5.4.

(c) The US-APWR standard plant design is based on the premise that there is no potential of liquefaction, therefore, the site parameter stated in Table 2.0-1 for the potential of soil liquefaction for seismic Category I structures on site is "none."

The DCD will be revised by adding “The USAPWR standard plant design is based on the premise that there is no potential of liquefaction occurring at the site."

Based on its review of the applicant’s response to RAI 2.5.4-1 and Sections 3.7.2 and 3.8.5 of the DCD, the staff found the following:

With respect to part (a) of RAI 2.5.4-1, the staff found that the applicant did not provide an adequate description of the model used to determine the static and dynamic loading pressures. Since the bearing capacity of the foundation is determined by external loads that induce pressure applied on the foundation, the bearing capacity depends on the type of foundation and loading conditions. Thus, appropriate models are needed to account for factors such as basemat dimensions, properties of the foundation and subgrade (including stiffness), all static, dynamic and seismic loads and combinations, and possible 3D effects. In addition, the staff found that the minimum static and dynamic bearing capacity requirement, which is based on the maximum loading pressure obtained from model analyses, needs to be specified in order to ensure the stability of the foundation at site.

In part (b) of its response to RAI 2.5.4-1, the applicant stated that it did not specify a parameter value for settlement in Tier 1 or Tier 2, Section 2.5.4 because it is stated in DCD Section 3.8.5.4.4. However, the staff notes that foundation settlement is one of the important parameters to determine foundation stability and is also necessary to ensure the normal functioning of equipment inside the structures built on the foundation. Furthermore, according to the guidance provided in RG 1.206, COL applicants need to perform stability analyses for all safety-related facilities, including the analysis of foundation settlement and differential settlement. Thus, the staff concludes that foundation settlement is an important site parameter and DCD Section 2.5.4 would be an appropriate place to discuss related requirements.

In part (c) of its response to RAI 2.5.4-1, the applicant provided further explanation regarding the liquefaction potential requirement and stated that the US-APWR standard plant design is based on the premise that there is no potential of liquefaction occurring at the site, and intends to revise the DCD revision 1 accordingly. Therefore, the staff concludes that the applicant provided adequate explanation about the “none” liquefaction potential requirement for the standard design. In addition, the staff confirms that the proposed change by the applicant has been incorporated in revision 2 of the US-APWR DCD. The staff finds part (c) of RAI 2.5.4-1 to be resolved. However, the staff determined that the information provided in response to parts (a) and (b) of RAI 2.5.4-1 were insufficient. The need to provide further clarification for parts (a) and (b) of RAI 2.5.4-1 as described in the previous two paragraphs was identified as Open Item 2.5.4-1.

To address the open item, the applicant provided its revised response on June 22, 2009. In this response, the applicant first described in detail how the static and dynamic foundation bearing pressures were determined. The applicant then stated that the COL applicant should demonstrate adequate safety factors for bearing capacity by comparing the allowable bearing pressure demands with the ultimate capacity of the site at the bottom elevation of the foundation. The applicant further proposed a new minimum allowable static bearing capacity of 718 kPa (15,000 psf) and a minimum allowable dynamic bearing capacity (normal conditions plus SSE) of 2,873 kPa (60,000 psf) based on new bearing pressure demands values obtained from new analyses and with certain margin. The applicant also addressed the staff’s concern regarding settlement requirements in the standard design by specifying settlement limits of: 1) total settlement of 152 mm (6.0 in.) for the R/B complex foundation; 2) differential settlement of

51 mm (2.0 in.) for the R/B complex foundation; 3) maximum differential settlement between buildings of 13 mm (0.5 in.); and 4) maximum tilt of the R/B complex basemat foundation generated during operational life of the plant of 1/2000. The applicant further clarified that those foundation settlement parameters are guidelines for COL applicants referencing the US-APWR standard design, and it is the responsibility of the COL applicant to provide any special construction or operational provisions to accommodate site-specific settlements that exceed the values provided in the DCD.

After review of the revised RAI response, the staff concludes that the applicant provided clear foundation bearing capacity requirements both under static and dynamic loading conditions based on new analysis results; and specified requirements that the COL applicant must apply adequate factors of safety when determining site specific bearing capacity, therefore the site parameters for minimum allowable bearing capacity and the related requirements for the COL applicant are reasonable. The staff also concludes that the applicant specified adequate site parameters of foundation settlement limits as one of the measures that will ensure the stability of the safety related structures and normal operation of the plant, and those settlement parameters are necessary to meet the guidelines of regulations. However, since the revised minimum allowable bearing capacity value of 2,873 kPa (60,000 psf) is about one-third smaller than the original values of 4,548 kPa (95,000 psf), the staff asked the applicant to provide further explanation. As the applicant will provide additional information regarding the change of design dynamic bearing capacity value in a revised DCD, in response to RAIs from DCD Sections 3.7 and 3.8, the staff needs to review these RAI responses and confirm that the basis for the change is reasonable and acceptable. Thus, the staff will continue to track Open Item 2.5.4-1 and it will be closed once the staff confirms that the revised dynamic bearing capacity value is reasonable and acceptable.

In addition, the staff confirms that all proposed changes by the applicant to DCD Tier 1 Section 2.1 Table 2.1-1 and its footnotes, and Tier 2 Section 2.0 Table 2.0-1 and its footnotes in its June 22, 2009 response have been incorporated in revision 2 of the US-APWR DCD.

Because there is no requirement on site subsurface material uniformity, which will directly affect the stability of structures and foundation of the power plant, in Section 2.5.4 of the DCD, in RAI 2.5.4-2, the staff asked the applicant to provide site uniformity requirements of foundation support media and to clarify how a COL applicant should address the site subsurface material variability. In its response, the applicant stated that the Soil Structure Interaction (SSI) analysis for the US-APWR standard plant used a uniform elastic half-space model to simulate the subgrade, which was characterized by a set of generic soil profiles. The applicant then stated that since it did not consider the effects of variation of properties, depth, and the layering of the soil over the bedrock in the models, since it is the responsibility of COL applicant to perform site-specific SSI analyses, as described in DCD Section 3.7.2.4.1 and as specified in COL Information Item 3.7(25), to verify that these effects are enveloped by the standard design. The applicant also described the procedure for performing the site-specific SSI analyses, which should use the model SASSI, and incorporate the following:

1) A minimum of three sets of layered soil profiles representing lower bound, best estimate, and upper bound site-specific properties of the subgrade;

2) A site-dependent input control motion that is derived from the site-specific GMRS and FIRS;

3) Soil properties that are compatible to the strains induced by site-specific SSE in order to account for the primary non-linear material behavior of the soil.

The applicant stated that the standard plant seismic design needs to be verified by the COL applicant based on a comparison of the standard design in-structure response spectra to those derived from site-specific SASSI analysis. DCD Section 3.7.2.4.1 provides information regarding the requirements of the site-specific SSI analysis. Specifically, the DCD states that "After the SASSI analysis is first performed for a specific unit, subsequent COL applications for other units may be able to forego SASSI analyses if the FIRS and GMRS derived for those subsequent units are much smaller than the US-APWR standard plant CSDRS, and if the subsequent unit can also provide justification through comparison of site specific geological and seismological characteristics."

After reviewing the applicant's response to RAI 2.5.4-2, and the information provided in DCD Sections 2.5.4 and 3.7.2, the staff determined that although the SSI analyses performed for the US-APWR standard design did not consider several important site-specific factors such as subsurface non-uniformity, non-linearity of subsurface materials, variation of soil properties, depth and layering of soil over the bedrock, as well as the variation of groundwater level, the DCD requires that a COL applicant referencing the US-APWR DC needs to perform site-specific analysis with consideration of the aforementioned factors to demonstrate that the site is suitable if the site-specific FIRS and GMRS are enveloped by the CSDRS. The applicant also described procedures and criteria for COL applicants to follow when conducting the site-specific analyses. Since the applicant clearly described the requirements and procedures that COL applicants need to follow regarding site-specific GMRS and FIRS determination and SSI analysis to ensure that site uniformity and other factors that affect the site-specific subsurface material properties are taken into consideration, and to also ensure that the site specific structural seismic responses can meet the standard design, the staff therefore finds that this approach is adequate to ensure the stability of the nuclear power plant facilities utilizing the US-APWR design, and will meet the related requirements of GDC 2 and Appendix S to 10 CFR 50, and 10 CFR 100.23. Therefore, the staff finds that this approach is acceptable.

Based on its review of the US-APWR DCD Tier 1, Table 2.1-1 and Tier 2, Section 2.5.4, the staff concludes that the applicant provided adequate descriptions of the site-specific geotechnical and geophysical information and investigations that COL applicants must provide to determine the properties and stability of all soils and rock, which may affect the safety of nuclear power plant facilities under both static and dynamic loading conditions including the vibratory ground motions associated with the SSE. The staff further concludes that the site-specific information and site investigations requirements, as well as the design site parameters such as minimum allowable static bearing capacity of 718.2 kilonewtons per square meter (kPa) (15,000 pounds per square foot (lb/ft^2); minimum allowable dynamic bearing capacity, under normal conditions plus SSE, of 2,872.8 kPa (60,000 lb/ft^2); minimum shear wave velocity of 304.8 meter per second (m/s) (1,000 feet per second (fps); at ground surface; Differential settlement across R/B complex foundation of 51 millimeters (mm) (2.0 inches(in)), Maximum differential settlement between buildings of 1.3 mm (0.5 in); and other parameters as specified in DCD Tier 1 Table 2.1-1 and Tier 2 Table 2.0-1, are reasonable in line with general engineering practices and sufficient to ensure that the relevant requirements of GDC 2, 10 CFR Part 50 and Part 100 can be met by COL applicants. Accordingly, the staff concludes that, with the exception of the need to provide additional explanation on the dynamic bearing capacity analyses, the US-APWR DCD Section 2.5.4 is acceptable.

COL Action Item 2.5-1 requires a COL applicant that references the US-APWR DC to clearly describe the site subsurface material uniformity and its impact on site parameters and related foundation, structure and slope stability analyses.

COL Action Item 2.5-1 requires a COL applicant that references the US-APWR DC to verify that there will be no liquefaction potential for Seismic Category I structures at proposed site.

COL Action Item 2.5-1 requires a COL applicant that references the US-APWR DC to verify that the shear wave, Vs, at SSE input at ground surface will meet the standard design values.

COL Action Item 2.5-1 requires a COL applicant that references the US-APWR DC to verify that site-specific foundation soils beneath the foundation basemats of Seismic Category I structures have the capacity to support the designed static and dynamic bearing pressures with adequate factors of safety.

COL Action Item 2.5-1 requires a COL applicant that references the US-APWR DC to verify that the maximum total settlement, maximum differential settlement and maximum tilt of the reactor building complex foundation, and the maximum differential settlement between buildings will meet the standard design values.

Stability of Slopes, DCD Section 2.5.5

The staff reviewed the regulatory guidance and the description provided in DCD Tier 2, Section 2.5.5 regarding the site-specific information that COL applicants referencing the US-APWR design must provide to determine the stability of all slopes.

Because the applicant did not specify any loading conditions for its slope stability analysis in the DCD, in RAI 2.5.5-1, the staff asked the applicant to clarify the dynamic/seismic loads to be considered in the slope stability analysis (e.g., site-specific GMRS). In its response to this RAI dated December 3, 2008, the applicant explained that the US-APWR standard plant design is based on the premise that there is no site-specific potential for slope failure that could jeopardize safety-related SSCs. The evaluation of slope stability is site-specific with respect to site conditions, slope characteristics and appropriate methodology for slope stability analysis. The seismic loads are developed based on the site-specific SSE using the site-specific GMRS and/or FIRS. The applicant further clarified that the use of site-specific GMRS will be only for stability evaluations of some slopes comprised of native soil materials; and it is anticipated that it will be more appropriate to use FIRS as the basis for development of seismic loads for analysis of slopes comprised of borrowed and engineered backfill material. To incorporate this clarification into the DCD, the applicant stated that it will revise US-APWR DCD by inserting "The US-APWR standard plant design is based on the premise that there is no site-specific potential for slope failure that could jeopardize safety-related SSCs" in front of the first sentence of DCD Section 2.5.5.

Based on its review of the applicant's response to RAI 2.5.5-1, the staff finds that the applicant adequately clarified how the site-specific slope stability analysis will be performed by the COL applicants. The staff also agrees with the applicant that the proposed revisions to the DCD will be adequate to reflect this clarification. Based upon its review of Revision 2 of the DCD, the staff confirms that all proposed changes by the applicant are incorporated in Revision 2 of the US-APWR DCD; therefore, the staff considered RAI 2.5.5-1 to be resolved.

In DCD Tier 1, Table 2.1-1 and Tier 2, Table 2.0-1 the applicant did not state any requirements

regarding factor of safety for slope stability. Thus, in RAI 2.5.5-2, the staff asked the applicant to provide an explanation. In its response, the applicant reiterated that slope stability evaluations are site-specific and that COL applicants should use design criteria with consideration of the site-specific conditions, slope characteristics, assumptions inherent to the methods of analysis, and uncertainties associated with the input design parameters, such as variation of soil properties, and water table, etc. The applicant further pointed out that for site-specific design criteria in terms of allowable minimum factors of safety and/or allowable maximum displacements, COL applicants should follow the guidance issued by public agencies, such as the U.S. Department of the Navy, U.S. Army Corps of Engineers, and U.S. Bureau of Reclamation. Based on its review of the applicant's response to RAI 2.5.5-2**,** the staff concludes that it is acceptable because the DCD will require the COL applicant that references the US-APWR DC to perform site-specific slope stability analysis following the appropriate guidance as acceptance criteria, which will meet the basic requirement that any potential slope failure at the site will have no adverse effect on the safety of the nuclear power plant facilities.

Based on its review of the US-APWR DCD Tier 1, Table 2.1-1 and Tier 2, Section 2.5.5, the staff concludes that the applicant provided adequate requirements that COL applicants must meet to determine the stability of all slopes, both natural and man-made, and to ensure that no slope at the site will adversely affect the safety of the plant facilities during the life of the plant. The staff further concludes that ensuring that no slope failure at the site will adversely affect the safety of the plant facilities during the life of the plant is a reasonable design basis, and the related COL application requirements are in accordance with the guidance of SRP 2.5.5. Therefore US-APWR DCD Section 2.5.5 is acceptable.

COL Action Item 2.5-1 requires a COL applicant that references the US-APWR DC to evaluate the stability of earth and rock slopes at site, both natural and manmade, the failure of which under any of the conditions to which they could be exposed during the life of the plant, could adversely affect the safety of the plant.

2.5.5 Combined License Information Items

The following is the COL information item number and description pertinent to DCD Tier 2, Section 2.5, from Table 1.8-2 of the DCD:

Table 2.5-1
US-APWR Combined License Information Items

Item No.	Description	Section	Action Required By COL Applicant	Action Required By COL Holder
2.5(1)	The COL applicant is to provide sufficient information regarding the seismic and geologic characteristics of the site and the region surrounding the site.	2.5.6	Y	

2.5.6 Conclusions

Basic Geologic and Seismic Information, DCD Section 2.5.1

Based on its review of DCD Tier 2, Section 2.5.1, the staff concludes that the applicant provided an adequate description of the necessary geologic and seismic information and investigations that COL applicants must address when submitting a COL application that references the US-APWR DC. Although this information is not required for design certification and is entirely site specific, the COL Applicant needs this information to meet the relevant requirements of GDC 2 and 10 CFR 100.23. Accordingly, the staff considers this section of the DCD to be acceptable.

Vibratory Ground Motion, DCD Section 2.5.2

Based on its review of US-APWR Tier 1 Section 2.1, Table 2.1-1 and Tier 2 Section 2.5.2, and the Applicant's responses to related RAIs, the staff concludes that the US-APWR CSDRS is determined by following the guidelines of RG 1.60, Rev. 1 with enhanced spectra in the high frequency range, and considered potential nuclear power plants sites in the U.S.. The applicant adequately described the geologic, seismic, geophysical, and geotechnical information and investigations, which the COL applicant needs to perform for detailed site-specific analyses. The applicant also adequately specified the re-design or modification requirement that the COL applicant must meet when the site-specific FIRS exceeds the CSDRS or verification analyses results indicate that the seismic design may be inadequate for a particular site in order to meet the relevant requirements of GDC 2 and 10 CFR Part 100.23. Accordingly, the staff concludes that Section 2.5.2 of the US-APWR DCD is acceptable.

As discussed in the staff's technical evaluation, the applicant has selected the site parameters referenced in SER Summary of Application, Section 2.5.2, above for plant design inputs (a subset of which is included as Tier 1 information), and the staff finds that they are representative of a reasonable number of sites in the U.S. that have been or may be considered for a COL application. Local and regional geologic and seismic parameters are specific to the site and region and will be addressed by the COL applicant.

Surface Faulting, DCD Section 2.5.3

Based on its review of DCD Tier 2, Section 2.5.3, the staff concludes that the applicant provided an adequate description of the site-specific geologic and seismic information and investigations that COL applicants must provide to determine the potential of surface deformation at the site.

The applicant clearly specifies that there should be no potential for surface tectonic deformation within the EAB of a proposed site for COL applicants referencing the US-APWR DCD, and thereby ensures that there will be no surface faulting at site that will have adverse impact on the structural integrity of safety-related SSCs. Therefore, the staff concludes that this design basis meets the relevant requirements of GDC 2 of Appendix A to 10 CFR Part 50, and 10 CFR 100.23, and this section of the application is acceptable.

Stability of Subsurface Materials and Foundations, DCD Section 2.5.4

Based on its review of DCD Tier 1, Section 2.1, Table 2.1-1 and Tier 2, Section 2.5.4, and related DCD Sections 3.7.2 and 3.8.5, as well as the applicant's responses to RAIs, the staff concludes that the applicant provided adequate descriptions of the site-specific geotechnical and geophysical information and investigations that COL applicants must provide to determine the properties and stability of all soils and rock at the site, which may affect the nuclear power plant facilities under both static and dynamic loading conditions including the vibratory ground motions associated with the GMRS. Those requirements are sufficient to ensure that the

relevant requirements of GDC 2, Appendix S to 10 CFR Part 50 and Part 100 can be met by the COL applicants.

The applicant has provided the site parameters referenced in the SER Summary of Application, Section 2.5.2 above, for plant design inputs (a subset of which is included as Tier 1 information). The applicant provided site-specific parameters that are related to subsurface material, foundation and structure stability, and the COL Applicant needs this information to meet the relevant design and regulatory requirements. The staff, however, needs to review applicant's responses to the RAIs related to DCD Sections 3.7 and 3.8 that will provide additional explanations regarding the change in the design dynamic bearing capacity value in the revised DCD to confirm that the basis for the change is reasonable and acceptable. The staff thus further concludes that with the exception of Open Item 2.5.4-1, which is identified in Section 2.5.4.4 of this SER, Section 2.5.4 of the US-APWR DCD is acceptable.

Stability of Slopes, DCD Section 2.5.5

Based on its review of DCD Tier 2, Section 2.5.5, the staff concludes that the applicant provided an adequate description of the site-specific geotechnical and geologic information and site investigations that the COL applicant referencing the US-APWR DCD must provide to determine the stability of all slopes, both natural and man-made, whose failure, under any of the conditions to which they could be exposed during the life of the plant, could adversely affect the safety of the plant. In addition, the applicant also adequately addressed all issues described in the staff's RAIs and revised the US-APWR DCD accordingly.

Since the applicant defines that the US-APWR standard plant design is based on the premise that there is no site-specific potential for slope failure that could jeopardize safety-related SSCs and requires that a COL applicant referencing the US-APWR DCD must determine the stability of all slopes and meet the standard design and relevant requirements of GDC 2 of Appendix A to 10 CFR Part 50 and 10 CFR 100.23, the staff concludes that this DCD section is acceptable.