CHAPTER 2 - SITE CHARACTERISTICS

2.0 Site Characteristics

2.0.1 Introduction

Chapter 2, "Site Characteristics," of the Comanche Peak Nuclear Power Plant (CPNPP), Units 3 and 4, Reference Combined License (RCOL) Safety Evaluation Report (SER) describes the United States Nuclear Regulatory Commission (NRC) staff's (hereinafter referred to as the staff) review of Luminant Generation Company, LLC's (Luminant) (hereinafter referred to as the COL applicant) CPNPP, Units 3 and 4 combined operating license (COL) Final Safety Analysis Report (FSAR), Chapter 2, Rev. 3 and the results of that review. CPNPP COL FSAR Chapter 2 discusses the geological, seismological, hydrological, and meteorological characteristics of the proposed site and vicinity, in conjunction with present and projected population distributions and land use and site activities and controls.

The COL applicant will compare CPNPP, Units 3 and 4, site-specific data to the design parameter data identified in the Design Control Document (DCD) for the design certification (DC) of Mitsubishi Heavy Industries, Ltd.'s United States - Advanced Pressurized Water Reactor (US-APWR), which is to be referenced by the CPNPP, Units 3 and 4, RCOL. For example, if the specific data for the site falls within the assumed design parameter data and characteristics for the US-APWR, then the US-APWR standard design is bounding for the site. However, if the site parameters or characteristics fall outside the US-APWR design parameters, then the COL applicant will need to demonstrate that the proposed facility is acceptable at the proposed site.

2.0.2 Summary of Application

The information in CPNPP COL FSAR Section 2.0 provides a summary description of all Sections in Chapter 2 of the CPNPP COL FSAR. CPNPP COL Section 2.0, Revision 3, incorporates, by reference, US-APWR DCD, Tier 2, Revision 3. Section 2.0.

In addition, in CPNPP COL FSAR Section 2.0, the COL applicant provided the following information:

Supplemental Information (SUP)

- Comanche Peak (CP) SUP 2.0(1)

CPNPP COL FSAR Section 2.0 states, in part, the following information after the third paragraph of US-APWR DCD, Tier 2, Section 2.0:

> Chapter 2 describes the characteristics of the CPNPP, Units 3 and 4, site. The site location and description are provided in sufficient detail to support a safety assessment. This chapter is divided into five sections:

- Geography and Demography (Section 2.1)
- Nearby Industrial, Transportation, and Military Facilities (Section 2.2)
- Meteorology (Section 2.3)
- Hydrologic Engineering (Section 2.4)
- Geology, Seismology, and Geotechnical Engineering (Section 2.5)

In this chapter, the following definitions and associated figures are provided to assist in understanding the scope of the discussion:

- CPNPP, Units 2 and 4, site - the 7950 acre area identified by the site boundary (Figure 2.1-201, “Site Plot Plan”)
- CPNPP, Units 3 and 4, vicinity - the area within approximately the six mile radius around the site (Figure 2.1-202, “Vicinity Base Map”)
- CPNPP, Units 3 and 4, region - the area within approximately the 50 mile radius around the site (Figure 2.1-203, “CPNPP Region”)

Table 2.0-1R, “Key Site Parameters,” provides a comparison of site-related design parameters for which the US-APWR is designed and site characteristics to CPNPP, Units 3 and 4, in support of this safety assessment.

CPNPP COL Table 2.0-1R contains the information called for within, and provides cross references to, the Chapter 2 CP COL Information Items as follows:

CP COL Information Items

- CP COL 2.1(1)

The COL applicant provided additional information in CP COL 2.1(1) to address COL Information Item 2.1(1). Specifically, the COL applicant provided the site-specific parameters, in FSAR Table 2.0-1R, associated with the CPNPP, Units 3 and 4, site geography and demography.

- CP COL 2.2(1)

The COL applicant provided additional information in CP COL 2.2(1) to address COL Information Item 2.2(1). In CPNPP COL FSAR Table 2.0-1R, the COL applicant provided the site-specific hazards associated with nearby industrial, transportation, and military facilities located in the vicinity of the CPNPP, Units 3 and 4, site and determined whether these hazards are to be design-basis events (DBEs).

- CP COL 2.3(1)

The COL applicant provided additional information in CP COL 2.3(1) to address COL Information Item 2.3(1). In CPNPP COL FSAR Table 2.0-1R, the COL applicant provided the site-specific parameters associated with the CPNPP, Units 3 and 4, site regional and local meteorology.

- CP COL 2.3(2)

The COL applicant provided additional information in CP COL 2.3(2) to address COL Information Item 2.3(2). In CPNPP COL FSAR Table 2.0-1R, the COL applicant provided the estimated short term atmospheric dispersion factors for the CPNPP, Units 3 and 4, site.

- CP COL 2.3(3)

The COL applicant provided additional information in CP COL 2.3(3) to address COL Information Item 2.3(3). In CPNPP COL FSAR Table 2.0-1R, the COL applicant provided the estimated annual average atmospheric dispersion factors and deposition factors for the CPNPP, Units 3 and 4, site.

- CP COL 2.4(1)

The COL applicant provided additional information in CP COL 2.4(1) to address COL Information Item 2.4(1). In CPNPP COL FSAR Table 2.0-1R, the COL applicant provided the site-specific parameters to demonstrate that hydrologic related events will not affect the safety basis for the US-APWR.

- CP COL 2.5(1)

The COL applicant provided additional information in CP COL 2.5(1) to address COL Information Item 2.5(1). In CPNPP COL FSAR Table 2.0-1R, the COL applicant provided the seismic and geologic characteristics of the CPNPP, Units 3 and 4, site and the region surrounding the site.

Interface Requirements

The US-APWR DCD, Tier 2, Revision 3, Section 1.8, Table 1.8-1, “Significant Site-Specific Interfaces with the Standard US-APWR Design,” identifies significant interfaces between the US-APWR standard design and the COL application (COLA). This table does not specify any interfaces related to US-APWR DCD, Tier 2, Section 2.0.

2.0.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the Final SER (FSER) related to the DCD.

The acceptance criteria associated with the relevant requirements of NRC regulations for site characteristics and site parameters are given in NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants – LWR Edition,” Section 2.0, “Site Characteristics and Site Parameters.”

- Title 10 of the *Code of Federal Regulations* (10 CFR) Part 52, Section 79(a)(1)(i)-(iv), as it relates to the requirements for the site-related contents of the application

2.0.4 Technical Evaluation

The staff reviewed CPNPP COL FSAR Section 2.0 and checked the referenced DCD to ensure that the combination of the DCD and the information in the CPNPP COL FSAR represents the complete scope of information relating to this review topic.[1] The staff finds that CPNPP COL FSAR Section 2.0 incorporates, by reference, US-APWR DCD, Tier 2, Section 2.0 with no departures. US-APWR DCD, Tier 2, Section 2.0 is being reviewed by the staff under Docket No. 52-021. The staff's technical evaluation of the information, incorporated by reference, related to the site characteristics will be documented in the staff's safety evaluation (SE) of the DC application for the US-APWR design.

The staff's review confirmed that the supplemental and COL information contained in the COL application and DCD information, incorporated by reference, addresses the required information related to site characteristics. The staff verified that the COL applicant provided the information required by 10 CFR 52.79(a)(1)(i). In addition, according to the guidance in NUREG-0800a COL applicant is requested to demonstrate that the characteristics of the site fall within the site parameters specified in the DC rule. The staff evaluations of the COL applicant's responses to these COL information items regarding the site characteristics will be documented in the corresponding sections of this Chapter 2 SE. As such, the staff concludes that the COL applicant has adequately addressed CP COL 2.1(1), CP COL 2.2(1), CP 2.3(1), CP COL 2.3(2), CP COL 2.3(3), CP COL 2.4(1), and CP COL 2.5(1).

2.0.5 Post-Combined License Activities

There are no post-COL activities related to this section.

2.0.6 Conclusion

The staff is reviewing the information in US-APWR DCD, Tier 2, Section 2.0 under Docket No. 52-021. The results of the staff's technical evaluation of the information related to the site characteristics, incorporated by reference, in the CPNPP COL FSAR will be documented in the staff's SER of the DC application for the US-APWR design. The SER for the US-APWR is not yet complete, and is being tracked as part of **Open Item [1-1].** The staff will update Section 2.0 of this SE to reflect the final disposition of the DC application.

In addition, the staff concludes that the COL applicant has demonstrated that the requirements of 10 CFR 52.79(a)(1)(i) have been met. The staff also concludes that the COL applicant has met the guidance described in NUREG-0800, SRP 2.0.

2.1 Geography and Demography

CPNPP COL FSAR, Revision 3, Section 2.1, "Geography and Demography," incorporates by reference, US-APWR DCD, Tier 2, Revision 3, Section 2.1 of the same title with the following departures and/or supplemental information:

[1] See Chapter 1 of this SE for a discussion on the staff's review related to verification of the scope of information to be included within a COLA that references a design certification.

Standard (STD) COL Information Item

In CPNPP COL FSAR, Revision 3, Section 2.1, STD COL 2.1(1), the text of US-APWR DCD, Tier 2, Section 2.1, is replaced by the following:

> This section of the Final Safety Analysis Report (FSAR) provides information regarding the site location and description including the distribution of infrastructure, natural features, and population in the plant area. The discussion below is provided to address the guidance in NUREG-0800 (Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants) and Regulatory Guide 1.206 (Combined License Applications for Nuclear Power Plants [LWR Edition]). Radius distances defined by NUREG-1555 (Standard Review Plans for Environmental Reviews for Nuclear Power Plants) are used for the population analysis, rather than the distances described in RG 1.206 as an alternative method. The alternative method is used to ensure consistency of the population data between the FSAR and Environmental Report (ER). No other exceptions to the regulatory documents noted or alternative methods are used in the development of this section.

The COL applicant provided information pertaining to this COL information item in CPNPP COL FSAR Section 2.1.1, "Site Location and Description," Section 2.1.2, "Exclusion Area and Control," and Section 2.1.3, "Population Distribution." Similarly, the staff's evaluation of the COL applicant's information to STD 2.1(1) is provided below in Section 2.1.1 through Section 2.1.3 of this SE.

2.1.1 Site Location and Description

2.1.1.1 Introduction

CPNPP COL FSAR Section 2.1.1 describes the site location, site area and provides a site map with a boundary for establishing effluent release limits. The descriptions of the site area and reactor location are used to assess the acceptability of the reactor site. The staff's review covers the following specific areas: (1) Specification of reactor location with respect to latitude and longitude, political subdivisions; and prominent natural and manmade features of the area; (2) site area map to determine the distance from the reactor to the boundary lines of the exclusion area, as defined in 10 CFR 100.3, 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, "Licenses, certifications, and approvals for Nuclear Power Plants." The purpose of the staff's review is to ascertain the accuracy of the COL applicant's description for use in independent evaluations of the exclusion area authority and control, the surrounding population, and nearby manmade hazards.

2.1.1.2 Summary of Application

CP COL Information Item

- CP COL 2.1(1)

In CPNPP COL FSAR Section 2.1.1, the COL applicant provided additional information in CP COL 2.1(1) to address COL Information Item 2.1(1) from the US-APWR DCD. COL 2.1(1) states: "The COL applicant is to describe the site geography and demography including the specified site parameters."

To address COL 2.1(1), in CPNPP COL FSAR Section 2.1.1, the COL applicant provided information in CPNPP COL FSAR Subsection 2.1.1, "Site Location and Description," Subsection 2.1.1.1, "Specification of Location," and Subsection 2.1.1.2, "Site Area Map." The information the COL applicant provided to address the COL information item included site plot plan; vicinity base map; map of region surrounding CPNPP; United States Geological Survey (USGS) topographic map; Universal Transverse Mercator (UTM) coordinate system; location of cities, Squaw Creek Reservoir (SCR), rivers and lakes, railroad spur, and industrial facilities.

Interface Requirements

US-APWR DCD, Tier 2, Revision 3, Section 1.8, Table 1.8-1, "Significant Site-Specific Interfaces with the Standard US-APWR Design," identifies significant interfaces between the US-APWR standard design and the COLA. This table does not specify any interfaces related to US-APWR DCD, Tier 2, Section 2.1.1.

2.1.1.3 Regulatory Basis

The relevant requirements of NRC regulations for the site location and description, and the associated acceptance criteria, are given in NUREG-0800, Section 2.1.1, "Site Location and Description."

The applicable regulatory requirements for site location and description are as follows:

1. 10 CFR Part 52.79(a)(1) and 10 CFR 50.34(a)(1) as they relate to the inclusion of the CPNPP 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.

2. 10 CFR Part 100, "Reactor Site Criteria," as it relates to:

    - Defining an exclusion area and setting forth requirements regarding activities in that area (10 CFR 100.3)

    - Addressing and evaluating factors that are used in determining the acceptability of the site (10 CFR 100.20(b))

    - Exclusion area selection relative to dose limits 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

    - Population density and use characteristics relative to hazardous consequences of accidents and risk to the public, in accordance with 10 CFR 100.20(b) and 10 CFR 100.21, which requires site location and engineered safeguards ensure low risk of public exposure

The related acceptance criteria from NUREG-0800, Section 2.1.1 are as follows:

1. Specification of Location: The COL application information is adequate and meets the requirements of 10 CFR 50.34(a)(1), 10 CFR 52.17(a)(1), and 10 CFR 52.79(a)(1) if it describes the 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 of 10 CFR 100.3.

2. The information is adequate and meets the requirements of 10 CFR 50.34(a)(1), 10 CFR 52.17(a)(1), and 10 CFR 52.79(a)(1) if it describes the site location, including the exclusion area and location of the plant within the area, in sufficient detail to enable the reviewer to evaluate the analysis of postulated fission product release, thereby allowing the reviewer to determine (in NUREG-0800, Section 2.1.2 and Section 2.1.3 and Chapter 15, "Accident and Analysis") that the COL applicant has met the requirements of 10 CFR 50.34(a)(1) and 10 CFR Part 100.

2.1.1.4 Technical Evaluation

The staff reviewed CPNPP COL FSAR Section 2.1.1 and checked the referenced DCD to ensure that the combination of the DCD and the information in the CPNPP COL FSAR represent the complete scope of information relating to this review topic. The staff' finds that CPNPP COL FSAR Section 2.1.1 incorporates, by reference, US-APWR DCD, Tier 2, Section 2.1.1 with no departures. US-APWR DCD, Tier 2, Section 2.1.1 is being reviewed by the staff under Docket No. 52-021. The staff's technical evaluation of the information, incorporated by reference, related to site characteristics will be documented in the staff's SE of the US-APWR design DC application.

The guidance contained in NUREG-0800, SRP 2.1.1 states that the COL application is sufficient if the highways, waterways, and railroads that traverse the exclusion area are described in sufficient detail to enable the staff to determine that the COL applicant has met the requirements of 10 CFR 100.3.

The staff reviewed the resolution of the site-specific items related to the site location and description included under CPNPP COL FSAR Section 2.1. The staff independently estimated and verified the site latitude and longitude coordinates and the UTM coordinate system coordinates provided by the COL applicant in the CPNPP, Units 3 and 4, COLA. Using maps readily available in most libraries and Internet sources, the staff verified the accuracy of the information provided by the COL applicant related to political subdivisions and prominent manmade features of the area.

The staff verified that the site area map in CPNPP COL FSAR Figure 2.1-201, "Site Plot Plan"; Figure 2.1-202, "Vicinity Base Map"; Figure 2.1-203, "CPNPP Region"; Figure 2.1-204, "USGS Topographic Map"; and Figure 2.1-205, "Distance to the Exclusion Area Boundary (EAB)," provided by the COL applicant, showed the distance from the reactor to the boundary lines of the CPNPP, Units 3 and 4, exclusion areas. The staff verified that no public roads, commercial railroads, or commercial waterways cross or lie adjacent to the exclusion areas. The staff finds the information addressed in CPNPP COL FSAR Section 2.1, and confirmatory review of pertinent information generally available in literature and on the Internet, and the information provided by the COL applicant with regard to the site location and description adequate and acceptable.

The staff concludes that the COL applicant has provided sufficient information to establish the site location and description and meets the guidance in NUREG-0800, Section 2.1.1. The staff also concludes that the information the COL applicant provided is sufficient to allow the staff to evaluate whether the COL applicant has met the requirements of 10 CFR 52.79(a)(1) and 10 CFR 100.3. As such, the staff finds that the COL applicant has adequately addressed CP COL 2.1(1).

2.1.1.5 Post-Combined License Activities

There are no post-COL activities related to this section.

2.1.1.6 Conclusions

The staff is reviewing the information in US-APWR DCD, Tier 2, Section 2.1.1 under Docket No. 52-021. The results of the staff's technical evaluation of the information related to site location and description, incorporated by reference, in the CPNPP COL FSAR will be documented in the staff's SER of the DC application for the US-APWR design. The SER for the US-APWR is not complete, and is being tracked as part of **Open Item [1-1].** The staff will update Section 2.1.1 of this SE to reflect the final disposition of the DC application.

As set forth above, the COL applicant has presented and substantiated information to establish the site location and description. The staff has reviewed the information provided and concludes that it is sufficient for the staff to evaluate compliance with the siting evaluation factors in 10 CFR Part 100.3, as well as with the radiological consequence evaluation factors in 10 CFR 52.79(a)(1). The staff further concludes that the COL applicant provided sufficient details regarding the site location and site description to allow the staff to evaluate, as documented in Section 2.1.2, "Exclusion Area Authority and Control"; Section 2.1.3,"Population Distribution"; and Section 13.3, "Emergency Planning"; as well as Chapter 11, "Radioactive Waste Management System"; and Chapter 15, "Transient and Accident Analysis," of this SE, whether the COL applicant has met the relevant requirements of 10 CFR Part 52.79(a)(1) and 10 CFR Part 100 with respect to determining the acceptability of the site. The staff finds that the COL applicant has provided sufficient information for satisfying 10 CFR Part 52.79(a)(1), and 10 CFR Part 100 with regard to site location and description.

2.1.2 Exclusion Area Authority and Control

2.1.2.1 Introduction

CPNPP COL FSAR Section 2.1.2 describes the COL applicant's legal rights with respect to all areas that lie within the designated exclusion area and establishes its authority to determine all activities, including exclusion and removal of personnel and property from the area. This section also describes any activities unrelated to plant operation that are to be permitted within the exclusion area, the number of persons engaged in them, and the specific locations within the exclusion area where the activities are permitted. Where a highway, railroad, or waterway traverses the exclusion area, the COL applicant describes the arrangements made to control traffic in the event of an emergency. In addition, the COL applicant describes the need for abandoning or relocating any public roads traversing the proposed exclusion area.

As part of the staff's review of the acceptability of the reactor site, the staff evaluated the COL applicant's legal authority to determine and control activities within the designated exclusion area. The staff's review covered the following specific areas: (1) Establishment of 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; (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.

2.1.2.2 Summary of Application

CP COL Information Item

- CP COL 2.1(1)

The COL applicant provided additional information in CP COL 2.1(1) to address COL Information Item 2.1(1). The COL applicant provided information on the authority and control of the CPNPP, Units 3 and 4, plant exclusion area.

CPNPP COL FSAR Section 2.1.2 addresses the following COL-specific information identified in US-APWR DCD, Tier 2, Section 2.1.

COL Information Item 2.1(1);

- The COL applicant provided a specific description of its legal rights with respect to all areas that lie within the designated exclusion area.
- The COL applicant has obtained ownership of all land within the exclusion area.
- The COL applicant described any activities unrelated to plant operation that will be permitted within the exclusion area, aside from transit through the area.
- No highway, railroad or commercial waterway traverses the exclusion area.
- A 26-inch crude oil pipeline operated by Sunoco Pipeline L.P. traverses the exclusion area.
- No public roads traverse the proposed exclusion area that will have to be abandoned or relocated.

Interface Requirements

US-APWR DCD, Tier 2, Revision 3, Section 1.8, Table 1.8-1, "Significant Site-Specific Interfaces with the Standard US-APWR Design," identifies significant interfaces between the US-APWR standard design and the COLA. This table does not specify any interfaces related to US-APWR DCD, Tier 2, Section 2.1.2.

2.1.2.3 Regulatory Basis

The relevant requirements of NRC regulations for the exclusion area authority and control, and the associated acceptance criteria, are given in NUREG-0800, Section 2.1.2.

The applicable regulatory requirements for the exclusion area authority and control are as follows:

1. 10 CFR Part 50.34(a)(1), 10 CFR 52.17(a)(1), and 10 CFR Part 52.79(a)(1), as they relate to the inclusion in the CPNPP 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, in accordance with 10 CFR 50.34(a)(1), 10 CFR 52.17(a)(1), and 10 CFR 52.79(a)(1).

2. 10 CFR Part 100, as it relates to (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 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.

The related acceptance criteria from NUREG-0800, Section 2.1.2 are as follows:

1. The information is adequate and meets the requirements of 10 CFR 50.34(a)(1), 10 CFR 52.79(a)(1), and 10 CFR Part 100 if it provides sufficient detail for the staff to evaluate the COL applicant's legal authority within the exclusion area. To meet the requirements of 10 CFR Part 100, the COL applicant must demonstrate that it has the authority within the exclusion area as defined in 10 CFR 100.3 prior to issuance of a construction permit or limited work authorization.

2. The information is adequate and meets the requirements of 10 CFR 50.34(a)(1), 10 CFR 52.79(a)(1), and 10 CFR Part 100 if it provides sufficient detail to enable the reviewer to evaluate the COL applicant's legal authority for the exclusion or removal of personnel or property from the exclusion area. A highway, railroad, or waterway may traverse the exclusion area but should not be so close to the facility so as to interfere with normal operations. In addition, appropriate and effective arrangements should be made to control traffic during an emergency.

3. The information is adequate and meets the requirements of 10 CFR 50.34(a)(1), 10 CFR 52.79(a)(1), and 10 CFR Part 100 if it provides sufficient detail to enable the reviewer to evaluate the COL applicant's legal authority over all activities within the exclusion area.

2.1.2.4 Technical Evaluation

The staff reviewed CPNPP COL FSAR Section 2.1.2 and checked the referenced DCD to ensure that the combination of the DCD and the information in the CPNPP COL FSAR represent the complete scope of information relating to this review topic. The staff finds that CPNPP COL FSAR Section 2.1.2 incorporates, by reference, US-APWR DCD, Tier 2, Section 2.1.2 with no departures. US-APWR DCD, Tier 2, Section 2.1.2 is being reviewed by the staff under Docket No. 52-021. The staff's technical evaluation of the information, incorporated by reference, related to exclusion area control will be documented in the staff's SE of the DC application for the US-APWR design.

The staff reviewed CP COL 2.1(1) included under CPNPP COL FSAR Section 2.1. This COL 2.1(1) item is identified as CP COL 2.1(1).

The staff reviewed the information contained in the CPNPP, Units 3 and 4, COLA related to the exclusion area authority and control include including size of the area, and activities that may be permitted within the designated exclusion area included under CPNPP COL FSAR Section 2.1 using the review procedures described in NUREG-0800, Section 2.1.2.

The COL applicant provided the information concerning the following:

- Complete legal authority to regulate access and activity within the exclusion area boundary.

- Identification of any facilities within the EAB that have activities unrelated to plant operation being controlled and considered for emergency planning.

  The staff verified that no public roads, railroads, or commercial waterways cross or lie adjacent to the EAB. A portion of the SCR is included in the EAB, but the entire reservoir is owned and controlled by the COL applicant and the COL applicant controls public access to the reservoir. A 26 inch crude oil pipeline crosses the EAB approximately 2275 feet west-southwest of the center point.

  The staff verified the COL applicant's description of the exclusion area as well as the authority under which all activities within the exclusion area can be controlled. For consistency, the staff also verified that the EAB is the same as being considered for the radiological consequences in CPNPP COL FSAR Chapter 15 and Chapter 13.3, by the COL applicant. Although the COL applicant does not own all of the mineral rights at the site, the restrictions have been added to the non-owned mineral rights to the deeds to ensure adequate applicant control over all activities at the site. The staff concludes that the COL applicant has acquired authority to control all activities within the designated exclusion area.

- The property is clearly posted and actions to be taken in the event of emergency conditions at the plant are clearly outlined in the site physical security plan. The CPNPP, Units 3 and 4, EABs are at least 0.5 miles from the potential release points and meets the requirements of 10 CFR 50.34(a)(1)(ii)(D)(1). As such, the staff finds that the COL applicant has adequately addressed CP COL 2.1(1).

2.1.2.5 Post-Combined License Activities

There are no post-COL activities related to this section.

2.1.2.6 Conclusion

The staff is reviewing the information in US-APWR DCD, Tier 2, Section 2.1.2 under Docket No. 52-021. The results of the staff's technical evaluation of the information related to EAB, incorporated by reference, in the CPNPP COL FSAR will be documented in the staff's SER of the DC application for the US-APWR design. The SER for the US-APWR is not complete, and is being tracked as part of **Open Item [1-1].** The staff will update Section 2.1.2 of this SE to reflect the final disposition of the DC application.

As set forth above, the COL applicant has provided and confirmed information concerning its legal authority and control of all activities within the designated exclusion area. The staff has reviewed the information provided and, for the reasons discussed above, concludes that the COL applicant's exclusion area is acceptable to meet the requirements of 10 CFR 50.34(a)(1), 10 CFR 52.79(a)(1), 10 CFR Part 100, and 10 CFR 100.3 with respect to determining the acceptability of the site. The staff's conclusion is based on the COL applicant having appropriately described the plant exclusion area, the authority under which all activities within the exclusion area can be controlled, and the methods by which access and occupancy of the exclusion area can be controlled during normal operation and in the event of an emergency situation. In addition, the COL applicant has the required authority to control activities within the designated exclusion area, including the exclusion and removal of persons and property, and has established acceptable methods for control of the designated exclusion area.

2.1.3 Population Distribution

2.1.3.1 Introduction

CPNPP, Units 3 and 4 CPNPP COL FSAR Section 2.1.3 describes the population data in the vicinity of the CPNPP, Units 3 and 4, based on the latest U.S. Census Bureau data, including inhabitants within the exclusion area, the surrounding population zones, transient population and population density.

The description of population distributions addresses the need for information concerning: (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 Guide (RG) 4.7, "General Site suitability Criteria for Nuclear Power Stations," Regulatory Position C.4; and (6) any additional information requirements prescribed within the "Contents of Application," sections of the applicable Subparts to 10 CFR Part 52.

2.1.3.2 Summary of Application

CPNPP COL FSAR Section 2.1 describes the population distribution for the site environs, while addressing the following COL-specific information:

CP COL Information Item

- CP COL 2.1(1)

The COL applicant provided additional information in CP COL 2.1(1) to address COL Information Item 2.1(1). The COL applicant provided information regarding the population data in the vicinity of the CPNPP, Units 3 and 4, including inhabitants within the exclusion area, the surrounding population zones, and population density along with population projections for the operational period of 40 years from year 2016 through year 2056.

The COL applicant also provided the following information for CP COL 2.1(1);

- The COL applicant provided a description of the population within 10 miles of the plant.
- The COL applicant provided a description of the population between 10 and 50 miles of the plant.
- The COL applicant provided a description of the seasonal and daily variations in population and population distribution resulting from land uses.
- The COL applicant provided population projections for the 40 years from 2016 through 2056, assuming completion of construction date of year 2016.
- The COL applicant specified the LPZ.
- The COL applicant identified the nearest population center.

Interface Requirements

US-APWR DCD, Tier 2, Revision 3, Section 1.8, Table 1.8-1, "Significant Site-Specific Interfaces with the Standard US-APWR Design," identifies significant interfaces between the US-APWR standard design and the COLA. This table does not specify any interfaces related to US-APWR DCD, Tier 2, Section 2.1.3.

2.1.3.3 Regulatory Basis

The relevant requirements of NRC regulations for population distribution, and the associated acceptance criteria, are given in NUREG-0800, Section 2.1.3. The applicable regulatory requirements for population distribution information are as follows:

1. 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 (population density), 10 CFR 52.17, and 10 CFR 52.79, as they relate to provisions in the CPNPP COL FSAR for existing and projected future population profile in the surrounding vicinity of the plant site.

2. 10 CFR 100.20 and 10 CFR 100.21, as they relate to determining the acceptability of the site for a power reactor. 10 CFR 100.3, 10 CFR 100.20, and 10 CFR 100.21 provide definitions and other requirements for determining an exclusion area, LPZ, and population center distance.

The related acceptance criteria from NUREG-0800, Section 2.1.3 are as follows:

1. 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 U.S. Census and projected population for determining the population density within 20 miles of the plant at the year of plant approval and 5 years thereafter, in the geographical format given in RG 1.70, "Standard Format And Content of Safety Analysis Reports for Nuclear Power Plants," Section 2.1.3 and in accordance with RG 1.206, "Combined License Applications for Nuclear Power"; (2) the SAR describes the methodology and sources used to obtain the population data, including the projections; and (3) the SAR includes information regarding transient populations in the site vicinity.

2. The exclusion area should either contain no residents or any such residents should be subject to ready removal, if necessary.

3. The LPZ is acceptable if it is determined that appropriate protective measures could be taken on behalf of the enclosed residents in the event of a serious accident.

4. 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. RG 4.7, "General Site Suitability Criteria for Nuclear Power Stations," Regulatory Position C.4, Revision 2, April 1998, provides population density guidelines. Population Density: If the population density exceeds the guidelines given in RG 4.7, Regulatory Position C.4, the COL applicant must give special attention to the consideration of alternative sites with lower population densities.

2.1.3.4 Technical Evaluation

The staff reviewed CPNPP COL FSAR Section 2.1.3 and reviewed the referenced DCD to ensure that the combination of the DCD and the information in the CPNPP COL FSAR represent the complete scope of information relating to this review topic. The staff's finds that CPNPP COL FSAR Section 2.1.3 incorporates, by reference, US-APWR DCD, Tier 2, Section 2.1.3 with no departures. US-APWR DCD, Tier 2, Section 2.1.3 is being reviewed by the staff under Docket No. 52-021. The staff's technical evaluation of the information, incorporated by reference, related to population density will be documented in the staff's SE of the DC application for the US-APWR design. The staff reviewed the COL applicant's resolution to CP COL 2.1(1) related to the population distribution around the site environs included under CPNPP COL FSAR Section 2.1.3.

The staff reviewed the data regarding the population in the site environs, as presented in CPNPP COL FSAR Section 2.1.3, to determine whether the exclusion area, LPZ, and population center distance for the proposed site comply with the requirements of 10 CFR Part 100. In accordance with RG 4.7, Regulatory Position C.4 of RG 4.7, the staff also evaluated whether the COL applicant should consider alternative sites with lower population densities.

Furthermore, the staff also reviewed whether appropriate protective measures could be taken on behalf of the enclosed populace within the emergency planning zone (EPZ), which encompasses the LPZ, in the event of a serious accident. Using the U.S. Census Bureau estimates, the staff verified the COL applicant's provided population distribution data. The staff also reviewed the projected population data provided by the COL applicant, including the weighted transient population for years 2007, 2016, 2026, 2036, 2046, and 2056. The staff reviewed the extensive transient population data provided by the COL applicant. Since the COL applicant's calculated values were within a few percent of the NRC-determined values, the staff finds the COL applicant's estimate of the population reasonable.

The staff verified the distances to the nearest population centers are more than 8 times the minimum population center distance of 2.67 miles (one and one-third times the distance from center point to the outer boundary of the LPZ). The CPNPP, Units 3 and 4, LPZ is defined as a circle with a two mile radius from the CPNPP, Units 3 and 4, site center point. The nearest

population center, as defined by 10 CFR 100.3, is Cleburne, TX. The distance to the Cleburne, TX urban boundary, as defined by U.S. Census data, is 24 miles from the CPNPP, Units 3 and 4, center point. This distance is over eight times greater than the one and one third times the distance from the CPNPP, Units 3 and 4, center point to the boundary of the LPZ as required by NUREG-0800 and complies with the guidance provided by RG 4.7. Therefore, the staff concludes that the proposed site meets the population center distance requirement as defined in 10 CFR Part 100, Subpart B.

RG 4.7, Regulatory Position C.4, Revision 2 states that the population density, including the weighted transient population projected at the time of the initial site approval and 5 years thereafter should not exceed 500 persons per 2.59 km^2 (1 square mile (mi^2)) averaged over any radial distance out to 20 miles (cumulative population at a distance divided by the area at that distance).

The staff evaluated the site population density against the criterion in RG 4.7, Regulatory Position C.4, Revision 2, regarding whether it is necessary to consider alternative sites with lower population densities. The staff concurred with the COL applicant that the population densities at the time of initial site operation (assumed year 2016) and 5 years thereafter, would not exceed the criteria of 500 persons per square mile averaged over any radial distance out to 20 miles (cumulative population within a distance of up to 20 miles divided by the area of the same radius circle). Use of the initial site operation is more conservative than use of the initial site approval date required by RG 4.7.

Therefore, the staff concludes that the CPNPP, Units 3 and 4, site conforms to RG 4.7, Regulatory Position C.4, Revision 2.

The staff reviewed CP COL 2.1(1) included under CPNPP COL FSAR Section 2.1.3. This COL 2.1(1) item is identified as CP COL 2.1(1).

> The COL applicant evaluated the population distribution data in the vicinity of the CPNPP, Units 3 and 4, against general site suitability criteria for nuclear power stations in compliance with RG 4.7

2.1.3.5 Post-Combined License Activities

There are no post-COL activities related to this section.

2.1.3.6 Conclusion

The staff is reviewing the information in US-APWR DCD, Tier 2, Section 2.1.3 under Docket No. 52-021. The results of the staff's technical evaluation of the information related to population distribution, incorporated by reference, in the CPNPP COL FSAR will be documented in the staff's SER of the DC application for the US-APWR design. The SER for the US-APWR is not complete, and is being tracked as part of **Open Item [1-1].** The staff will update Section 2.1.3 of this SE to reflect the final disposition of the DC application.

The staff finds the relevant information presented in CPNPP COL FSAR Section 2.1.3, acceptable and meets the applicable requirements on the basis of the following:

As set forth above, the COL applicant has provided an acceptable description of current and projected population, distribution in, and around the site. The staff reviewed the information

provided and, for the reasons discussed above, finds the population data provided acceptable to meet the requirements of 10 CFR 50.34(a)(1), 10 CFR 52.79(a)(1), 10 CFR 100.20(a), 10 CFR 100.20(b), 10 CFR Part 100, and 10 CFR 100.3. This finding is based on the COL applicant having provided an acceptable description and safety assessment of the site, which contains present and projected population densities that are within the guidelines of RG 4.7, Regulatory Position C.4, and properly specified the LPZ and population center distance. Additionally, the staff reviewed and confirmed, by comparison with independently obtained population data, the COL applicant's estimates of the present and projected populations surrounding the site, including transients. The COL applicant also has calculated the radiological consequences of design-basis accidents (DBAs) at the outer boundary of the LPZ (SRP Chapter 15) and has provided reasonable assurance that appropriate protective measures can be taken within the LPZ to protect the population in the event of a radiological emergency. This addresses CPNPP COL FSAR Section 2.1 specific items. The staff finds that the COL applicant has provided sufficient information for complying with the requirements of 10 CFR Part 50, 10 CFR Part 52, and 10 CFR Part 100.

2.2 Nearby Industrial, Transportation, and Military Facilities

CPNPP COL FSAR, Revision 3, Section 2.2, "Nearby Industrial, Transportation, and Military Facilities," incorporates by reference, US-APWR DCD, Tier 2, Revision 3, Section 2.2 of the same title with the following supplemental information:

CP COL Information Item

In CPNPP COL FSAR, Revision 3, Section 2.2, CP COL 2.2(1), the text of US-APWR DCD, Tier 2, Section 2.2, is replaced by the following information:

> The Comanche Peak Nuclear Power Plant (CPNPP) is located in Hood and Somervell counties, Texas. Hood County is located north of Somervell County. The two counties are bounded by Parker County to the north, Johnson County to the east, Bosque County to the south, Erath County to the west, and Palo Pinto County to the northwest, as seen in Figure 2.1-203.
>
> The CPNPP site is accessible by road and rail. Interstate 20 (I-20) connects the Dallas-Fort Worth metropolitan area with Abilene, and its closest portion to the site is located approximately 28 mile (mi) northwest (Reference 2.2-201). U.S. Highway 377 (US 377) runs southwest from the City of Fort Worth to Stephenville passing through Granbury. U.S. Highway 67 (US 67) connects Cleburne to Stephenville after passing through Glen Rose. The site is accessible by rail via a rail spur that runs from the CPNPP site to an intersection with the main line in Tolar, Texas. The Tolar line is owned by Fort Worth and Western Railroad and is located approximately 9.5 mi northwest of the center point between CPNPP Units 3 and 4.
>
> This section of the safety analysis report provides information regarding the potential effects on the safe operation of the nuclear facility from industrial, transportation, mining, and military installations in the CPNPP vicinity.

The COL applicant provided additional information pertaining to this COL information item in CPNPP COL FSAR Section 2.2.1, "Locations and Routes," Section 2.2.2, "Descriptions," and

Section 2.2.3, "Evaluation of Potential Accidents." Similarly, the staff's evaluation of the COL applicant's information to CP 2.2(1) is provided below in Section 2.2.1 through Section 2.2.3 of this SE.

2.2.1 Locations and Routes

2.2.1.1 Introduction

CPNPP COL FSAR Section 2.2.1 identifies the locations of, and transportation routes associated with, nearby industrial, transportation, and military facilities relative to the potential hazards they could pose to safe operation of the reactors.

2.2.1.2 Summary of Application

To address US-APWR DCD, COL Information Item 2.2(1), the COL applicant provided the following COL information:

CP COL Information Item

- CP COL 2.2(1)

CP COL 2.2(1) provided descriptions of the locations and transportation routes of industrial, transportation, and military facilities nearby the CPNPP, Units 3 and 4 site, relative to the potential hazards these routes could pose to safe operation of the reactors, including a description of the products and materials associated with each facility, plus a description of the pipelines, waterways, highways, railroads, and airways. In addition, the possibility of industrial growth is also presented.

Interface Requirements

US-APWR DCD, Tier 2, Revision 3, Section 1.8, Table 1.8-1, "Significant Site-Specific Interfaces with the Standard US-APWR Design," identifies significant interfaces between the US-APWR standard design and the COLA. This table does not specify any interfaces related to US-APWR DCD, Tier 2, Section 2.2.1.

2.2.1.3 Regulatory Basis

The regulatory basis of the information, incorporated by reference, is addressed in the SER for the US-APWR DCD. The relevant requirements of NRC regulations for providing locations and transportation routes of nearby industrial, transportation, and military facilities, and the associated acceptance criteria, are given in NUREG-0800, Section 2.2.1. Review interfaces with other NUREG-0800 sections are located in NUREG-0800, Section 2.0.

The applicable regulatory requirements for providing locations and transportation routes of nearby industrial, transportation, and military facilities are as follows:

1. 10 CFR 100.20(b), as it relates to the requirement that the nature and proximity of man-made hazards be evaluated to establish site parameters for use in determining whether the plant design can accommodate commonly occurring hazards, and whether the risk of other hazards is very low.

2. 10 CFR 52.79(a)(1)(iv), as it relates to the factors to be considered in the evaluation of the location and description of industrial, transportation, and military facilities.

3. 10 CFR 52.79(a)(1)(vi), as it relates to compliance with 10 CFR Part 100.

The related acceptance criteria from NUREG-0800, Section 2.2.1 and Section 2.2.2 are as follows:

1. Data in the CPNPP COL FSAR adequately describe the locations and distances from the plant of nearby industrial, transportation, and military facilities and that such data are in agreement with data obtained from other sources, when available.

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 NUREG-0800, Section 2.2.1, Section III.

3. Sufficient statistical data with respect to hazardous materials are provided to establish a basis for evaluating the potential hazards to the plant.

2.2.1.4 Technical Evaluation

The staff reviewed CPNPP COL FSAR Section 2.2.1 and CPNPP COL FSAR Section 2.2.2 and reviewed the referenced DCD to ensure the COL applicant has addressed all issues relating to this section. The staff finds that the information contained in the COL application, and incorporated by reference, addresses the relevant information related to this section. US-APWR DCD, Section 2.2.1 and Section 2.2.2 are being reviewed by the staff under Docket No. 52-021. The staff's technical evaluation of the information, incorporated by reference, related to these sections will be documented in the corresponding SER for the US-APWR DC application.

In CPNPP COL FSAR Section 2.2.1 and CPNPP COL FSAR Section 2.2.2, the COL applicant provided the following information for CP COL 2.2(1).

> A COL applicant that references the US-APWR design certification will provide site-specific information related to the identification of potential hazards stemming from nearby industrial, transportation, and military facilities within the site vicinity, including an evaluation of potential accidents (such as explosions, toxic chemicals, and fires).

CPNPP COL FSAR Section 2.2.1, "Locations and Routes," and CPNPP COL FSAR Section 2.2.2, "Descriptions," determine whether the effects of potential accidents in the vicinity of CPNPP, Units 3 and 4, site from present and projected industrial, transportation, and military installations and operations should be used as design-basis events for plant design parameters related to the selected accidents. The staff identified significant facilities and activities within 5 miles and major airports within 10 miles of the CCNPP site. The staff also evaluated the facilities and activities, and significant facilities at greater distances.

The COL applicant's investigation of potential external hazard facilities and operations within 5 miles of the site identified, include seven significant industrial facilities including one electric generation plant; one railroad; four farm-to-market roads; one State highway; one Federal highway; eight pipelines; military training airway; underground and aboveground storage tanks; gas wells; and CPNPP Units 1 and 2, and its associated onsite chemical storage facilities for further evaluation.

The location of the facilities and transportation routes within 5 miles of CPNPP, Units 3 and 4, are shown in CPNPP COL FSAR Figure 2.2-201, "Transportation Routes, Storage Tank Locations, and Industrial Facilities within 5 miles of CPNPP." The location of the gas wells are shown in CPNPP COL FSAR Figure 2.2-202, "Gas Wells within 5 mi of CPNPP." The airways in the vicinity of the CPNPP site are shown in CPNPP COL FSAR Figure 2.2-203, "Airways near CPNPP."

The staff's evaluation of COL Information Item 2.2(1), which was addressed in CPNPP COL FSAR Section 2.2.1, "Location and Routes," and Section 2.2.2, "Descriptions," is provided below after each subject.

<u>Location and Routes</u>

The US-APWR DCD includes the following COL Information Item 2.2(1) in Section 2.2.1:

The site-specific location and routes for nearby industrial, transportation, and military facilities are addressed by the COL applicant. The potential external hazard facilities and operations within 5 miles of CPNPP, Units 3 and 4, include seven significant industrial facilities including one electric generation plant; one railroad; four farm-to-market roads; one State highway; one Federal highway; eight pipelines; military training airway; underground and above ground storage tanks; gas wells; and CPNPP, Units 1 and 2 and its associated onsite chemical storage facilities for further evaluation. The COL applicant revised information in CPNPP COL FSAR Section 2.2.2.2.8 pertaining to DeCordova SES facility stating that it is located 9.35 miles northeast of the center point of CPNPP, Units 3 and 4. In RAI 2843, Question 02.02.01 -02.02.02-1, the staff requested that the COL applicant revise the information for consistency with this facility throughout the CPNPP COL FSAR sections and tables. In an October 15, 2009, response to RAI 2843, Question 02.02.01-02.02.02-1, the COL applicant provided proposed changes to the CPNPP COL FSAR as requested by the staff. The staff finds the COL applicant's proposed CPNPP COL FSAR changes acceptable and, therefore, consider RAI 2843, Question 02.02.01-02.02.02-1 resolved.

> The location of the facilities and transportation routes within 5 miles of CPNPP, Units 3 and 4, include the following and are shown in CPNPP COL FSAR Figure 2.2-1.
>
> - IESI Somervell County Transfer Station
> - Wolf Hollow 1, Limited Partnership (L.P)
> - Glen Rose Medical Center
> - Cleburne Propane
> - Wheeler Branch Reservoir and Water Treatment Facility

- CPNPP, Units 1 and 2
- DeCordova Compressor Station
- Glen Rose Wastewater Treatment Plant (WWTP)
- Texas Department of Transportation Maintenance Station
- Farm to Market Road 56 (FM 56)
- Farm to Market Road 205 (FM 205)
- Farm to Market Road 200 (FM 200)
- Farm to Market Road 51 (FM 51)
- Texas State Highway 144 (SH 144)
- U.S. Highway 67 (US 67)
- CPNPP Railroad spur

There are no significant manufacturing plants, chemical plants, or refineries located within 8 km (5 mi) of CPNPP, Units 3 and 4.

Aboveground and underground storage tanks are located within 5 miles of the CPNPP site. The IESI Somervell County Transfer Station has one aboveground storage tank containing 2000 gallons of diesel fuel. To the east of the site, Martha A. Newkirk is the location of three underground storage tanks, which have not been used since February 2007. To the south of the CPNPP Units 3 and 4 site, the Somervell County Maintenance Department has two tanks with a capacity of 4000 gallons each, one containing diesel fuel and other containing gasoline. The details of these tanks are provided in CPNPP COL FSAR Table 2.2-201, and the locations are shown in CPNPP COL FSAR Figure 2.2-201. In addition to these registered tanks, there are some underground and aboveground storage tanks at Wolf Hollow 1, L.P.; and CPNPP, Units 1 and 2. There are no coal or lignite mines within the vicinity of CPNPP. There are 37 regular producing gas wells and two injection wells within 8 km (5 mi) of the CPNPP Units 3 and 4 site. The closest producing gas well to CPNPP Units 3 and 4 site is located 1.2 miles northwest, while the closest permitted location is 1.2 miles to the north-northeast.

Descriptions

CPNPP COL FSAR Section 2.2.2 includes COL Information Item COL 2.2(1). The COL item includes the descriptions of the industrial, transportation, and military facilities located in the vicinity of the CPNPP, Units 3 and 4 site. The description of facilities identified in CPNPP COL FSAR Section 2.2.1, along with a detailed description of the products and materials are addressed in this CPNPP COL FSAR section. CPNPP COL FSAR Table 2.2-202 provides a concise description of seven industrial facilities, including the functions and major products as well as number of persons employed. The detailed descriptions are provided in CPNPP COL FSAR Sections 2.2.2.2.1 through 2.2.2.2.6, and Section 2.2.2.2.10. The detailed information regarding the electric generation stations, Wolf Hollow 1, L.P.; and CPNPP, Units 1 and 2, are

provided in CPNPP COL FSAR Section 2.2.2.2.7 and CPNPP COL FSAR Section 2.2.2.2.9. The mining and quarry operations, drilling operations, and wells are described in CPNPP COL FSAR Section 2.2.2.2.11. Oil and gas pipelines are discussed in CPNPP COL FSAR Section 2.2.2.3. The detailed descriptions of the facilities would help evaluate the potential accidents in CPNPP COL FSAR Section 2.2.3. A brief description of each of the facilities identified is provided below.

Description of Industrial Facilities

IESI Somervell County Transfer Station

This site is a waste transfer station for Somervell County, TX and is located 4.2 miles south-southeast of the CPNPP Units 3 and 4 site. No hazardous materials are stored on-site, with the exception of an oil dump. The tank has a capacity of 200 gallons and is emptied periodically.

Wolf Hollow 1, L.P.

Wolf Hollow 1, L.P. is a 730-megawatt (MW) gas-fired combined-cycle power plant located 4.2 miles northeast of the CPNPP Units 3 and 4 site. Hazardous materials stored on-site are listed in CPNPP COL FSAR Table 2.2-205 (without quantities).

Glen Rose Medical Center

The Glen Rose Medical Center is a combined hospital and nursing home facility, and is located 5 miles southeast of the CPNPP Units 3 and 4 site. Liquid oxygen is stored in a 1000 pound tank that is refilled by truck as needed.

Cleburne Propane

This facility is located 3.9 miles east-southeast of the center point of CPNPP, Units 3 and 4 site. Two 14,500 gallon and one 18,000 gallon above ground propane tanks are located on-site. The propane is delivered to these tanks via semi trailer trucks travelling south from Granbury SH 144, with an average of two or three deliveries per week during the winter and three or four deliveries per month during the summer. Bobtail trucks with propane tanks ranging from 2600 - 2800 gallons are used to make local deliveries.

Wheeler Branch Reservoir and Water Treatment Facility

The Wheeler Branch Reservoir was completed in 2007 and is located 3.2 miles southeast of the CPNPP, Units 3 and 4, center point. The reservoir has a surface area of 180 acres and a storage capacity of 4118 acre-feet. The water treatment plant was expected to be constructed in 2010. The COL applicant anticipates that cylinders of chlorine will be stored on-site for use in water treatment. In RAI 2843, Question 02.02.01-02.02.02-2, the staff requested that the COL applicant provide an estimate for the amount of anticipated chlorine cylinders that may be stored on site and evaluate the potential control room habitability impact. In its October 15, 2009, response to RAI 2843, Question 02.02.01-02.02.02-2, the COL applicant stated that it is anticipated that 1000 gallons of sodium hypochlorite at 12.5 percent will be stored at the Wheeler Branch and Water Treatment Facility and used for water treatment. The applicant added that 12.5 percent sodium hypochlorite has a hazardous materials identification system (HMIS) rating of 2 and, as such, is not considered highly or extremely toxic. Therefore, the

sodium hypochlorite stored at the Wheeler Branch and Water Treatment Facility does not pose a credible hazard to the control room. The staff finds the COL applicant‘s response acceptable because the COL applicant’s response met the guidance described in NUREG-0800, Section 2.2.3 since the COL applicant provided the estimated chlorine amount. The staff confirmed that the proposed revision to the FSAR was incorporated into CPNPP COL FSAR Section 2.2.2.2.10, Revision 3. Based on the above discussion RAI 2843, Question 02.02.01-02.02.02-2 is resolved and closed.

DeCordova Compressor Station

The DeCordova Compressor Station is a natural gas compressor station operated by Enterprise and is located 3.1 miles northeast of CPNPP, Units 3 and 4, center point. The station has a volume of 700 - 800 cubic feet per day, and is operational most of the time. Approximately 100 gallons of lube oils are stored in a tank on-site.

Glen Rose WWTP

The Glen Rose WWTP is run by the City of Glen Rose, TX and treats approximately 320,000 gallons per day (gpd)), and is located 4.2 miles southeast of the CPNPP, Units 3 and 4, center point. On-site there are ten 150 pound chlorine cylinders used to treat the water.

Texas Department of Transportation Maintenance Station

The Texas Department of Transportation Maintenance Station is located 4.9 miles south of CPNPP, Units 3 and 4, center point. The station’s hazardous materials are listed in CPNPP COL FSAR Table 2.2-204.

CPNPP, Units 1 and 2

The existing CPNPP, Units 1 and 2 are located within the CPNPP site boundary. The hazardous chemicals located on-site are listed in CPNPP COL FSAR Table 2.2-209. There are 22 aboveground storage tanks and four underground storage tanks on site. These contents of the storage tanks are described in the CPNPP COL FSAR Table 2.2-211.

Descriptions of Mining and Quarrying Activities

There are no coal or lignite mines within the vicinity of CPNPP. There are 37 producing gas wells and two injection wells within 5 miles of CPNPP. The closest producing gas well to CPNPP is located 1.2 miles northwest, while the closest permitted location is 1.2 miles to the north-northeast. There are no oil wells within 5 miles of CPNPP.

Descriptions of Military Facilities

There are no military facilities within 5 miles of the CPNPP Units 3 and 4 site center point. The closet operating military facility is the Naval Air Station, Fort Worth, TX, Joint Reserve Base (JRB) located approximately 36 miles northeast of the site.

Descriptions of Pipelines

There are eight major pipelines within 5 miles of the center point of CPNPP, Units 3 and 4, as shown in CPNPP COL FSAR Figure 2.2-204. None of the pipelines operate at a higher-than-

normal pressure and there are no plans to use them for other products other than the present products.

Atmos Energy operates three natural gas pipelines: (1) One 36 inch pipeline passing through the northern portion of the site; one 6.63 inch pipeline crossing the northern and western portions of the site; and one 16 inch pipeline located northeast of the site.

Quicksilver Resources operates a 20 inch natural gas pipeline to the northeast of the site and a 12 inch natural gas pipeline to the east of the site. These two pipelines have a maximum allowable operating pressure (MAOP) of 1050 pounds per square inch (psi) and have valves typically located every 7 miles.

Sunoco Pipeline, LP operates a 26 inch crude oil pipeline that crosses the western and southern portions of the site. It has a MAOP of 750 psi.

Enterprise operates two natural gas pipelines; one 30 inch pipeline that passes through the northern portion of the CPNPP Units 3 and 4 site and one 14 inch pipeline located northeast of the site. These pipelines have an MAOP of 1050 psi.

In addition to these major pipelines, there are numerous lines delivering natural gas to residential, commercial, and industrial units.

Description of Waterways

The only waterway near CPNPP is SCR, which is available to the public for recreational use via controlled access. Boating and fishing are permitted with a maximum of 100 boats at any given time, not including special events. There is no commercial traffic on SCR. There are no navigable rivers within 5 miles of the CPNPP Units 3 and 4 site.

Description of Highways

The nearest highway with commercial traffic, FM 56, passes 1.4 miles west-southwest of the center of CPNPP, Units 3 and 4. The nearest Federal highway with commercial traffic is US 67, passing about 4.4 miles to the south at it closest point. Segments of SH 144 are located within a 5 mile radius of the center point of CPNPP, Units 3 and 4.

Description of Railroads

The Fort Worth Western Railroad Company owns and operates a Railroad line that runs through the City of Tolar approximately 9.5 miles northwest of CPNPP. An average of two trains per day use the Tolar route. No radiological material is transported on this line, but four to five cars of hazardous materials are transported each month. The nearest public transportation Railway is the Amtrak Texas Eagle Route that passes through Cleburne, 24 miles east of CPNPP.

Description of Airports and Airways

There are no commercial airports within 8 km (5 mi) of the CPNPP Units 3 and 4 site. The Granbury Municipal Airport is the nearest public Airport and is located approximately 10 miles north of CPNPP in Granbury, TX. An average of 73 operations per day is reported from this airport, of which 67 percent are local general aviation and 33 percent are transient general aviation. None are military operations. These reported operations of 73 per day are well below

the threshold criterion of 500 d^2 operations per year where d represents the airport distance from the site. There are airports outside of the 10 mile radius of the site and the operations at the airports do not exceed the criterion of 1000 d^2.

There are no airways that pass within 5 mile of CPNPP Units 3 and 4 site as shown in CPNPP COL FSAR Figure 2.2-203. The centerlines of two low-altitude flight lines pass within 10 miles of CPNPP. One military training route VR-158 passes within 10 miles of the CPNPP Units 3 and 4 site and is located 7.8 miles southwest at its closest point. Brownwood 1 East military operations area (MOA) is located 33 miles southwest of CPNPP Units 3 and 4 at its closest point.

Projections of Industrial Growth

There are no industrial parks within 8 km (5 mi) of the CPNPP Units 3 and 4 site. No sizeable industrial growth is expected in the Glen Rose, TX area. In Granbury, TX, industrial expansion focuses around the airport. The staff's independent collection of information from local organizations, and officials confirms that there are no plans for any major industries such as chemical, petrochemical or manufacturing other than minor light industrial type of facilities.

2.2.1.5 Post-Combined License Activities

There are no post-COL activities related to this section.

2.2.1.6 Conclusion

The staff finds the information pertaining to CPNPP COL FSAR Section 2.2.1 and CPNPP COL FSAR Section 2.2.2 is within the scope of the DC and adequately incorporates, by reference, US-APWR DCD, Tier 2, Section 2.2.1 and US-APWR DCD, Tier 2, Section 2.2.2, and is therefore acceptable.

The staff is reviewing the information for the US-APWR under Docket Number 52-021. The results of the staff's technical evaluation of the information related to this section incorporated, by reference, in the CPNPP COL FSAR will be documented in the SER of the DC application for the US-APWR. The SER for the US-APWR is not yet complete, and is being tracked as part of **Open Item 1-1.** The staff will update Sections 2.2.1 and 2.2.2 of this SE to reflect the final disposition of the DC application for the US-APWR.

As set forth above, the staff finds that the COL applicant has presented and substantiated information to establish an identification of potential hazards in the site vicinity. The staff has reviewed the information provided and, for the reasons discussed above, concludes that the COL applicant has provided information with respect to identification of potential hazards in accordance with the requirements of 10 CFR 52.79(a)(1)(iv) and 10 CFR 52.79(a)(1)(vi) for compliance evaluation. The nature and extent of activities involving potentially hazardous materials that are conducted at nearby industrial, military, and transportation facilities have been evaluated to identify any such activities that have the potential for adversely affecting plant safety-related structures. Based on an evaluation of information in the CPNPP COL FSAR, as well as information that the staff independently obtained, the staff has concluded that all potentially hazardous activities on site and in the vicinity of the plant have been identified. The hazards associated with these activities have been reviewed and are discussed in Sections 2.2.3, 3.5.1.5, and 3.5.1.6 of this SE.

2.2.2 Descriptions

2.2.2.1 Introduction

CPNPP COL FSAR Section 2.2.2 provides a description of the industrial, transportation, and military facilities in the vicinity of the plant site that could pose a hazard to site operations.

2.2.2.2 Summary of Application

CP COL Information Item

- CP COL 2.2(1)

The COL applicant provided additional information in CP COL 2.2(1) to address COL Information Item 2.2(1). The COL applicant provided descriptions of the industrial, transportation, and military facilities near the CPNPP, Units 3 and 4 site, relative to the potential hazards they could pose to safe operation of the reactors.

Interface Requirements

US-APWR DCD, Tier 2, Revision 3, Section 1.8, Table 1.8-1, "Significant Site-Specific Interfaces with the Standard US-APWR Design," identifies significant interfaces between the US-APWR standard design and the COLA. This table does not specify any interfaces related to US-APWR DCD, Tier 2, Section 2.2.2.

2.2.2.3 Regulatory Basis

The relevant requirements of NRC regulations for providing descriptions of nearby industrial, transportation, and military facilities and the associated acceptance criteria, are given in NUREG-0800, Section 2.2.2.

The applicable regulatory requirements for providing descriptions of nearby industrial, transportation, and military facilities are as follows:

1. 10 CFR 100.20(b), as it relates to the requirement that the nature and proximity of man-made hazards be evaluated to establish site parameters for use in determining whether the plant design can accommodate commonly occurring hazards, and whether the risk of other hazards is very low.

2. 10 CFR 52.79(a)(1)(iv), as it relates to the factors to be considered in the evaluation of the location and description of industrial, transportation, and military facilities.

3. 10 CFR 52.79(a)(1)(vi), as it relates to compliance with 10 CFR Part 100.

The related acceptance criteria from NUREG-0800, Section 2.2.2 is as follows:

1. Data in the CPNPP COL FSAR adequately describe the locations and distances from the plant of nearby industrial, transportation, and military facilities and that

such data are in agreement with data obtained from other sources, when available.

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 NUREG-0800, Section 2.2.1, Section III.

3. Sufficient statistical data with respect to hazardous materials are provided to establish a basis for evaluating the potential hazards to the plant.

2.2.2.4 Technical Evaluation

The staff reviewed CP COL 2.2(1) included under CPNPP COL FSAR Section 2.2.2. This COL 2.2(1) item is identified as CP COL 2.2(1).

The staff's review of CPNPP COL FSAR Section 2.2.2 is documented in Section 2.2.1 of the staff's SE above.

2.2.2.5 Post-Combined License Activities

There are no post-COL activities related to this section.

2.2.2.6 Conclusion

The staff's conclusion of the CPNPP COL FSAR Section 2.2.2 is documented in Section 2.2.1.6 of this SE.

2.2.3 Evaluation of Potential Accidents

2.2.3.1 Introduction

CPNPP COL FSAR Section 2.2.3 provides the COL applicant's evaluation of potential hazards associated with nearby industrial, transportation, and military facilities, including the effects of toxic vapors or gases, explosions, fires, and missiles (aircraft impact). The COL applicant's probability analyses of potential accidents involving hazardous materials or activities on site and in the vicinity of the CPNPP, Units 3 and 4, site is also provided.

2.2.3.2 Summary of Application

CPNPP COL FSAR, Revision 3, Section 2.2.3 incorporates by reference, US-APWR DCD, Tier 2, Revision 3, Section 2.2.3.

In addition, in CPNPP COL FSAR Section 2.2.3, the COL applicant provided the following supplemental information:

Supplemental Information (SUP)

- CP SUP 2.2(2)

In CPNPP COL FSAR Section 2.2.3, the COL applicant added the statement that a variety of potential accidents, and their effects on the plant or plant operation, is included in the section. In addition, the COL applicant provided the nuclear power plant requirements for 10 CFR Part 50, Appendix A, GDC 4.

In addition, after CPNPP COL FSAR Section 2.2.3, the COL applicant provided the following supplemental information for CP COL 2.2(1):

CP COL Information Item

- CP COL 2.2(1)

The COL applicant provided additional information in CP COL 2.2(1) to address COL Information Item 2.2(1). The COL applicant provided information regarding the determination of DBEs, pertaining to explosions, due to transportation routes, nearby industrial facilities, on-site explosion hazards, gas wells explosions, and flammable vapor clouds (delayed ignition) due to transportation routes, industrial facilities, pipelines, gas wells; toxic chemicals from mobile sources and stationary sources; fires, collision with intake structure; liquid spills; and effects of DBEs for the CPNPP, Units 3 and 4 site.

This site-specific supplementary information provided by the COL applicant in CPNPP COL FSAR Section 2.2.3 addresses the evaluation of potential accidents on the basis of information provided in CPNPP COL FSAR Sections 2.2.1 and 2.2.2. These potential accidents are considered as DBEs, and the potential effects of those accidents on the nuclear plant, in terms of design parameters (e.g., overpressure, missile energies) or physical phenomena (e.g., impact, flammable and/or toxic vapor clouds) are identified.

The following types of hazardous events potentially attributable to nearby industrial, transportation, and military facilities are addressed in CPNPP COL FSAR Section 2.2.3: explosion, vapor cloud delayed ignition, toxic chemical release, fire, collision with the plant intake structure, liquid spills, and radiological release. Only an aircraft impact event is identified as requiring further analysis as a DBE.

Interface Requirements

US-APWR DCD, Tier 2, Revision 3, Section 1.8, Table 1.8-1, “Significant Site-Specific Interfaces with the Standard US-APWR Design,” identifies significant interfaces between the US-APWR standard design and the COLA. This table does not specify any interfaces related to US-APWR DCD, Tier 2, Section 2.2.3.

2.2.3.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the US-APWR DCD.

In addition, the relevant requirements of NRC regulations for the CPNPP, Units 3 and 4, site-specific evaluation of potential accidents, and the associated acceptance criteria, is provided in NUREG-0800, Section 2.2.3.

The applicable regulatory requirements for CPNPP, Units 3 and 4, site-specific evaluation of potential accidents are as follows:

1. 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.

2. 10 CFR 52.79(a)(1)(vi), as it relates to compliance with 10 CFR Part 100.

The related acceptance criteria from NUREG-0800, Section 2.2.3 are as follows:

1. The identification of DBEs resulting from the presence of hazardous materials or activities in the vicinity of the plant 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 10 CFR 50.34(a)(1), as it relates to the requirements of 10 CFR Part 100 is estimated to exceed the staff's objective of an order of magnitude of 10^{-7} per year.

2. 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 have been performed and measures have been taken to mitigate the consequences of such events.

2.2.3.4 Technical Evaluation

The staff reviewed CPNPP COL FSAR Section 2.2.3 and checked the referenced DCD to ensure that the combination of the DCD and the information in the CPNPP COL FSAR represent the complete scope of information relating to this review topic. The staff finds that the information contained in the COL application and incorporated by reference addresses the required information related to the evaluation of potential accidents. US-APWR DCD, Tier 2, Section 2.2.3 is being reviewed by the staff under Docket No. 52-021. The staff's technical evaluation of the information, incorporated by reference, related to the evaluation of potential accidents will be documented in the staff's SER of the DC application for the US-APWR design.

The staff reviewed the information contained in the CPNPP COL FSAR:

Supplemental Information (SUP)

- CP SUP 2.2(2)

This supplemental information adds the statement in CPNPP COL FSAR Section 2.2.3 to US-APWR DCD, Tier 2, Section 2.2.3 that a variety of potential accidents and their effects on the plant or plant operation are included in CPNPP COL FSAR Section 2.2.3. The added supplemental information also discusses the nuclear power plant requirements for 10 CFR Part 50, Appendix A, GDC 4. The COL applicant added this section as general introductory paragraph.

CP COL Information Item

- CP COL 2.2(1)

The staff reviewed CP COL 2.2(1), which is added after US-APWR DCD, Tier 2, Section 2.2.3 and provides additional CPNPP COL FSAR Sections 2.2.3.1, 2.2.3.1.1, 2.2.3.1.1.1, 2.2.3.1.1.2, 2.2.3.1.1.3, 2.2.3.1.1.4, 2.2.3.1.2, 2.2.3.1.2.1, 2.2.3.1.2.2, 2.2.3.1.2.3, 2.2.3.1.2.4, 2.2.3.1.3, 2.2.3.1.3.1, 2.2.3.1.3.2, 2.2.3.1.3.2.1, 2.2.3.1.3.2.2, 2.2.3.1.4, 2.2.3.1.5, 2.2.3.1.6, and 2.2.3.2. With these additional subsections, the COL item adds information on the determination of DBEs, explosions, transportation routes, nearby industrial facilities, on-site explosion hazards, gas wells explosions, flammable vapor clouds (delayed ignition), transportation routes, industrial facilities, pipelines, gas wells, toxic chemicals, background, source evaluation, mobile sources, stationary sources, fires, collision with intake structure, liquid spills, and effects of DBEs for the CPNPP, Units 3 and 4, site.

The COL applicant has performed the site-specific evaluations and provided the added information in CPNPP COL FSAR Section 2.2.3.1 and CPNPP COL FSAR Section 2.2.3.2 as supplements to the US-APWR DCD.

Determination of Design-Basis Events

DBEs internal and external to the nuclear plant are defined as those accidents that have a probability of occurrence on the order of magnitude of 1×10^{-7} per year, or greater, with potential consequences serious enough to affect the safety of the plant to the extent that the guidelines of 10 CFR Part 100 could be exceeded. The accident categories considered in selecting DBEs include explosions, flammable vapor clouds (delayed ignition), toxic chemicals, fires, collisions with intake structure, liquid spills, and radiological hazards.

The COL applicant analyzed the postulated accidents at the following facility locations:

- Nearby transportation routes FM 56 and pipelines
- Gas wells
- Nearby industrial facilities
- Onsite chemical storage CPNPP, Units 1, 2, 3 and 4)

<u>Explosions</u>

The COL applicant evaluated the accidents involving potential explosions from nearby highways, and facilities to critical plant structures. Minimum safe distance not to exceed 1 psi peak incident pressure is determined and presented in CPNPP COL FSAR Section 2.2.3.1.1. The COL applicant stated that the RG 1.91, “Evaluations of Explosions postulated to occur on Transportation Routes near Nuclear Power Plants,” Revision 1, methodology was used to determine the minimum safe distances. However, for the liquid chemicals stored (i.e., propylene and propane) the COL applicant considered the in-vessel confined vapor amount to determine the potential for explosion, and also the amount of unconfined vapor in the air to determine the minimum safe distance. Therefore, in RAI 2844, Question 02.02.03-1, the staff requested that the COL applicant provide potential explosion evaluation for the flammable hazardous chemicals Dimethylamine and Hydrazine listed in CPNPP COL FSAR Table 2.2-214. The COL applicant evaluated potential explosions from nearby highways, railways, and facilities using the one psi overpressures as a criterion for adversely effecting plant operation or preventing safe shutdown of the plant. In accordance with RG 1.91, peak positive incident overpressures below one psi are considered to cause no significant damage. In its October 15, 2009, response to RAI 2844, Question 02.02.03-1, the COL applicant stated that the hydrazine stored on-site is a 35 percent solution with an NFPA flammability rating of 1. Likewise, the

dimethylamine stored on site is a 40 percent solution and has an HMIS flammability rating of 1. Materials with a flammability rating of 1 require considerable preheating under all ambient temperature conditions before ignition and combustion occur. Thus, the form of dimethylamine and hydrazine used on site does not pose an explosion hazard. The COL applicant provided proposed changes to CPNPP COL FSAR Table 2.2-214 that showed the correct percentage of concentrations of dimethylamine and hydrazine that will be stored on site. The staff finds the COL applicant's response acceptable as it complies with RG 1.91. The staff has confirmed that these proposed changes were incorporated into Revision 3 of the FSAR. Based on the above discussion RAI 2844, Question 02.02.03-1 is resolved and closed.

Flammable Vapor Clouds (Delayed Ignition)

The COL applicant evaluated the chemicals to determine the possible effects of a flammable vapor cloud explosion. The COL applicant used the Area Locations of Hazardous Atmospheres (ALOHA) model with a wind speed of 1 m/s, F stability, and an ambient temperature of 105 °F. The ALOHA model is designed to model chemical releases and is used to estimate how a toxic cloud might disperse after a postulated chemical release. This model calculates the rate of release for chemicals escaping from tanks, pipes, and predicts the release rate over time.

CPNPP COL FSAR Section 2.2.3.1.2.1, states that the chemicals gasoline, propane, acetylene, ethyl acetylene, ethylene oxide, and propylene oxide were analyzed assuming the transport on FM 56 of a tanker truck volume of 9600 gallons and considering the rupture sizes of 4.5 m^2 and 1 m^2. The COL applicant concluded that for all cases there is a negligible overpressure at the site due to ignition of the vapor cloud and the concentrations remain below the lower explosive limit (LEL) at CPNPP, Units 3 and 4. The COL applicant also analyzed the potential vapor cloud explosion from the largest volume source, an 18,000 gallons propane tank at Cleburne Propane facility assuming the rupture sizes of 5 m^2, and 1 m^2, and concluded that there is a negligible overpressure and the concentration is much lower than the LEL at the CPNPP, Units 3 and 4. The staff's independent analyses confirm the COL applicant's results and, therefore, the staff considers the COL applicant's approach, methodology, and conclusions reasonable and acceptable.

The COL applicant analyzed the flammable vapor cloud explosion from the pipelines addressed in the CPNPP COL FSAR. The Energy Transfer Partners (ETP) pipeline represented the bounding natural gas pipeline accident having the largest size and maximum operating pressure that resulted in a concentration of 2260 ppm compared to the LEL of 44000 ppm. The staff's confirmatory calculation resulted in a comparable value of 2130 ppm. Therefore, staff considers the COL applicant's conclusion appropriate and acceptable.

The COL applicant also analyzed the Sunoco crude oil pipeline by calculating a large and small break flow. However, it was unclear to the staff how it was modeled to obtain the results. Therefore, in RAI 2844, Question 02.02.03-2, the staff requested that the COL applicant provide the details of the modeling analysis. In an October 15, 2009, response to RAI 2844, Question 02.02.03-2, the COL applicant used the ALOHA model and determined that the overpressure at the nearest safety structure is less than 1 psi and vapor concentration at the control room intakes is below 8680 ppm, which is below the LEL of 13,000 ppm. The staff reviewed the information provided in a data package in the CPNPP electronic reading room to confirm the COL applicant's analysis. The staff concluded that the COL applicant has adequately addressed this issue and considers the RAI 2844, Question 02.02.03-2 resolved.

The COL applicant analyzed a potential flammable vapor cloud explosion due to gas wells. The closest functioning natural gas well is located 1.2 miles from the center point of CPNPP, Units 3 and 4. The COL applicant assumed a maximum gas release rate of 15.6 million cubic feet per day. However, it was unclear to the staff how the modeling was performed and the length of time that was assumed for the release in calculating the maximum concentration of 346 ppm at the control room intake, and for an overpressure not exceeding 1 psig at a distance less than 0.1 mile. Therefore, in RAI 2844, Question 02.02.03-3, the staff requested that the COL applicant provide the basis for and the release duration that was used for the analysis of gas wells in FSAR Section 2.2.3.1.2.4 to calculate the gas concentration at the control room at a distance of 1.2 miles. In its October 15, 2009, response to RAI 2844, Question 02.02.03-3, the COL applicant stated that the largest open flow was about 13,000,000 cubic feet per day. Luminant, in its analysis, increased this value by 20 percent to allow for the flow associated with piping and to account for the possibility of a future well with a larger absolute open flow. The result of the 20 percent increase is 15,600,000 cubic feet per day. The closest gas well to CPNPP is 1.2 miles, which the COL applicant chose for conservatism. The COL applicant stated, in part, that natural gas is not a control room habitability threat based upon a review of the Material Safety Data Sheet. Natural gas has a NFPA rating of 1 and only chemicals with NFPA ratings of 3 or 4 were considered in the analysis, unless otherwise specified in RG 1.78. Since natural gas is lighter than air, its release would disperse quite readily, thus concentrations at the control room intake due to a release from a well 1.2 miles away would be negligible. The staff reviewed the information provided in the data package folder in the CPNPP electronic reading room and confirmed the COL applicant's calculations. The staff finds the COL applicant's response reasonable and acceptable since it meets the guidance described in NUREG-0800, Section 2.2.3. Therefore, the staff considers **RAI 2844, Question 02.02.03-3** resolved.

Toxic Chemicals

The COL applicant evaluated accidents involving the release of toxic chemicals from on-site storage facilities and nearby mobile and stationary sources to determine the possible effects regarding control room habitability. The chemicals considered for the evaluation are presented in CNCPP COL FSAR Table 2.2-214, "Toxic Chemicals that do not Meet the Regulatory Guide 1.78 Screening Criteria."

The staff determined that the COL applicant did not provide enough details in selecting these chemicals for the evaluation and screening out the other chemicals. Therefore, in RAI 2844, Question 02.02.03-5, the staff requested that the COL applicant provide the source, methodology, and rationale in determining the chemicals for the evaluation and the quantities.

In an October 15, 2009, response to RAI 2844, Question 02.2.03-5, the COL applicant stated that CPNPP COL FSAR Section 2.2 identifies the facilities located within 5 miles of the site and the chemicals located at each facility. CPNPP COL FSAR Table 2.2-203 through Table 2.2-213, lists the chemicals at the various facilities. As described in CPNPP COL FSAR Section 2.2.3.1.3.1, only chemicals with National Fire Protection Association (NFPA) 704 Health Hazard or HMIS Health ratings of three or four were considered in this calculation, unless otherwise specified in RG 1.78, "Evaluating the Habitability of a Nuclear Power Plant Control Room During Postulated Hazardous Chemical Release," or NUREG/CR-6624, "Recommendation for Revision of Regulatory Guide 1.78." All chemicals that did not meet these criteria were excluded from further consideration. The facilities containing chemicals that were not screened out were discussed in CPNPP COL FSAR Section 2.2.3.1.3.2.2.

The COL applicant provided the information for the chemical and quantities and the rationale for screening out the chemicals from evaluation. Those chemicals that were evaluated are provided in the response. The COL applicant identified hydrogen sulfide concentration in the crude oil as 400 ppm. In addition, the COL applicant stated that Chlorine was deemed a sufficient example as a toxic gas that serves as the qualification chemical for roadway transportation chemical screening. Further discussion of roadway transportation analysis is provided in the COL applicant's October 15, 2009, response to RAI 2844, Question 02.02.03-5. Based on the staff's review of the COL applicant's response, the staff considers the information provided by the COL applicant adequate and reasonable for the staff to perform confirmatory calculations, using RG 1.78 methodology.

The COL applicant assumed 42500 pounds of chlorine in evaluating the effects of the control room habitability from mobile sources. There are no details in the CPNPP COL FSAR as to how this chlorine quantity is established for the evaluation. In addition, two chemicals, ethylene oxide and propylene oxide, addressed for tanker truck transport explosion are not considered for the toxic chemical evaluation. Therefore, in RAI 2844, Question 02.02.03-4, the staff requested that the COL applicant address these chemicals for evaluation and provide the rationale for the quantity of chlorine evaluated. In an October 15, 2009,response to RAI 2844, Question 02.02.03-4, the COL applicant stated that the two chemicals, ethylene oxide and propylene oxide, are screened out based on RG 1.78 methodology and the chlorine amount is based on the loading for a large tanker truck, The staff concurred that the amount of chlorine considered for the analysis is reasonable, and the RG 1.78 methodology applied for screening out ethylene oxide and propylene oxide from the control room habitability consideration is applicable and acceptable.

The staff also reviewed the COL applicant's information and concluded that the COL applicant's consideration of chemicals presented in CPNPP COL FSAR Table 2.2-214, for the evaluation of control room habitability are appropriate and acceptable. Therefore, the staff considers RAI 2844, Question 02.02.03-4 resolved.

The COL applicant used the HABIT model consisting of EXTRAN and CHEM modules with a wind speed of 2.5 m/s and G stability. EXTRAN models toxic chemical transport from the selected release point to the intake of the control room. The CHEM model is then applied to the model chemical exposure to the control room personnel using the control room design air flow parameters. The results of the analysis are presented in CPNPP COL FSAR Table 2.2-214. The concentration of each chemical at the intake of the control room is not provided in CPNPP COL FSAR Table 2.2-214. Therefore, in RAI 2844, Question 02.02.03-6, the staff requested that the COL applicant provide for each chemical listed in CPNPP COL FSAR Table 2.2-214, the intake concentration calculated by the EXTRAN module of HABIT to compare against the respective Immediate Danger to Life and Health (IDLH) value. This information would help the staff to ascertain which chemical has the impact potential for the control room habitability and also would help in performing confirmatory analyses. In an October 15, 2009, response to RAI 2844 Question 02.02.03-6, the COL applicant added the calculated control room maximum concentration of toxic chemicals that were analyzed using the EXTRAN module of HABIT to CPNPP COL FSAR Table 2.2-214. The chemicals from various locations addressed in CPNPP COL FSAR Table 2.2-214, will be reviewed by the staff as part of the control room habitability in Section 6.4 of this SE.

Fires

The COL applicant evaluated the fires from accidents at adjacent to the industrial plants and storage facilities, as well as from the oil and gas pipelines; brush and forest fires; and fires from transportation accidents that could lead to high heat fluxes or to form smoke clouds. The evaluation concluded that the impact from such fires would not affect the safe operation of the nuclear plant.

A potential gas well fire was also analyzed assuming a well distance of 1.2 miles from the center point of CPNPP, Units 3 and 4, and a maximum burn rate of 3.3×10^4 pounds per minute using the ALOHA model as a jet fire. The resulting heat flux from a gas well fire on the closest safety-related structure is less than 0.02 kilowatts per square meter (kw/m^2). The analysis also showed that the heat flux decreases to 2.0 (kw/m^2)at 219 yards (0.12 miles) from the jet fire. This heat flux is sufficiently low and within the thermal acceptance criteria of the structures.

The staff reviewed the information, assumptions and analyses of the fires and concluded, with the COL applicant's analysis, that the impact from such fires would not affect the safe operation of the nuclear plant. Therefore, the staff considers the COL applicant's approach and conclusion reasonable and acceptable.

Collisions with Intake Structure

The only waterway near CPNPP is SCR, which does not provide public access to the site. There is no commercial or recreational traffic on SCR and therefore, no collisions with the intake structure is expected.

Liquid Spills

There is no commercial or recreational traffic on SCR. The only source of liquid spills may be due to the crude oil pipeline. Since the petroleum products, having specific gravity of less than one, float on the surface and the intake is from the submerged pipes from the bottom, spills are not likely to be drawn into the makeup water system.

Radiological Hazards

The release of radioactive material from CPNPP, Units 1 and 2, due to normal operations or an unanticipated event that may threaten the safety of the plant or personnel at CPNPP, Units 3 and 4, is not addressed by the COL applicant. Therefore, in RAI 2864, Question 02.02.03-7, the staff requested that the COL applicant provide a discussion of the potential effects from Unit 1 or 2 on the personnel at Units 3 and 4. In its November 18, 2009, response to RAI 2864, Question 02.02.03-7, the COL applicant stated that the CPNPP, Units 1 and 2 FSAR provides an evaluation of the Units 2 construction worker dose resulting from Unit 1 operations and that this evaluation showed the estimated doses received by construction workers on Unit 2, as a result of Unit 1 operations, was within the limits specified by 10 CFR Part 20. The COL applicant further added that because Units 3 and 4 are considerably further away from the evaluated Unit 2 site, the doses to the construction workers would be even less. The staff's evaluation of the dose to construction workers is presented in the staff's safety evaluation for Chapter 12, 'Radiation Protection,' Section 12.4.

In its same response, the COL applicant stated that the liquid effluent releases from Units 1 and 2 are maintained within the limits specified by 10 CFR Part 20, Appendix B. The ventilation and

radiation monitoring systems for Units 1 and 2 were designed to ensure the maximum airborne radioactivity levels for normal and anticipated operational occurrences were within the limits specified in 10 CFR Part 20, Appendix B.

Finally, the COL applicant stated, in part, the consequences of unanticipated events at Units 1 and 2 are bounded by the consequences of a design basis loss of coolant accident (LOCA). Therefore, the impact on the safety of the plant or personnel at CPNPP, Units 3 and 4 due to the release of radioactive materials from Units 1 and 2 for an unanticipated event will only consider the consequences of radioactive material releases for a design basis LOCA. Following a LOCA at Unit 1 or 2, any non-essential personnel will be evacuated in accordance with the Emergency Plan so that doses to these personnel will not be considered. The staff reviewed the COL applicant's information, confirmed the proposed changes to the CPNPP COL FSAR were implemented into COL FSAR, Revision 3, and found the COL applicant's approach reasonable and acceptable since the estimated doses due to the releases of CPNPP, Units 1 and 2 were within the limits of 10 CFR Part 20, Appendix B. The staff considers **RAI 2864, question 02.02.03-7** to be resolved and closed.

2.2.3.5 Post-Combined License Activities

There are no post-COL activities related to this section.

2.2.3.6 Conclusion

The staff reviewed the COL application and checked the referenced DCD. The staff's review confirmed that the COL applicant addressed the required information relating to the evaluation of potential accidents, and there is no outstanding information expected to be addressed in the CPNPP COL FSAR related to this section.

The staff is reviewing the information in US-APWR DCD, Tier 2, Section 2.2.3 under Docket No. 52-021. The results of the staff's technical evaluation of the information related to the evaluation of potential accidents, incorporated by reference, in the CPNPP COL FSAR will be documented in the staff's SER of the DC application for the US-APWR design. The SER for the US-APWR is not yet complete, and is being tracked as part of **Open Item [1-1]**. The staff will update Section 2.2.3 of this SE to reflect the final disposition of the DC application.

In addition, the staff concludes that the relevant information presented within the CPNPP Units 3 and 4, CPNPP COL FSAR is acceptable and meets the applicable requirements regarding the basis of the following:

CPNPP COL FSAR Section 2.2.3 incorporates, by reference, US-APWR DCD, Tier 2, Section 2.2.3, "Evaluation of Potential Accidents," with CP SUP 2.2(2) and CP COL 2.2(1). The staff concludes that the information pertaining to CPNPP COL FSAR Section 2.2.3 is within the scope of the DC and adequately incorporates, by reference, US-APWR DCD, Tier 2, Section 2.2.3 and, therefore, considered acceptable.

As set forth above, the COL applicant has identified potential accidents related to the presence of hazardous materials or activities in the site vicinity that could affect a nuclear power plant or plants of the specified type that might be constructed on the proposed site, has appropriately determined those that should be considered as DBEs, and has demonstrated that the plant is adequately protected and can be operated with an acceptable degree of safety with regard to the DBAs. The staff has reviewed the information provided and, for the reasons discussed

above, concludes that the COL applicant has established that the construction and operation of a nuclear power plant or plants of the specified type on the proposed site location is acceptable to meet the requirements of 10 CFR 52.79(a)(1)(iv) and 10 CFR 52.79(a)(1)(vi) for compliance with respect to determining the acceptability of the site.

The staff finds that the COL applicant has provided sufficient information to comply with the applicable regulatory requirements.

2.3 Meteorology

To ensure that a nuclear power plant or plants can be designed, constructed, and operated on a COL applicant's proposed site in compliance with NRC regulations, the staff evaluates regional and local climatologically information, including climate extremes and severe weather occurrences that may affect the design and siting of a nuclear power plant. The staff also reviews the COL applicant's onsite meteorological monitoring program and information regarding the atmospheric dispersion characteristics of a nuclear power plant site to determine whether the radioactive effluents from postulated accidental releases, as well as routine operational releases, are within NRC guidelines. The staff has prepared Section 2.3.1 through Section 2.3.5 of this SE in accordance with the review procedures described in NUREG-0800, using information presented in CPNPP COL FSAR Section 2.3 (which references the US-APWR DCD, Tier 2, Revision 3), responses to the staff RAIs, and generally available reference materials (as cited in NUREG-0800 applicable sections).

2.3.1 Regional Climatology

2.3.1.1 Introduction

CPNPP COL FSAR Section 2.3.1, "Regional Climatology," addresses averages and extremes of climatic conditions and regional meteorological phenomena that could affect the safe design and siting of the plant, including information describing the general climate of the region, severe weather phenomena, and other meteorological conditions to be used for design- and operating-basis considerations.

2.3.1.2 Summary of Application

CPNPP COL FSAR, Revision 3, Section 2.3.1 incorporates, by reference, US-APWR DCD, Tier 2, Revision 3, Section 2.3.

In addition, in CPNPP COL FSAR Section 2.3, the COL applicant provided the following:

US-APWR COL Information Item

- CP COL 2.3(1)

The COL applicant provided additional information in CP COL 2.3(1) to address COL Information Item 2.3(1). The COL applicant provided a description of the general climate of the region with respect to airflow patterns, temperature and humidity, precipitation, storm tracks and severe weather phenomena, and air quality.

2.3.1.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the certification of the US-APWR DCD.

In addition, the acceptance criteria associated with the relevant requirements of NRC regulations for regional climatology are given in NUREG-0800, Section 2.3.1.

The applicable regulatory requirements for regional climatology information are:

- 10 CFR 52.79(a)(iii), as it relates to identifying 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 time in which the historical data have been accumulated.

- 10 CFR 100.20(c)(2), and 10 CFR 100.21(d), as it relates to the consideration given to the regional meteorological characteristics of the site.

The climatological and meteorological information assembled in compliance with the above regulatory requirements are necessary to determine a proposed facility's compliance with the following requirements in 10 CFR Part 50, Appendix A:

- GDC 2, "Design Bases for Protection Against Natural Phenomena," and 10 CFR 52.79(a)(iii), as they relate to consideration of the most severe 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.

- GDC 4, "Environmental and Dynamic Effects Design Bases," as it relates to information regarding tornadoes that could generate missiles.

The related acceptance criteria from NUREG-0800, Section 2.3.1 are as follows:

- The description of the general climate of the region should be based on standard climatic summaries compiled by the National Oceanic and Atmospheric Administration (NOAA). Consideration of the relationships between regional synoptic-scale atmospheric processes and local (site) meteorological conditions should be based on the appropriate meteorological data.

- Data regarding severe weather phenomena should be based on standard meteorological records from nearby representative National Weather Service (NWS), military, or other stations recognized as standard installations that have long periods of data on record. The applicability of these data to represent site conditions during the expected period of reactor operation should be substantiated.

- The tornado parameters should be based on RG 1.76, "Design Basis Tornado and Tornado Missiles for Nuclear Power Plants." Any deviations from RG 1.76 should be identified by the COL applicant. Alternatively, a COL applicant may

specify any tornado parameters that are appropriately justified, provided that a technical evaluation of the site-specific data is conducted.

- The basic (straight line) 100-year return period 3-second gust wind speed should be based on appropriate standards, with suitable corrections for local conditions.

- Consistent with RG 1.27, "Ultimate Heat Sink for Nuclear Power Plants," Revision 2, January 1976, the ultimate heat sink (UHS) meteorological data that would result in the maximum evaporation and drift loss of water and minimum water cooling should be based on long-period regional records that represent site conditions. If applicable, the potential for water freezing in the UHS water storage facility should be analyzed. The bases used to select critical meteorological data should be provided and justified.

- The weight of the 100-year return period snowpack should be based on data recorded at nearby representative climatic stations or obtained from appropriate standards with suitable corrections for local conditions. The weight of the 48-hour probably maximum winter precipitation (PMWP) should be determined in accordance with reports published by NOAA's Hydrometeorological Design Studies Center.

- Ambient temperature and humidity statistics should be derived from data recorded at nearby representative climatic stations or obtained from appropriate standards with suitable corrections for local conditions.

- High air pollution potential information should be based on U.S. Environmental Protection Agency (EPA) studies.

- All other meteorological and air quality conditions identified by the COL applicant as climate site characteristics should be documented and substantiated.

Interim Staff Guidance (ISG) document DC/COL-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 NUREG-0800, Section 2.3.1 to clarify the staff's position regarding 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.

2.3.1.4 Technical Evaluation

The staff reviewed CPNPP COL FSAR Section 2.3.1 and checked the referenced DCD to ensure that the combination of the US-APWR DCD and the CPNPP COL COLA represents the complete scope of information relating to this review topic. The staff confirmed that the information contained in the COL application and incorporated by reference, addresses the required information relating to regional climatology. The results of the staff's evaluation of the information incorporated by reference in the CPNPP COLA are documented in the FSER related to the certification of the US-APWR Standard Design.

The staff reviewed the information in the CPNPP COL FSAR:

US-APWR COL information item

- CP COL 2.3(1)

The staff reviewed CP COL 2.3(1) related to the provision of regional climatology included in CPNPP COL FSAR Section 2.3.1. The COL information item in US-APWR DCD, Tier 2, Section 2.3.6.1 states:

> The COL Applicant, whether the plant is to be sited inside or outside the continental US, 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.

Evaluation of the information provided in CP COL 2.3(1) is discussed below:

Supplemental Information

- CP SUP 2.3(1)

The staff reviewed supplemental information in CPNPP COL FSAR Section 2.3 discussing regional climatological conditions and local meteorological conditions.

2.3.1.4.1 General Climate

The COL applicant characterized the State of Texas and regional climatology for the CPNPP site using data from the National Climatic Data Center (NCDC), the Climatic Atlas of Texas (published by the Texas Department of Water Resources), and a number of other climatological sources. Based on the Climatic Atlas of Texas, the proposed site of CPNPP, Units 3 and 4, is located in Texas' Climatic Division 3 known as the Cross Timbers. This is characterized as subtropical, sub humid. The staff concludes that references used by the COL applicant were appropriate for describing the general climate of both the proposed site and the state.

CPNPP COL FSAR, Reference 2.3-202, "Online Handbook of Texas," was used by the COL applicant as the source of general precipitation data for the State of Texas. This reference provided the range of mean annual precipitation in Texas from a maximum of 59.20 inches at Orange to a low of 7.82 inches at El Paso. Precipitation data was also taken from CPNPP COL FSAR Reference 2.3-201, "Texas Water Development Board," which indicated West Texas to be the driest region (11.65 inches) of precipitation annually) and the Upper Coast of Texas (45.93 inches) and East Texas (44.02 inches) being the wettest. Since the sources of these data were not cited in these CPNPP COL FSAR references, the staff compared this information to the data in the Climate Atlas of the United States[2], the NCDC 1971-2000 Monthly Station Normals for Texas, "Climatology of the United States No. 81," and the Texas Department of Water Resources, "Climatic Atlas of Texas," (1983) based on data from 1951-1980. These latter two sources indicated annual precipitation in the El Paso area from approximately 8 - 11 inches, and annual precipitation at Orange approximately 56 - 63 inches. In addition, the

[2] National Climatic Data Center. 2002. Climate Atlas of the United States. Version 2.0. [CD-ROM]. National Climatic Data Center - National Oceanic and Atmospheric Administration, Asheville, NC.

staff obtained information from the Climate Atlas of the United States stating that the mean annual precipitation ranges from 5 - 12 inches in West Texas to 50 - 70 inches at the Upper Coast of Texas and portions of East Texas. The staff finds the statewide precipitation data provided by the COL applicant consistent with other reliable sources.

CPNPP COL FSAR Section 2.3.1.1 also provided general data regarding hurricane strikes, frequency of tornadoes in Texas, and the annual average of percent of sunshine. The staff confirmed these data using available NCDC and NWS data.

The CPNPP COL FSAR provided averaged temperature and precipitation data for the CPNPP area based on data from Dallas-Fort Worth Airport, Dallas Love Field Airport, Mineral Wells Airport, and Glen Rose, TX. The mean daily maximum and mean daily minimum temperatures based on averaging these sites are 77.6 °F and 54 °F, respectively. For Glen Rose (1971-2000), the highest daily maximum temperature recorded was 115 °F and the lowest daily minimum temperature recorded was - 15 °F. Based on the four sites, the average annual precipitation for this region is 34.6 inches. The staff confirmed these data based on climatology data from NCDC for the period 1971-2000.

The COL applicant stated that based on data (i.e., wind roses generated by the COL applicant) from Dallas-Fort Worth Airport, the Mineral Wells Airport and the CPNPP site, the typical wind direction is from 147 degrees (south-southeast) and the average wind speed is 10.5 mph. The staff compared these values with the Climate Atlas of the United States (1979) which indicated prevailing winds in the eastern half of Texas are from the southeasterly clockwise through the southerly directions. (The 1979 version of the “Climatic Atlas” was used as these data were not available in the 2002 version.) The staff also prepared wind roses for Dallas-Fort Worth Airport (1984 through 1992) and Stephenville (1984, 1985, 1987, 1989, 1990, and 1992) from data provided by the U.S. EPA on the EPA Support Center for Regulatory Atmospheric Modeling (SCRAM) website. The wind roses generated using these data indicated predominant winds, on an annual basis, from the south-southeast and south consistent with the wind roses generated by the COL applicant. The 2008 NCDC Local Climatological Data (LCD) summary for Dallas-Fort Worth Airport indicates a mean wind speed of 10.5 mph (1971 through 2000).

The COL applicant provided climatic data in CPNPP COL FSAR Table 2.3-202 through Table 2.3-205, for Dallas-Fort Worth Airport, Dallas Love Field, Mineral Wells, and Glen Rose, TX. The staff confirmed the data in these tables against NCDC sources.

NUREG-0800, Section 2.3.1, Part I.1.6.e, indicates ambient temperature and humidity statistics should be developed “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” (also see RG 1.206 C.I.2.3.1.2(5)). These include:

- Two percent and one percent annual exceedance and 100-year maximum dry bulb temperature and coincident wet bulb temperature.
- Two percent and one percent annual exceedance and 100-year maximum wet bulb temperature (non-coincident).
- Ninety-eight percent and 99 percent annual exceedance and 100-year minimum dry bulb temperature.

US-APWR DCD, Tier 2, Table 2.0-1 indicates that these statistics should be based on the 0 percent, 1 percent, 99 percent, and 100 percent annual exceedance levels, instead of the 1 percent, 2 percent, 98 percent, and 99 percent statistics discussed above. The COL applicant used the criteria presented in the US-APWR DCD in compiling the values presented in CPNPP COL FSAR Table 2.0-1R.

In RAI 5287, Question 02.03.01-11, the staff requested that the COL applicant update the CPNPP COL FSAR to include the 100-year return period dry-bulb and wet-bulb temperatures. In a January 24, 2011, response to RAI 5287, Question 02.03.01-11, the COL applicant provided the most severe temperature statistics based on the worst case temperatures from either the 100-year return period data or historically recorded data collected at Dallas-Fort Worth Airport. The 100-year return period maximum and minimum dry bulb temperatures of 115 °F and -5 °F were based on the 2009 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Handbook 100-year return period values for Dallas, TX. The 100-year return period mean coincident wet bulb temperature of 78 °F was estimated by the COL applicant using 30 years of Dallas-Fort Worth Airport data. The 100-year return period maximum non-coincident wet bulb temperature provided in the CPNPP COL FSAR is 86 °F.

The one percent exceedance maximum and one percent exceedance minimum dry bulb temperatures are given in the CPNPP COL FSAR as 99 °F and 25 °F, respectively. For the one percent exceedance maximum dry bulb temperature, the coincident wet bulb temperature is 75 °F and the non-coincident wet bulb temperature is 78 °F.

In a March 18, 2011, response to RAI 5465, Question 02.03.01-12, the COL applicant committed to updating CPNPP COL FSAR Table 2.0-1R, the references section to include the 2009 ASHRAE Handbook, and the CPNPP COL Table 2.3-202 to address the 100-year return period temperatures. The staff notes that the COL applicant has updated the CPNPP FSAR as stated in its response to RAI 5465, Question 02.03.01-12.

Analyses conducted by the staff confirmed the site characteristic temperatures and concluded that they are bounded by the US-APWR DCD site parameter values. Accordingly, the staff finds the COL applicant's responses to RAIs 5287, Question 02.03.01-11 and RAI 5465, Question 02.03.01-12 acceptable and, therefore, considers these RAIs resolved.

2.3.1.4.2 Hurricanes

CPNPP COL FSAR Section 2.3.1.2.2 states in the second paragraph that the number of hurricanes and tropical storms affecting Texas from 1899 through 2006 is 39. CPNPP COL FSAR Table 2.3-206 indicates the value of 39 represents only hurricanes. The staff conducted a review of NOAA Technical Memorandum NWS SR-206 (1899-1999) and Monthly Weather Review for 2000 through 2006 to determine tropical storm and hurricane totals. This review demonstrated there were 76 tropical storms and 39 hurricanes affecting Texas during this period of time.

The staff confirmed the hurricane return period for Texas of 2.8 years given in the CPNPP COL FSAR text and CPNPP COL FSAR Table 2.3-207 using Technical NOAA Memorandum NWS SR-206 and Monthly Weather Review (2000 through 2006) annual hurricane summaries. The staff also calculated a 1.4 year return period for tropical storms affecting Texas.

CPNPP COL FSAR Figure 2.3-211 shows the tropical storm and hurricane return period (2.3 years), the hurricane return period (4 years), and major hurricane return period (12.5 years)

for the Galveston, TX area. The reference in CPNPP COL FSAR Figure 2.3-211 cites the data from the "Historical Climatology Series 6-2, Tropical Cyclones of the North Atlantic Ocean, 1871-1998."

The staff confirmed the information provided in CPNPP COL FSAR Table 2.3-208, "Tropical Storms Within 50 Mi of CPNPP," using NOAA data. Only one hurricane has passed within 50 statute miles of the CPNPP site from 1851 to 2006. Historical data further confirms that the greatest frequency of hurricanes impacting Texas is during August and September.

CPNPP COL FSAR Figure 2.3-214, "Decay of Tropical Cyclone Winds after Landfall," provides an illustration of the decay of tropical cyclone winds as a storm moves inland. The text referencing this figure states, "a tropical cyclone with 86 mph winds traveling at 18 mph will have dissipated to less than 40 mph at the CPNPP site." Based on the reference given in CPNPP COL FSAR Figure 2.3-214, the staff performed an independent calculation to confirm the 40 mph wind speed at the CPNPP site. The calculation demonstrated the wind speed at between 40 mph and 41 mph.

The staff confirmed the Probable Maximum Hurricane (PMH) sustained (10-minute average) wind speed at 30 feet above ground of 81 mph by comparing with the value provided in the COL FSAR for CPNPP, Units 1 and 2.

NUREG-0800, Section 2.3.1 indicates that as part of the Regional Climatology Review, information regarding severe weather phenomena including annual and seasonal frequency should be provided. Based on the CPNPP COL FSAR text and tables, this information along with the level of intensity of hurricanes has been provided by the COL applicant and verified by the staff.

2.3.1.4.3 Tornadoes

The staff confirmed that 158 tornadoes were reported between January 1, 1950, and July 31, 2006, for the counties of Bosque, Erath, Hood, Johnson, and Somervell, TX, using data from the NCDC's Storm Events database. During this period, the greatest numbers of events were reported in Johnson County, TX (75) and the fewest were reported in Somervell County, TX (3) where CPNPP is located. For the five county area, this equates to about 2.8 tornadoes reported per year. The COL applicant provided a calculation based on a 1963 paper by H.C.S. Thom (published in Monthly Weather Review) which determined a Point Probability Mean Recurrence Interval, for the five county area of 5883 years, or an annual frequency of a tornado striking a particular point in the five county area of 0.00017 per year. These values are based on the 2.8 tornadoes reported per year in the five county area.

In RAI 3555, Question 02.03.01-2, the staff requested that the COL applicant update the discussion regarding tornado frequency and tornado wind speeds, as presented in CPNPP COL FSAR Section 2.3.1.3. In an October 21, 2009, response to RAI 3555, Question 02.03.01-2, the COL applicant updated the CPNPP COL FSAR to reflect tornado data based on NUREG/CR-4461, "Tornado Climatology of the Contiguous United States," Revision 2, February 2007, from data the COL applicant had previously provided from NUREG-0800, Revision 1. The updated pages provided for the CPNPP COL FSAR state that based on a one degree longitude and latitude box around the CPNPP site, 246 tornadoes have occurred between the years 1950 and 2003. This value was confirmed by the staff. Expected maximum tornado wind speed (in mph) and upper limit (95 percent) expected tornado wind speed by probability (based on a two degree box around the CPNPP site) as provided by the COL

applicant in tabular form in the revised CPNPP COL FSAR Section 2.3.1.2.3 pages, were updated based on NUREG\CR-4461, Revision 2. Accordingly, the staff finds the COL applicant's October 21, 2009, response to RAI 3555, Question 02.03.01-2 acceptable and, therefore, considers this RAI resolved.

Consistent with RG 1.76, Revision 1 and the requirements of NUREG-0800, the COL applicant proposed the following tornado site characteristics, which are listed in CPNPP COL FSAR Table 2.0-1R:

Maximum Wind Speed:	103 m/s (230 mph)
Translational Speed	21 m/s (46 mph)
Maximum Rotational Speed	82 m/s (184 mph)
Radius of Max Rotational Speed	45.7 m (150 ft)
Maximum Pressure Drop	83 millibars (mb) (1.2 psi)
Rate of Pressure Drop	37 mb/s (0.5 psi/s)

These values are bounded by the US-APWR DCD tornado site parameters presented in US-APWR DCD, Tier 2, Table 2.0-1. Since the COL applicant has correctly identified the tornado site characteristic values presented in RG 1.76, Revision 1, the staff concludes that the COL applicant has chosen acceptable tornado site characteristics.

Further, NUREG-0800, Section 2.3.1 indicates that as part of the Climatology Review, information regarding severe weather phenomena including annual and seasonal frequency should be provided. As requested, the CPNPP COL FSAR provides the annual and seasonal number of tornado occurrences for the five county area around CPNPP (see CPNPP COL FSAR Table 2.3-209, "Tornadoes In Surrounding Area," and Table 2.3-210, "Tornadoes in Surrounding Counties by Month.")

CPNPP COL FSAR Table 2.3-210, indicates 159 tornadoes instead of the 158 discussed in the text. The staff notes there is an additional entry in CPNPP COL FSAR Table 2.3-210 for January in Hood County, TX. The staff recognizes this error and concludes that it will have no bearing on the SE of the proposed units.

2.3.1.4.4 Thunderstorms

The COL applicant provided data on the occurrence of thunderstorms in the five county area around the CPNPP site based on an approximate 24 year period. The data was obtained from the NCDC Storm Events database, and is consistent with NUREG-0800. The CPNPP COL FSAR presented data for both annual and monthly thunderstorm occurrences. The data demonstrated that approximately 17 thunderstorms are reported per year in the five counties. Based on CPNPP COL FSAR Table 2.3-211, the greatest number of thunderstorms is reported in May and June, while the least number are reported in January. The staff confirmed these statistics and agrees with the thunderstorm data presented in the CPNPP COL FSAR.

2.3.1.4.5 Lightning

The COL applicant provided data regarding lightning strikes from years 1989 through 1996. Data from Huffines and Orville indicates a mean annual flash density of 3 to 5 flashes/km^2-yr (13 flashes/mi^2-yr) for the CPNPP area. The data record is short as the National Lightning Detection Network used for this study has only been measuring cloud-to-ground lightning since

1989. The staff independently evaluated this estimate based on a 1999 study[3] by G. Huffines and R.E. Orville, "Lightening Ground Flash Density and Thunderstorm Duration in the Continental United States: 1989-1996" (3 - 5 flashes/km^2-yr (1.2 – 1.9 flashes/mi^2-yr), and a 10-year flash density map from Vaisala[4] (4 - 5 flashes/km^2-yr (1.5 – 1.9 flashes/mi^2-yr). Thus, the staff concludes that the COL applicant has provided a reasonable estimate of the frequency of lightning flashes.

2.3.1.4.6 Hail

The staff confirmed the number of hail events in the five county (Bosque, Erath, Hood, Johnson and Somervell, TX) area around the project (as presented in CPNPP COL FSAR Table 2.3-212) using the NCDC Storms Events database. The NCDC website listed 707 events between January 1, 1950, and March 31, 2007. As with other severe weather occurrences evaluated over the five counties, there may be some overlap in events between the counties. For Somervell County, TX there were 54 hail events reported between January 1, 1950, and March 31, 2007. For the five county area, the 707 events translate to an average of 12.3 events per year. For Somervell County, TX the 54 events, translates to an annual average of approximately one per year.

During the course of the review, the staff noted an inconsistency between the data provided in CPNPP COL FSAR Table 2.3-212 and reference to this table in CPNPP COL FSAR Section 2.3.1.2.6. The table provides the total number of large hail events in the five counties around the site during the period of January 1950, through March 2007, while the reference in the text indicates the table provides a seasonal and annual breakdown of large hail events. Therefore, in RAI 3555, Question 02.03.01-3, the staff requested that the COL applicant address the inconsistency. In an October 21, 2009, response to RAI 3555, Question 02.03.01-3, the COL applicant committed to correcting the text in CPNPP COL FSAR Section 2.3.1.2.6. The staff notes that the COL applicant has since updated the CPNPP COL FSAR as stated in its response to RAI 3555, Question 02.03.01-3. Therefore, the staff considers RAI 3555, Question 02.03.01-3, resolved.

2.3.1.4.7 Air Pollution Potential

The staff confirmed that Somervell County, TX is located in the Metropolitan Dallas-Fort Worth Intrastate Air Quality Control Region. As noted in the CPNPP COL FSAR, Somervell County, TX is classified as being in attainment for each criteria pollutant. This attainment classification was also confirmed by the staff using U.S. EPA data.

The COL applicant provided a discussion of ventilation rates, which are based on mixing height and wind speed, as these rates influence pollutant concentrations and the dispersion of pollutants. Mixing heights vary by time of year and time of day. CPNPP COL FSAR Table 2.3-213 provides morning and afternoon seasonal and annual average mixing heights for the project area based on Holzworth (CPNPP COL FSAR Reference 2.3-215) and is consistent with NUREG-0800, Section 2.3.1, Reference 24. The data presented from Holzworth, in the CPNPP COL FSAR, was confirmed by the staff.

[3] Huffines, G. and R.E. Orville, 1999. Lightning Ground Flash Density and Thunderstorm Duration in the Continental United States: 1989-96. *Journal of Applied Meteorology* 38(7) 1013-1019

[4] http://www.lightningsafety.noaa.gov/stats/08_Vaisala_NLDN_Poster.pdf accessed 11/14/2010

CPNPP COL FSAR Table 2.3-214 and CPNPP COL FSAR Table 2.3-215 also provide monthly, seasonal, and annual average morning and afternoon mixing heights, along with monthly mean morning and afternoon ventilation rates for Stephenville, TX. The source of the data is the U.S. EPA SCRAM site, which provides NCDC data for meteorological and air quality modeling purposes. Stephenville, TX is located approximately 25 miles to the west-southwest of CPNPP. Data from Stephenville, TX indicate the lowest average mixing height in the morning during April and highest average mixing height in the afternoon in August.

The CPNPP COL FSAR presented data regarding occurrences of stagnation from Wang and Angell (NOAA, 1999). These data are based on the number of times anticyclones persisted for four days or more. The staff confirmed that these data indicate stagnating conditions about five percent of the days annually.

2.3.1.4.8 Precipitation

The COL applicant obtained precipitation data from NWS, NOAA, and NCDC documents including references given in NUREG-0800.

CPNPP COL FSAR data indicates that the maximum 24-hour rain event occurred July 31, 1995, during which approximately 8.5 inches fell at Glen Rose, TX. This event was associated with Tropical Storm Dean. The staff confirmed this data by reviewing the Glen Rose Climatological Data (Climatology of the United States No. 20) for the maximum daily Rain event. The result indicated 8.48 inches on July 31, 1995. This timing coincides with the timing of Tropical Storm Dean.

CPNPP COL FSAR Table 2.3-217, provides maximum possible precipitation recurrence intervals for the CPNPP area. For the 100-year return period, the staff confirmed the maximum possible precipitation amounts of 4.0, 6.9, 8.3, 9.5 and 11.0 inches as given for durations of 1, 6, 12, 24 and 48 hours. These values were confirmed using the U.S. Department of Commerce Hydrometeorological Reports, referenced in NUREG-0800. The staff notes that in CPNPP COL FSAR Table 2.3-217, the precipitation amounts for the 50-year recurrence interval are the same as the 100-year period for the durations of five minutes through one hour.

CPNPP COL FSAR provided information regarding the frequency and duration of droughts in Texas based on the North Central Texas Council of Governments (NCTCOG) “HazMAP Multi-Hazard Risk Assessment: Forewarnings of Natural Hazards to the Year 2030” document (CPNPP COL FSAR Reference 2.3-224). The data provided in the CPNPP COL FSAR stated that a drought of six months or longer is expected in the State of Texas once every 16 months and a drought with duration of 12 months are likely in the state once every three years. Further data provided indicated that from 1892 to 1996 droughts, when they occurred, lasted from 61 to 73 days. The staff confirmed these figures with the NCTCOG document referenced in the CPNPP COL FSAR.

The staff confirmed that historical NCDC data demonstrated annual snowfall amounts in the Glen Rose and Mineral Wells area on the order of 1.8 inches annually. The maximum 24-hour snowfall in this area is reported at Glen Rose in 1973 (4.5 inches). Amounts reported at the Dallas-Fort Worth Airport are somewhat greater, with an annual average of 2.5 inches and the greatest 24-hour snowfall of 12.1 inches in 1964.

CPNPP COL FSAR Table 2.3-218 presents snow and ice storm events for the period of January 1, 1994, through March 31, 2007, based on data collected from the NCDC Storm

Events database. The end of the table states that there were 81 ice storms over the five county area were considered. Based on the designations given for each storm, the total of 81 represents both ice and winter/snow storms. Based on the "Ice Storm" designation, the staff concluded that it appears there were only 19 ice storms over this period. Another item noted by the staff in the CPNPP COL FSAR table is that the reported ice storms across the five counties occurred on only four different days (the same four storms affected the overall region). Thus, there were four ice storm events over this 13.25 year period (an average of about 0.3 events per year).

Estimates of maximum ice thickness were provided in the CPNPP COL FSAR for six locations in Dallas and Tarrant Counties, TX based on the NCTCOG "HazMAP Multi-Hazard Risk Assessment: Forewarnings of Natural Hazards to the Year 2030" document (CPNPP COL FSAR Reference 2.2.224). The data demonstrated the greatest 100-year estimate of ice thickness as 5.06 inches. These estimates were based on conditions where the minimum temperatures for the current day and previous day were below 33 °F and precipitation exceeded 0.25 inches. The staff confirmed these values with the NCTCOG document and agrees with the CPNPP COL FSAR that this approach likely provides an upper bound to actual ice thickness estimates.

Based on Hydrometeorological Report No. 53 ("Seasonal Variation of 10-Square-Mile Probable Maximum Precipitation Estimates", issued 1980), the COL applicant calculated the 48-hour PMWP as 31 inches. This value was based on the period of November through March and a linear interpolation between the 24-hour period PMWP and 72-hour PMWP. These values were confirmed by the staff. Consistent with the "Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures" (DC/COL-ISG-007), the staff also determined the PMWP for the months with the historically highest snow packs (December to February) to be 26.5 inches.

In an October 21, 2009, response to RAI 3555, Question 02.03.01-5, the COL applicant committed to updating the CPNPP COL FSAR to reflect the worst combination of the highest snow pack plus the extreme frozen precipitation event. The staff notes that the COL applicant has updated the CPNPP COL FSAR as indicated in the response to RAI 3555, Question 02.03.01-5. Accordingly, the staff finds the COL applicant's response to RAI 3555, Question 02.03.01-5 acceptable and, therefore, considers this RAI resolved.

Consistent with DC/COL-ISG-07, "Interim Staff Guidance on Assessment of Normal and Extreme Winter Precipitation Loads on the Roofs of Seismic Category I Structures," the COL applicant calculated the 100 year snow pack for the site. Data from the Dallas-Fort Worth Airport were used. This data is considered conservative as historical data demonstrates higher snowfall amounts at the Dallas-Fort Worth Airport then at Glen Rose, TX. The greatest snow depth of 8 inches over the 30 year record of data at the airport was converted to a 100-year value (11.2 inches) using a conversion factor of 1.4 (American Society of Civil Engineers and the Structural Engineering Institute (ASCE/SEI) 7-05[5], "Minimum Design Loads for Buildings and Other Structures," Table C7-3). The staff determined that these values provide an appropriate estimate for snow pack at the CPNPP site. Based on this information the 100-year snow load of 11.7 lb/ft^2 was calculated by the COL applicant. This calculated design load, of 11.7 lb/ft^2 is greater than that calculated for a ground snow load from ASCE/SEI 7-05 (approximately 6 lb/ft^2 for a 100-year return period). In addition to the snow pack value, the

[5] ASCE Standard No. 7-05, "Minimum Design Loads for Buildings and Other Structures," ASCE/SEI 7-05, American Society of Civil Engineers, 2006.

COL applicant provided an analysis of ice thickness from freezing rain. In RAI 4606, Question 02.03.01-7, the staff requested that the COL applicant update the CPNPP COL FSAR to include information requested in DC/COL-ISG 007. In a June 7, 2010, response to RAI 4606, Question 02.03.01-7, the COL applicant justified the combination of the highest snow pack plus the extreme frozen precipitation event as the worst case condition and stated that "US-APWR Seismic Category I structures have sloped roofs designed to preclude ponding of precipitation on the roof" and this "is accomplished by channeling Rainfall expeditiously off the roof" (US-APWR DCD, Tier 2, Section 3.4.1.2). From CPNPP COL FSAR Reference 2.3-224 (North Central Texas Council of Governments HazMAP Multi-Hazard Risk Assessment, Forewarnings of Natural Hazards to the Year 2030), the COL applicant provided an ice thickness value of 5.06 inches for a 100 year return period (based on a maximum regional value from Eagle Mountain Lake). The COL applicant used an ice thickness of 5.06 inches which equates to a 100-year return ice load of 26.1 lb/ft^2, in combination with the 100-year return period snow load of 11.7 lb/ft^2, giving a total roof load of 37.8 lb/ft^2. This estimated total roof load is used for comparison against the US-APWR DCD site parameter value of 75 lb/ft^2 (DCD maximum roof snow load 100-year return period). The staff confirmed these snowpack and ice thickness values based on the references cited in the CPNPP COL FSAR. Accordingly, the staff finds the COL applicant's June 7, 2010, response to RAI 4606, Question 02.03.01-7 acceptable and, therefore, considers RAI 4606, Question 02.03.01-7 resolved. Design loads are discussed in more detail in Section 3.4 of this SE.

2.3.1.4.9 Dust Storms

The staff confirmed that the NCDC Storm Events website indicated no reported dust storms in Somervell County, TX from January 1, 1950, through August 31, 2007.

2.3.1.4.10 Ultimate Heat Sink

In RAI 6193, Question 02.03.01-14, the staff requested that the COL applicant provide information and clarifications relating to the UHS. In a January 9, 2012, response to RAI 6193, Question 02.03.01-14, the COL applicant committed to updating CPNPP COL FSAR Section 2.3.1.2.10 to remove a discussion regarding ambient design air temperatures that were not used in the design of the UHS. The COL applicant also committed to inserting a discussion on how the zero percent exceedance non-coincident wet bulb temperature was used in the design of the UHS. These changes are being made to avoid confusion about which ambient design air temperatures were used. The staff finds the COL applicant's response to RAI 6193, Question 02.03.01-14, acceptable and, therefore, considers RAI 6193, Question 02.03.01-14 resolved.

RG 1.27, Revision 2, "Ultimate Heat Sink for Nuclear Power Plants," specifies that COL applicants should ensure that: (1) Design-basis temperatures of safety-related equipment are not exceeded and that; (2) a 30-day cooling supply is available. Therefore, COL applicants should identify the meteorological conditions that result in: (1) Minimum water cooling as well as; (2) maximum 30-day evaporation and drift loss. CPNPP COL FSAR Section 9.2.5 indicates that for the proposed mechanical cooling towers, the controlling parameter is wet bulb temperature. Consistent with this, mechanical cooling tower information indicates these units are designed based on the highest geographic wet bulb temperature as this temperature defines the minimum performance of the unit.

Based on an analysis of 30 years of NCDC data for Dallas-Fort Worth Airport (years 1977 - 2006), the CPNPP COL FSAR provided a worst case 30-day average wet bulb temperature of

78 °F. A 2 °F margin of safety was included so that the design wet bulb temperature is 80 °F. Using NCDC temperature and humidity data from Dallas-Fort Worth Airport for the period of 1954 – 2008, the staff confirmed the COL applicant's results for the worst 30-day average wet bulb temperature. The staff's results were within 1 °F of the data the COL applicant presented for the worst 1-day, 5-day, and 30-day average wet bulb temperatures.

In RAI 4606, Question 02.03.01-8, the staff requested that the COL applicant update the CPNPP COL FSAR to include meteorological information requested in RG 1.27, Revision 2. In a June 7, 2010, response to RAI 4606, Question 02.03.01-8, the COL applicant also estimated an evaporation rate for the worst case 30 day wet bulb temperature given above, and a coincident dry bulb temperature of 92.4 °F. This condition translates to a relative humidity of approximately 52 percent. Based on cooling tower data, the COL applicant calculated an evaporation rate of approximately 350 gallons per minute (gpm)) for conditions of a wet bulb temperature at 78 °F and 50 percent relative humidity. Since evaporation rates decrease with increasing relative humidity, the evaporation rate for the worst case 30 day meteorological conditions will be less than 350 gpm. The staff finds the COL applicant's June 7, 2010, response to RAI 4606, Question 02.03.01-8, acceptable and, therefore, considers this RAI resolved.

A more detailed description of the UHS is provided in CPNPP COL FSAR Chapter 9.

The CPNPP COL FSAR also notes that based on the site location and "infrequent occurrence of low temperatures and short duration of low temperatures," the potential for freezing of the UHS is "remote." Due to the location of the plant and the discussion provided in SER Section 2.3.1.4.1, "General Climate," the staff agrees with this conclusion.

2.3.1.4.11 Extreme Winds

The COL applicant provided extreme wind data for return periods of 2, 10, 50 and 100 years. The fastest mile wind speed for each of these return periods is 51, 61, 71 and 76 mph based on data provided from the CPNPP, Units 1 and 2 FSAR. Using data from ASCI/SEI 7-05 for exposure category C, the COL applicant provided a 100-year return period maximum 3-second gust wind speed of 96 mph. The staff confirmed the 100-year return period 3-second gust wind speed of 96 mph as calculated in the CPNPP COL FSAR.

This 100-year return period 3-second gust wind speed falls within the US-APWR DCD design limit of 155 mph (with an importance factor of 1.15 for Seismic Category I/II structures).

As a follow-up to RAI 4606, Question 02.03.01-9, in COLA Revision 2, the COL applicant, corrected the 100-year return period 3-second gust wind speed given in Table 2.0-1R from 90 mph to 96 mph as stated above. The staff notes that the COL applicant has updated the CPNPP COL FSAR as stated in its June 7, 2010, response to RAI 4606, Question 02.03.01-9. Accordingly, the staff finds the COL applicant's response to RAI 4606, Question 02.03.01-9, acceptable and, therefore, considers this RAI resolved.

2.3.1.4.12 Global Climate Change

NUREG-0800, Section 2.3.1, "Acceptance Criteria #2," states, in part, the applicability of severe weather phenomena data to represent site conditions during the expected period of reactor operation should be substantiated. NUREG-0800, Section 2.3.1, "Review Procedure #2," states, in part, that current literature on possible changes in the weather in the site region

should be reviewed to be confident that the methods used to predict weather extremes are reasonable.

In RAI 4606, Question 02.03.01-10, the staff requested that the COL applicant update the CPNPP COL FSAR to include a discussion of the potential effects of global climate change on the future regional conditions near the site. In a June 7, 2010, response to RAI 4606, Question 02.03.01-10, the COL applicant addressed the staff's question regarding the potential effects of global climate change regarding the future regional conditions near the site. The COL applicant committed to include this discussion in the next revision of the CPNPP COL FSAR. The staff notes that the COL applicant has updated the CPNPP COL FSAR as stated in the response to RAI 4606, Question 02.03.01-10. Accordingly, the staff finds the COL applicant's response to RAI 4606, Question 02.03.01-10, acceptable and, therefore, considers this RAI resolved.

As specified in NUREG-0800, the applicability of data used to discuss severe weather phenomena that may impact the proposed COL site during the expected period of reactor operation should be substantiated. Long-term environmental changes and changes to the region resulting from human or natural causes may affect the applicability of the historical data to describe the site's climate characteristics. Although there is no scientific consensus regarding the issue of climate change, the staff believes current climate trends should be analyzed for the potential of ongoing environmental changes.

The U.S. Global Change Research Program (USGCRP) released a report to the President and Members of Congress in June 2009, titled, "Global Climate Change Impacts in the United States." This report, produced by an advisory committee chartered under the Federal Advisory Committee Act, summarizes the science of climate change and the impacts of climate change on the U.S.

The USGCRP report stated that the average annual temperature in the Great Plains (which includes most of Texas, where the CPNPP site is located) did not change significantly over the past century as a whole, but the annual average temperature has risen about 2 °F since 1970 with the greatest seasonal increase in temperature occurring during the winter months. Climate models predict continued warming in all seasons across the Great Plains and an increase in the rate of warming throughout the end of the 21st century. Average temperatures in the Great Plains are projected to rise by 4 °F - 5 °F by the end of the 2050's, depending on assumptions regarding emissions.

The USGCRP report also states that there has been a 10 to 15 percent increase in the observed annual average precipitation from 1958 to 2008 in the region where the CPNPP site is located. Future changes in total precipitation are more difficult to project than changes in temperature. Model projections of future precipitation generally indicated that southern areas of the U.S. will become drier.

The USGCRP reports that the power and frequency of Atlantic hurricanes has increased substantially in recent decades, but the number of North American mainland land falling hurricanes does not appear to have increased over the past century. The USGCRP reports that likely future changes for the U.S. and surrounding coastal waters include more intense hurricanes with related increases in wind and rain, but not necessarily an increase in the number of these storms that make landfall.

The USGCRP further states that there is no clear trend in the frequency or strength of tornadoes since the 1950s for the U.S. as a whole. Increases in recorded severe weather events, if they are noted to occur, may also be attributable to a growing population, greater public awareness and interest, and technological advances in detection. The USGCRP reaches the same conclusion.

The USGCRP reports that the distribution by intensity for the strongest 10 percent of hail and wind reports is little changed, providing no evidence of an observed increase in the severity of such events. Climate models project future increases in the frequency of environmental conditions favorable to severe thunderstorms. But the inability to adequately model the small-scale conditions involved in thunderstorm development remains a limiting factor in projecting the future character of severe thunderstorms and other small-scale weather phenomena.

The staff acknowledges that long-term climatic change resulting from human or natural causes may introduce changes into the most severe natural phenomena reported for the site. However, no conclusive evidence or consensus of opinion is available on the rapidity or nature of such changes. There is a level of uncertainty in projecting future conditions because the assumptions regarding the future level of emissions of heat trapping gases depend on projections of population, economic activity, and choice of energy technologies. If it becomes evident that long-term climatic change is influencing the most severe natural phenomena reported at the site, the COL holders have a continuing obligation to ensure that their plants stay within the licensing basis.

2.3.1.5 Post-Combined License Activities

There are no post-COL activities related to this section.

2.3.1.6 Conclusion

The staff is reviewing the information in US-APWR DCD, Tier 2, Section 2.3.1 under Docket No. 52-021. The results of the staff's technical evaluation of the information related to the site characteristics, incorporated by reference, in the CPNPP COL FSAR will be documented in the staff's SER of the DC application for the US-APWR design. The SER for the US-APWR is not yet complete, and is being tracked as part of **Open Item [1-1]**. The staff will update Section 2.3.1 of this SE to reflect the final disposition of the DC application.

As set forth above, the COL applicant has presented and substantiated information to establish the regional meteorological characteristics. The staff has reviewed the information provided and, subject to the resolution of the open item above, concludes that the COL applicant has established the meteorological characteristics at the site and in the surrounding area acceptable to meet the requirements of 10 CFR 100.20(c)(2) and 10 CFR 100.21(d) with respect to determining the acceptability of the site.

The staff finds that the COL applicant has considered the most severe natural phenomena historically reported for the site and surrounding area in establishing the site characteristics. Specifically, the staff has accepted the methodologies used to analyze these natural phenomena and determine the severity of the weather phenomena reflected in these site characteristics, as documented in SERs for previous licensing actions. Since the COL applicant has correctly implemented these methodologies, as described above, the staff finds that the COL applicant has considered these historical phenomena with margin sufficient for the limited

accuracy, quantity, and period of time in which the data have been accumulated in accordance with 10 CFR 52.79(a)(iii).

US-APWR DCD, Tier 2, Revision 3, Section 2.3.6, states that a COL applicant shall address the site-specific regional climatological information. The staff finds that the COL applicant has provided a sufficient description to meet the requirements of the DCD. The staff finds that COL Information Item 2.3(1) has been adequately addressed by the COL applicant and, therefore, considers this item resolved.

2.3.2 Local Meteorology

2.3.2.1 Introduction

CPNPP COL FSAR Section 2.3.2, "Local Meteorology," addresses the local (site) meteorological parameters, the assessment of the potential influence of the proposed plant and its facilities on local meteorological conditions and the impact of these modifications on plant design and operation, and a topographical description of the site and its environs.

2.3.2.2 Summary of Application

CPNPP COL FSAR, Revision 3, Section 2.3 incorporates by reference US-APWR DCD, Tier 2, Revision 3, Section 2.3.

In addition, in CPNPP COL FSAR Section 2.3, the COL applicant provided the following:

US-APWR COL Information Item

- CP COL 2.3(1)

The COL applicant provided additional information in CP COL 2.3(1) to address COL Information Item 2.3(1). The COL applicant provided a description of the CPNPP site meteorology in terms of airflow, temperature, atmospheric water vapor, precipitation, fog, atmospheric stability, and air quality, and also an assessment of the construction and operation impacts of the plant and its facilities on the local meteorological parameters.

2.3.2.3 Regulatory Basis

The acceptance criteria associated with the relevant requirements of NRC regulations for local meteorology are given in NUREG-0800, Section 2.3.2.

The applicable regulatory requirements for identifying local meteorology are:

- 10 CFR 52.79(a)(1)(iii), as it relates to identifying 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 time in which the historical data have been accumulated.

- 10 CFR 100.20(c)(2), and 10 CFR 100.21(d), as it relates to the consideration given to the local meteorological characteristics of the site.

The related acceptance criteria from NUREG-0800, Section 2.3.2 are:

- Local summaries of meteorological data based on onsite measurements in accordance with RG 1.23, "On-Site Meteorological Programs," and NWS station summaries or other standard installation summaries from appropriate nearby locations (e.g., within 80 km (50 miles)) should be presented as specified in RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," Section 2.3.2.1.

- A complete topographical description of the site and environs out to a distance of 80 km (50 miles) from the plant, as described in RG 1.70, Section 2.3.2.2, and RG 1.206, Section 2.3.2.2, should be provided.

- A discussion and evaluation of the influence of the plant and its facilities regarding the local meteorological and air quality conditions should be provided. COL applicants should also identify potential changes in the normal and extreme values resulting from plant construction and operation. The acceptability of the information is determined through comparison with standard assessments.

- The description of local site airflow should include wind roses and annual joint frequency distributions of wind speed and wind direction by atmospheric stability for all measurement levels using the criteria provided in RG 1.23, Revision 1.

2.3.2.4 Technical Evaluation

The staff reviewed CPNPP COL FSAR Section 2.3.2 and checked the referenced DCD to ensure that the combination of the DCD and the CPNPP COL FSAR represents the complete scope of information relating to the review topic. The staff's review confirmed that the information in the COL application and incorporated by reference, addresses the required information relating to local meteorology. The results of the staff's evaluation of the information incorporated by reference in the CPNPP COLA are documented in the FSER related to the certification of the US-APWR Standard Design.

The staff reviewed the information in the CPNPP COL FSAR:

US-APWR COL Information Item

- CP COL 2.3(1)

The staff reviewed CP COL 2.3(1) related to the provision of local meteorology included in CPNPP COL FSAR Section 2.3.2. The COL Information Item in US-APWR DCD, Tier 2, Section 2.3.6.1 states:

> The COL Applicant, whether the plant is to be sited inside or outside the continental US, 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.

Evaluation of the information provided in CP COL 2.3(1) is discussed below.

2.3.2.4.1 Surface Winds

The COL applicant presented annual surface wind data for years 2001 - 2004 and year 2006 from the onsite meteorological tower, and years 2001 - 2006 for Dallas-Fort Worth Airport, and Mineral Wells, TX. CPNPP onsite data did not include year 2005 due to less than 90 percent data recovery as specified in RG 1.23, Revision 1. CPNPP COL FSAR Figure 2.3-208 through Figure 2.3-210, demonstrate that the most frequent winds in the region are from the south-southeast and south, with the predominant wind direction at the CPNPP site being from the south-southeast. All three sites indicate a secondary peak for northerly winds associated with the winter months. This secondary peak from the north is more pronounced in CPNPP COL FSAR Figure 2.3-274 (Mineral Wells winter wind rose) and CPNPP COL FSAR Figure 2.3-306 (CPNPP winter wind rose at 60 meters). Information presented by the COL applicant also stated that annual average wind speeds in the region for the five period from years 2001 - 2004 and year 2006 were 10.3 mph for Dallas-Fort Worth Airport, 9.0 mph for Mineral Wells, and 9.8 mph for the CPNPP site.

The staff reviewed the onsite data for years 2001 through 2004 and year 2006 as provided by the COL applicant, along with climatological data available from NCDC for Dallas-Fort Worth. Five year, 10 meter wind speed and direction joint frequency distributions developed by the staff from the available CPNPP hourly meteorology confirm that the predominant wind is from the south-southeast. Further, these data indicate that winds from the southeast clockwise through the south occur almost 46 percent of the time. Similar to the data presented by the COL applicant, the analysis conducted by the staff indicated a small secondary peak from the north. Climatological data for Dallas-Fort Worth Airport (NCDC LCD 1971-2000) shows the annual prevailing wind direction from 190 degrees which falls in the southerly direction. Climatological wind speed data from Dallas-Fort Worth Airport (NCDC LCD 1971-2000) indicates an annual average wind speed of 10.5 mph, while an estimate of the wind speed from data analyzed for the onsite meteorological tower at 10 meters demonstrated an annual wind speed for years 2001 through 2004 and year 2006 of around 10 mph. The staff finds these results consistent with information presented by the COL applicant in the CPNPP COL FSAR.

The COL applicant provided monthly and annual wind speed and direction joint frequency distributions spanning a variety of dates for Dallas-Fort Worth Airport (CPNPP COL FSAR Tables 2.3-220 through 2.3-232), Mineral Wells (CPNPP COL FSAR Tables 2.3 233 through 2.3-245), the CPNPP site 10 meter level (CPNPP COL FSAR Tables 2.3-246 through 2.3-258), and the CPNPP site 60 meter level (CPNPP COL FSAR Tables 2.3-259 through 2.3-271).

The joint frequency distributions for Dallas-Fort Worth (1997 – 2006) show a maximum monthly wind speed of 12.74 mph for March and a minimum monthly wind speed of 8.24 mph in September. This information is consistent with the NCDC climatological data for this location which indicates maximum monthly wind speeds of 12.1 mph for March and April and lowest monthly wind speeds in August (8.6 mph) and September (8.7 mph). The joint frequency distributions presented by the COL applicant further show the southerly wind direction to have the greatest frequency of occurrence during every month except December. During the winter, the data indicates a secondary peak from the north as discussed above.

At Mineral Wells (2001 – 2006), CPNPP COL FSAR Table 2.3-233 through CPNPP COL FSAR Table 2.3-245 show similar wind speed trends as at Dallas-Fort Worth, though wind speeds are

slightly lower. Maximum monthly wind speeds occur in the spring (10.73 mph in April) and lowest monthly wind speeds occur during August and September (7.32 mph). The frequency of winds from the south-southeast direction is greatest for each month of the year, being the most pronounced during mid-summer.

The 10 meter data at CPNPP for the five years presented by the COL applicant, like the other regional data provided, indicates a maximum monthly average wind speed in spring (April, 11.32 mph) and minimum monthly average wind speed in September (8.02 mph). The 10 meter wind direction data indicates that during January and February winds at the site occur almost equally from the north and north-northwest as winds from the south and south-southeast. Through spring and summer, 10 meter winds occur with greatest frequency from the south and south-southeast. During the fall, the prevailing wind direction is the south-southeast. Annually, 10 meter winds are from the southeast clockwise through the south just over 45 percent of the time. The annual wind direction frequencies presented in CPNPP COL FSAR Table 2.3-258 are very close to the 10 meter annual frequencies calculated by the staff.

During January and February, the 60 meter winds at CPNPP, as presented by the COL applicant, occur most frequently from the north-northwest (slightly more frequent than from the south or south-southeast). This changes abruptly when in March the highest frequency of winds shift to the south and south-southeast. This trend lasts through the warmer months of the year. By November and December, the frequency of winds from the north-northwest begins to approach the individual frequency of winds from the south and south-southeast. Annually, 60 meter winds from the southeast clockwise through the south occur nearly 45 percent of the time. Annual 60 meter wind direction frequencies were confirmed by the staff from hourly data provided for the CPNPP site. CPNPP COL FSAR Tables 2.3-259 through 2.3-271 indicate a maximum average monthly wind speed of 14.79 mph in April, a minimum average monthly wind speed of 10.29 mph in September, and annual average wind speed of 12.56 mph. The estimated annual wind speed calculated by the staff was 12.6 mph. Wind speed trends for the 60 meter level, as well as 10 meter level, at the CPNPP site are similar to the data trends at Dallas-Fort Worth and Mineral Wells, along with the NCDC Climatological data where highest monthly wind speeds occur in early spring and lowest monthly wind speeds occur in late summer. The staff generated a 60 meter joint frequency distribution for the period of 2001 through 2004 and 2006. This joint frequency distribution indicated a slightly higher peak for south-southwesterly winds than did CPNPP COL FSAR Table 2.3-271. In addition, discrepancies for other wind directions were slightly larger than were noted in a similar comparison for the 10 meter level.

The COL applicant provided maximum 2-minute and 5-second wind speeds of 51 mph and 78 mph, respectively, based on climatological data from Dallas-Fort Worth Airport (Source: Southern Regional Climate Center, 1971-2000). The staff compared these extreme values to LCD reports from NCDC. The NCDC data provided maximum 2-minute and 3-second wind speeds of 61 mph and 78 mph, respectively. The difference in the 2-minute values is due to the NCDC record extending through 2008. Thus, the staff accepts the values provided in the CPNPP COL FSAR.

The COL applicant also conducted an analysis of wind persistence (in hours) for Dallas-Fort Worth Airport (1997 – 2006), Mineral Wells (2001 – 2006), and the two levels (10 meters and 60 meters) at the CPNPP meteorological tower (2001 – 2004, and 2006). Data were tabulated for wind persistence within a single wind direction sector, within three adjacent sectors, and within five adjacent sectors (CPNPP COL FSAR Tables 2.3-272 through 2.3-283). The COL applicant compared the average annual number of hours of wind persistence between the four

locations in CPNPP COL FSAR Table 2.3-284. The comparison of the four locations demonstrated that for a single sector, the greatest average number of hours of persistence is 37.2 hours (south sector) at Dallas-Fort Worth, 18.7 hours (north sector) at Mineral Wells, 24.2 hours (north-northwest sector) for the CPNPP upper level, and 25.2 hours (north sector) for the CPNPP lower level. For the four locations considered, a secondary peak was noted to the north if the primary peak was in a southerly direction, and a secondary peak was found to the south if the primary peak was northerly. These data appear consistent with the joint frequency data as greatest persistence might be expected for directions with the highest frequency of winds. For the comparison of wind persistence across three adjacent sectors, hours of persistence ranged from 102.8 hours at Mineral Wells to 147.4 hours at the CPNPP upper level. For this three adjacent sector case, highest values occurred around either the south sector or south-southeast sector. For the five adjacent sector case, highest values of persistence ranged from 163.7 hours at Mineral Well to 222.4 hours at the CPNPP upper level, where these values were found around either the south or south-southeast sectors. Again, these results appear consistent with the data that shows the highest frequency of winds from the southeast through south wind direction sectors. The discussion on wind persistence is intended to provide a general understanding of the severe weather phenomena in the site region but does not result in the generation of site characteristics for use as design or operating bases. Therefore, the staff did not perform any detailed independent analysis of the hours of persistence and accepts these data for information.

The CPNPP COL FSAR presented monthly and seasonal wind roses for the 10 meter level (CPNPP COL FSAR Figures 2.3-278 through 2.3-293) and the 60 meter level (CPNPP COL FSAR Figures 2.3-294 through 2.3-309) for the CPNPP meteorological tower (2001 through 2004 and 2006). In addition, wind roses were provided for Mineral Wells (CPNPP COL FSAR Figures 2.3-262 through 2.3-277). The staff also generated seasonal and annual wind roses for Dallas-Fort Worth Airport (1984 through 1992) and Stephenville, TX (1984, 1985, 1987, 1989, 1990 and 1992) using hourly data available from the U.S. EPA SCRAM website. For the annual wind rose, all four locations (based on CPNPP 10 meter level) indicate the greatest frequency of winds from the south and south-southeast. Dallas-Fort Worth Airport and Stephenville, TX (for the period analyzed) show a stronger southerly peak, while Mineral Wells, TX data indicated a stronger south-southeasterly peak and CPNPP (10 meters) data indicated a more equal frequency of winds from the south and south-southeast directions. All four locations show a comparable secondary peak from the north. During winter, all four sites indicate a relatively greater frequency of winds from the sectors around the north direction, as well as a similar peak from the south or south-southeast. By summer, winds at these four locations have the greatest frequency from the southeast through south-southwest. Though there is the expected variability between all sites, the staff confirmed that the CPNPP onsite winds (10 meter) indicated similar trends as other regional locations. For the site, the winter wind roses are more similar between the 10 meter and 60 meter levels; however, by summer the upper level winds indicate higher velocities and more frequent winds with a northerly component.

During the review of CPNPP COL FSAR Table 2.3-284 it was noted that the column headings for lower level winds and upper level winds at CPNPP were reversed. Therefore, in RAI 3556, Question 02.03.02-1, the staff requested that the COL applicant address this inconsistency. In an October 19, 2009, response to RAI 3556, Question 02.03.02-1, the COL applicant committed to correcting the headings in this table in the next revision of the CPNPP COL FSAR. The staff notes that the COL applicant has updated the CPNPP COL FSAR as stated in its October 19, 2009, response to RAI 3556, Question 02.03.02-1. Accordingly, the staff finds the COL applicant's response to RAI 3556, Question 02.03.02-1, acceptable and, therefore, considers this RAI resolved.

2.3.2.4.2 Ambient Temperature

The COL applicant provided air temperature data from a number of locations in the region. Average monthly temperatures, annual temperatures, and extremes were presented.

The COL applicant provided temperature data for Dublin and Weatherford, TX (1902 through 2004) in CPNPP COL FSAR Table 2.3-219, which presented the average number of days (monthly and annually) that temperatures equaled or exceeded 90 °F and 100 °F, along with the average number of days (monthly and annually) that temperatures were at or were below 32 °F. These data indicate that temperatures equal or exceed 90 °F between 89 and 97 days per year, temperatures equal or exceed 100 °F around 15 days per year, and temperatures are at or below 32 °F between 45 and 57 times per year. The staff evaluated data for Glen Rose, TX (1971 through 2000), which indicated the average annual number of days that the maximum temperature equals or exceeds 90 °F and 100 °F is 117 days and 29 days, respectively. The Glen Rose, TX data also indicates that the average annual number of days that the minimum temperature is at or below 32 °F is 72 days and there are approximately 2 days per year on average that the maximum daily temperature is below 32 °F.

CPNPP COL FSAR Figures 2.3-251 through 2.3-253 presented normal monthly average, minimum and maximum temperatures for nine sites in the CPNPP region (Source: NCDC). These data were for the period of 1971 through 2000 and included: Benbrook Dam, Cleburne, Dallas-Fort Worth Airport, Dallas Love Airport, Dublin, Glen Rose, Mineral Wells, Stephenville and Weatherford, TX. Based on this data, the following temperature ranges were noted (in °F):

- Normal monthly averages: Highest 82 to 87 and Lowest 42 to 46
- Normal monthly minimum: Highest 70 to 77 and Lowest 28 to 37
- Normal monthly maximum: Highest 94 to 98 and Lowest 54 to 58

The staff reviewed NCDC climatological data (1971 through 2000) for Dallas-Fort Worth Airport, Dallas Love Airport, Mineral Wells, and Glen Rose, TX and find these data consistent with CPNPP COL FSAR Figures 2.3-251 through 2.3-253.

The COL applicant reported the normal mean temperature for the region based on Dallas-Fort Worth Airport, Dallas Love Airport, Mineral Wells, and Glen Rose, TX as 64 °F - 66 °F. The staff reviewed data (1971 through 2000) from these sites and noted normal mean temperatures near the range reported.

CPNPP COL FSAR Table 2.3-285, provides monthly and annual average temperatures (daily minimum, daily mean, and daily maximum) for the CPNPP site for the period 2001 through 2004 and 2006. The annual average daily mean temperature is 67.2 °F which is at the high end of the regional range of values given above. This annual average was confirmed by the staff from the hourly data provided by CPNPP. The following summarizes the range of monthly temperatures recorded at the CPNPP site (°F):

- Average daily mean by month: Highest 85.1 and Lowest 48.9
- Average daily minimum by month: Highest 72.7 and Lowest 18.6
- Average daily maximum by month: Highest 105.0 and Lowest 78.5

The CPNPP site temperatures for the period 2001 through 2004 and 2006 indicate a wider range of temperatures than temperatures at regional sites. Particularly, differences between the site and other regional climatic data are noted for the average monthly maximum temperatures. As indicated by the COL applicant this may be the result of the shorter record of data analyzed for the site.

The COL applicant's site characteristic temperatures are presented in CPNPP COL FSAR Table 2.0-1R. The COL applicant determined the extreme maximum dry bulb temperature of 115 °F from the 2009 ASHRAE Handbook 100-year return period value for Dallas, TX. The COL applicant also determined the extreme minimum dry bulb temperature of -5 °F was from the 2009 ASHRAE Handbook 100-year return period values for Dallas, TX. The COL applicant estimated the 100-year return period coincident wet bulb temperature of 78 °F using 30 years of Dallas-Fort Worth data. Using NCDC hourly data from for Dallas-Fort Worth Airport, Dallas Love Airport, Mineral Wells, and Glen Rose, TX (1971 through 2000) and climate data from the ASHRAE Handbook, the staff was able to verify the temperatures presented by the applicant in the CPNPP COL FSAR tables mentioned above. A further discussion on ambient temperature site characteristics is provided in Section 2.3.1.4.1 of this SER. Therefore, the staff finds the temperature values presented by the applicant to be acceptable.

2.3.2.4.3 Water Vapor

The COL applicant provided monthly and annual average relative humidity data for four periods of the day at Dallas-Fort Worth Airport and Mineral Wells in CPNPP COL FSAR Table 2.3-286 and Table 2.3-287. Further, based on NCDC data presented by the COL applicant, the average annual relative humidity for both of these locations is 65 percent and 69 percent, respectively. The CPNPP COL FSAR data for the Dallas-Fort Worth Airport was confirmed by the staff as reasonable using the NCDC LCD (2008) for the airport. The COL applicant also provided monthly and annual mean, maximum and minimum dew point temperatures for Mineral Wells, TX in CPNPP COL FSAR Table 2.3-288 for the period 1949 through 2006. The staff confirmed the monthly mean dew point temperatures to within a few degrees, as well as the monthly trends, using the Climate Atlas of the U.S.

Consistent with RG 1.27, Revision 2, the COL applicant conducted an analysis of the highest wet-bulb temperature for the worst day, worst consecutive five days, and worst consecutive 30 day period. The analysis was based on data from Dallas-Fort Worth Airport for the period of 1997 through 2006, and calculated the highest wet bulb temperature (and concurrent dry bulb temperature) for each of these time periods. CPNPP COL FSAR Table 2.3-289 through Table 2.3-291 present the results for the worst case periods. The highest 1 day average wet bulb temperature is 78.6 °F (May 26, 1997), the highest five day average wet bulb temperature is 77.4 °F (June 29, 1997 through July 3, 1997), and the highest 30 day wet bulb temperature is 76.1 °F (July 4, 2001 through August 2, 2001). A similar analysis was presented for Mineral Wells, TX for the period 2001 through 2006). These results are provided in CPNPP COL FSAR Table 2.3-292 through Table 2.3-294. At Mineral Wells, TX, the highest 1 day average wet bulb temperature is 77.0 °F (June 24, 2003), the highest 5 day average wet bulb temperature is 75.8 °F (June 21, 2003 through June 25, 2003), and the highest 30 day wet bulb temperature is 73.8 °F (July 14, 2001 through August 12, 2001). The staff has accepted these statistics as informational only, as they are not used in any UHS analysis. Section 2.3.1.4.10 of this SE and CPNPP COL FSAR Section 9.2.5.2.3 discuss the worst case temperature and humidity calculations for the UHS.

The staff performed an independent analysis of NCDC hourly data from Dallas-Fort Worth International Airport data from 1954 through 2008. The staffs' worst case 1-day, 5-day, and 30-day wet-bulb temperatures compared well (within 1 °F) with data that the COL applicant presented. Therefore, the staff finds the COL applicant's worst cast wet bulb temperature statistics acceptable.

2.3.2.4.4 Precipitation

The COL applicant provided monthly and annual average precipitation data for the CPNPP site in CPNPP COL FSAR Table 2.3-295. The information in this table is based on only 3 years of precipitation data (2001, 2003, and 2006). The table indicates on average the greatest amount of precipitation occurs in March (3.7 inches) and lowest monthly precipitation levels in July (0.7 inches). The 3 year annual average precipitation is 30.3 inches. The staff conducted an analysis of total rainfall from site data for 2001, 2003, and 2006 and calculated a similar annual average. The staff also compared the 3 year site data with long term averages (from NCDC data) for Dallas-Fort Worth Airport, Glen Rose and Mineral Wells, TX. Annual average precipitation at these three locations ranged from 31.79 inches - 34.82 inches. Mean monthly precipitation data from these three locations, however, indicate that May produces the greatest precipitation in the region; on the order of 4.5 inches to just over 5 inches on average; a secondary peak is also noted in October where precipitation amounts are around 4 inches on average. Based on the long term regional data, the staff concluded that the least amount of precipitation occurs during January (less than 2 inches). Data from these other regional locations also indicate maximum 24 hour precipitation amounts of 5.91 inches (Dallas-Fort Worth Airport) to 8.48 inches (Glen Rose, TX). The total number of days with precipitation greater than or equal to 0.01 inches is 74 days at CPNPP (based on the 3 year record), 79.2 days on average at Dallas-Fort Worth Airport, 80.3 days on average at Mineral Wells, and 84.8 days on average at Glen Rose, TX. The staff concludes that the limited number of years evaluated for the CPNPP is the likely reason for the lower values given for the site.

In CPNPP COL FSAR Table 2.3-296 through Table 2.3-298, the COL applicant provided the number of hours per month that precipitation exceeded various amounts at Dallas-Fort Worth Airport, Mineral Wells, and the CPNPP site. These data indicate that hourly precipitation rates, in the region, of greater than or equal to one inch are infrequent and that hourly precipitation rates up to 0.10 inches per hour occur with the greatest frequency. The staff conducted an analysis of the 2001, 2003, and 2006 data provided by CPNPP and estimated very similar annual values as indicated by the data for the CPNPP site in CPNPP COL FSAR Table 2.3-298. The staff concludes that the CPNPP data, though representative of a shorter period of time, demonstrates similar annual precipitation rate trends to that of Dallas-Fort Worth Airport, and Mineral Wells, TX.

The COL applicant also presented CPNPP COL FSAR Table 2.3-299 through Table 2.3-301 which detailed the percent of precipitation observations by wind direction and month. Data were provided for Dallas-Fort Worth Airport (1997 through 2006), Mineral Wells (2001 through 2006), and the CPNPP site (2001, 2003, and 2006). The data in these tables demonstrate the greatest number of observations occur during the colder months of the year with winds from the north or north-northwest. Based on precipitation data considered above, the amount of precipitation during these events is generally light. The staff agrees with the COL applicant, that these precipitation occurrences are likely associated with frontal activity that penetrates southward during the colder months of the year. These data were not evaluated independently by the staff and are received as information.

As discussed in Section 2.3.1.4.8 of this SE, snowfall in the region is infrequent with annual averages of around 2 inches.

2.3.2.4.5 Fog

CPNPP COL FSAR Table 2.3-302 and Table 2.3-303 provide average hours of heavy fog at Dallas-Fort Worth Airport (1997-2006) and Mineral Wells, TX (2001-2006). The data indicates the maximum monthly average hours of fog are 6.3 hours (Dallas-Fort Worth Airport) and 12.5 hours (Mineral Wells) for the month of January and the minimum average number of hours are 0.0 hours (Dallas-Fort Worth Airport) and 0.3 hours (Mineral Wells), TX. These minimum values are scattered amongst the warmer months of the year. Based on the CPNPP site characteristics it is expected that the Mineral Wells fog data better represents the conditions at the proposed site than the data from the more urbanized Dallas-Fort Worth area.

The staff reviewed the Climate Atlas of the United States (Version 2.0, 2002) for cases that visibility is less than or equal to 1/4 mile. These data indicate the probability, for the greater part of the year (February through November) is less than one percent of the time during each of these months. For January and December, the probability is one to two percent. These data are consistent with CPNPP COL FSAR Table 2.3-303 (Mineral Wells). The greatest difference between the Climate Atlas and the Mineral Wells data is in December where the CPNPP COL FSAR table indicated less than 1 percent of the hours with heavy fog. This is possibly due to the shorter record of data for Mineral Wells than that provided in the Climate Atlas. The staff concludes that data provided by the COL applicant, in particular for Mineral Wells, should reasonably represent the area around the CPNPP site.

2.3.2.4.6 Atmospheric Stability

The COL applicant presented CPNPP COL FSAR Table 2.3-304 which provided the frequency of each Pasquill stability class by month and annually. Annually, the frequency of each stability class over the 5 years of CPNPP data provided (2001 through 2004 and 2006) is as follows: A – 7.8 percent, B – 6.8 percent, C – 7.3 percent, D – 46.7 percent, E – 23.2 percent, F - 5.3 percent, and G – 2.9 percent. The staff tabulated CPNPP data over the same period of time and determined a similar annual percentage for each stability class. The staff also evaluated the frequency of stability by time of day to determine if the CPNPP data demonstrated expected diurnal trends. The results of the analysis produced the expected trends with unstable conditions (stability A through C) nearly never occurring overnight and during the early morning hours, then trending upward to mid afternoon and then falling again toward night time. Stability classes D through G showed the opposite trend, with stability classes F and G occurring with little frequency during the daytime. The occurrence of stability classes D and E drops to a minimum during mid afternoon and during early evening, then increases and levels off for the night time. Based on these findings, the staff finds the stability class data provided by the COL applicant to be representative of the CPNPP site.

The COL applicant also generated joint frequency wind distributions by stability class. These are presented in CPNPP COL FSAR Table 2.3-305, “Annual Stability Class Frequency Distribution for CPNPP.” Data in these tables are based on 5 years of onsite meteorological data.

2.3.2.4.7 Mixing Heights

Seasonal and annual morning and afternoon mixing heights were discussed in CPNPP COL FSAR Section 2.3.1.4.7. The COL applicant also provided inversion heights and strengths for the Dallas-Fort Worth area based on data from the Forecast Systems Laboratory (FSL) and NCDC Radiosonde Data Archive. These data were confirmed for use in the cooling tower model analysis described in SER Section 2.3.2.4.9.4. The data indicates that the average height of morning inversions are above 1000 meters and the average afternoon inversion heights are generally between 500 meters and 1000 meters. These inversion heights will have little effect on ground level releases as modeled in CPNPP COL FSAR Sections 2.3.4 and 2.3.5, especially closer to CPNPP where maximum concentrations are expected to occur.

2.3.2.4.8 Representativeness of Onsite Data

Based on the information provided above, which compares onsite data with regional meteorology and climatological data, data collected at CPNPP are expected to be representative of the site and its surroundings. This is further supported by the quality of the instrument monitoring system currently in place as described in Section 2.3.3 of this SE. Variations between the regional sites above can be expected. Some of these variations are a result of more urbanized surroundings or may be due to the shorter period of record of the data presented for CPNPP. Further for modeling releases from CPNPP, onsite measurements are expected to provide the best data because releases are ground level in nature and highest concentrations are expect closer to the plant.

2.3.2.4.9 Potential Influence of Plant and its Facilities on Local Surroundings

2.3.2.4.9.1 General

The staff agrees with the COL applicant's general conclusion that the two new units will have minimal influence on the local meteorology. The new units will influence wind flow and dispersion immediately around the new buildings and facilities, however, the extent of this influence is generally not significant for more than about 10 building heights around the structure(s) in question. Further, the dispersion models used to evaluate accidental and routine releases in the subsections that follow have routines to estimate these effects.

2.3.2.4.9.2 Impact of Squaw Creek Reservoir

As noted by the COL applicant in the CPNPP COL FSAR for Units 3 and 4, the filling of SCR has already been conducted and addressed in CPNPP COL FSAR Section 2.3. The COL applicant also noted that the impact of the SCR regarding the local meteorology has already taken place during the period that is being reviewed. The staff agrees that no further analysis is necessary.

2.3.2.4.9.3 Topographical Description

CPNPP COL FSAR Figure 2.3-369, "Terrain Elevation Profiles Within 5 Miles of the CPNPP Site," presents cross sections of terrain around the facility to five miles for each of the compass directions. These figures indicate terrain within 5 miles of the project to range from approximately 600 feet above mean sea level (MSL) to 1000 feet above MSL, with the plant grade at about 822 feet above MSL. Further, consistent with these cross sections, the staff

confirmed that highest terrain, at around 1000 ft, is found to the west-northwest at around 5 miles from CPNPP.

For within 50 miles of CPNPP, the COL applicant also provided cross sections of terrain, for the sixteen compass directions, in CPNPP COL FSAR Figure 2.3-371, "Terrain Elevation Profiles Within 50 Miles of the CPNPP Site." Consistent with this figure, the staff confirmed that elevations rise to approximately 1500 feet MSL to the west-southwest through northwest directions from the CPNPP site. These higher elevations are located at around 35 miles and beyond the proposed site. The staff also confirmed lowest elevations (around 500 feet MSL) are in the easterly directions.

The COL applicant also addressed air drainage and channeling associated with SCR. The COL applicant noted that due to the elevation differences and based on the results cited from the CPNPP, Units 1 and 2 FSAR, air drainage along SCR is not significant. Comparison of the site's wind roses indicates that during the winter months southeast and northwest winds occur at a slightly higher frequency at 10 meters than they do at 60 meters. The staff concludes that during these winter months some channeling may occur, however, the staff agrees with the COL applicant that this "is not a prominent effect."

As a result of these observations and analysis, the staff agrees with the CPNPP COL FSAR that the terrain does not have a significant effect on the local meteorology. Further, the steady state dispersion models used in the following sections for evaluating potential releases are suitable for modeling of facilities with these terrain characteristics. These models are particularly useful for modeling plumes in flat and rolling terrain. Since proposed CPNPP, Units 3 and 4, releases will generally be near ground level, highest plume concentrations are expected to be closer to the plant where the terrain is relatively flat.

2.3.2.4.9.4 Cooling Tower Plumes

The proposed project will include four Linear Mechanical Draft Cooling towers. The plume from these towers was evaluated in the CPNPP COL FSAR using the Electric Power Research Institute (EPRI)-sponsored Seasonal/Annual Cooling Tower Impact (SACTI) computer model. In addition to the plume, small water droplets associated with the circulating water and containing dissolved solids, known as drift, may be emitted from the cooling towers. These may eventually deposit on the local surroundings including land surfaces, buildings and vegetation. The COL applicant has indicated in the CPNPP COL FSAR it will utilize standard mitigation to alleviate drift. This will involve the use of drift eliminators.

The CPNPP COL FSAR states that the SACTI modeling was conducted with a set of meteorological data which consists of wind speed and direction data from the CPNPP meteorological tower, temperature, humidity and cloud cover data from Mineral Wells, and mixing heights from Stephenville, TX. The staff agrees with the selection of these locations as the CPNPP site does not collect all the necessary parameters to run the SACTI model. Both Mineral Wells and Stephenville, TX provide suitable substitute data for a region where topographical effects are relatively small and there are wide open spaces. Further, the COL applicant indicates that the source term for the cooling tower modeling is based on circulating water total dissolved solids of 8,402 mg/l (using an average input of total dissolved solids of 3,525 mg/l and 2.4 cycles in the tower).

In September 29, 2010, responses to follow-up RAIs, the COL applicant provided both input and output files for the SACTI modeling, along with a series of updated support calculations

demonstrating the selection and development of inputs to the model. The latest updates of the modeling were reviewed and confirmed by the staff. The staff also conducted a series of SACTI model runs which demonstrated results consistent with those provided by the COL applicant in its response to RAI 4607, Question 02.03.02-4. In the September 29, 2010, response to RAI 4607, Question 02.03.02-4, the COL applicant committed to updating CPNPP COL FSAR Section 2.3.2.4, CPNPP COL FSAR Tables 2.3-319 through 2.3-331, and CPNPP COL FSAR Figures 2.3-372 through 2.3-379 for the cooling tower plume analysis. The staff notes that the COL applicant has since updated the CPNPP COL FSAR in Revision 2 as stated in the response to RAI 4607, Question 02.03.02-4. Accordingly, the staff finds the COL applicant's response to RAI 4607, Question 02.03.02-4 acceptable and, therefore, considers this RAI resolved.

CPNPP COL FSAR Table 2.3-319 through Table 2.3-323 provide the length of visible plumes by season and wind direction. As expected, the longest plumes occur in winter when temperatures are cooler and moist plumes are more likely to condense, while plumes are shortest in summer when temperatures are warmest. For winter, average plume lengths are between 3 and 4 miles for most directions; the longest average visible plumes (just under 4 miles) are predicted to the southwest, west, and west-northwest. These CPNPP COL FSAR tables further indicate that in winter, plumes extend beyond five miles almost 38 percent of the time, while in summer plumes extend beyond 5 miles just 6.7 percent of the time.

CPNPP COL FSAR Tables 2.3-325 and Table 2.3-326 provide SACTI model estimates of annual hours of fogging and icing. The greatest number of hours of fogging occurs to the south-southeast at 0.19 miles from the tower, where around 350 hours per year of fogging are predicted. At 1 mile from the tower, 25 hours per year of fogging occur for the northerly and southerly directions combined, and less than or equal to one hour per year for the other individual directions. Predicted occurrences of icing follow a similar pattern to the fogging results where 133 hours per year are estimated to occur, using the SACTI model, to the south-southeast at around 0.12 miles from the tower. At 1 mile from the tower, annual hours of icing are almost zero for all but the north and south directions. For these two directions, approximately 12 hours per year of icing are predicted.

CPNPP COL FSAR Table 2.3-327 through Table 2.3-329 provide cooling tower deposition for salt, chloride, and total dissolved solids. The staff focused on the salt deposition table and the impact to the CPNPP, Units 3 and 4, switchyard. The CPNPP, Units 3 and 4, switchyard is south to south-southeast of the closest cooling tower, with the closest distance being just over 0.12 miles (based on CPNPP COL FSAR Figure 2.1-201). From the results in CPNPP COL FSAR Table 2.3-327, the staff estimated salt deposition to this switchyard will be at or below approximately 20 kg/(km^2-month), which is below the lower end of the "Light Contamination Level" range defined by the Institute of Electrical and Electronic Engineers (IEEE) standard[6]. The staff has independently verified data against this source. The maximum salt deposition from the cooling tower, for any distance and direction, from the SACTI modeling was approximately 137 kg/(km^2-month). This level is also found to be below the "Light Contamination Level" range of 300 – 800 kg/km^2 defined by the IEEE standard.

The COL applicant calculated that the maximum water deposition from the cooling towers is equivalent to 0.002 inches per month based on the maximum annual predicted SACTI water deposition value of 49,000 kg/(km^2-month) (see CPNPP COL FSAR Table 2.3-330). The staff confirmed this equivalent value and agrees with the COL applicant that this level is insignificant.

[6] IEEE Guide for Application of Power Apparatus Bushings, IEEE Standard C.57.19.100-1995, August 1995.

2.3.2.5 Post-Combined License Activities

There are no post-COL activities related to this section.

2.3.2.6 Conclusion

The staff is reviewing the information in Section 2.3.2 of the US-APWR under Docket Number 52-021. The results of the staff's technical evaluation of the information related to the site characteristics, incorporated by reference, in the FSAR will be documented in the staff's SE of the DC application for the US-APWR design. The SE for the US-APWR is not yet complete, and is being tracked as part of **Open Item [1-1].** The staff will update Section 2.3.2 of this SE to reflect the final disposition of the DC application.

As set forth above, the COL applicant has presented and substantiated information describing the local meteorological, air quality, and topographic characteristics important to evaluating the adequacy of the design and siting of this plant. The staff has reviewed the information provided and, for the reasons given above, concludes that the identification and consideration of the meteorological, air quality, and topographical characteristics of the site and the surrounding area are acceptable and meet the requirements of 10 CFR 100.20(c) and 10 CFR 100.21(d), with respect to determining the acceptability of the site.

The staff finds that the COL applicant has considered the appropriate site phenomena in establishing the site characteristics. Specifically, the staff has generally accepted the methodologies used to determine the meteorological, air quality, and topographic characteristics as documented in SERs for previous licensing actions. Since the COL applicant has correctly implemented these methodologies, as described above, the staff has determined that the use of these methodologies results in site characteristics containing margin sufficient for the limited accuracy, quantity, and period of time in which the data have been accumulated in accordance with 10 CFR 52.79(a)(iii).

2.3.3 Onsite Meteorological Measurements Program

2.3.3.1 Introduction

The CPNPP onsite meteorological measurement program addresses the need for onsite meteorological monitoring and the resulting data. The staff review covers the following specific areas: (1) Meteorological instrumentation, including siting of sensors, sensor type and performance specifications, methods and equipment for recording sensor output, the quality assurance program for sensors and recorders, data acquisition and reduction procedures, and special considerations for complex terrain sites; and (2) the resulting onsite meteorological database, including consideration of the period of record and amenability of the data for use in characterizing atmospheric dispersion conditions.

This section verifies that the COL applicant successfully implemented an appropriate onsite meteorological measurements program and that data from this program provide an acceptable basis for estimating atmospheric dispersion for DBA and routine releases from a nuclear power plant of the type specified by the COL applicant.

2.3.3.2 Summary of Application

CPNPP COL FSAR, Revision 3, Section 2.3 incorporates by reference US-APWR DCD, Tier 2, Revision 3, Section 2.3.

In addition, in CPNPP COL FSAR Section 2.3, the COL applicant provided the following:

US-APWR COL Information Item

- CP COL 2.3(1)

The COL applicant provided additional information in CP COL 2.3(1) to address US-APWR DCD, COL Information Item 2.3(1), specifically, a description of the CPNPP onsite meteorological measurements program.

2.3.3.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in the FSER related to the DCD.

The acceptance criteria associated with the relevant requirements of NRC regulations for the onsite meteorological measurements program are given in NUREG-0800, Section 2.3.3.

The applicable regulatory requirements for an onsite meteorological measurements program are as follows:

- 10 CFR 100.20(c)(2), as it relates to the meteorological characteristics of the site that are necessary for safety analysis or that may have an impact upon plant design in determining the acceptability of a site for a nuclear power plant.

- 10 CFR 100.21(c), as it relates to the meteorological data used to evaluate site atmospheric dispersion characteristics and establish dispersion parameters such that: radiological effluent release limits associated with normal operation can be met for any individual located offsite; and radiological dose consequences of postulated accidents meet prescribed dose limits at the EAB and LPZ.

- 10 CFR Part 50, Appendix A, GDC 19, “Control Room,” as it relates to the meteorological considerations used to evaluate the personnel exposures inside the control room during radiological and airborne hazardous material accident conditions.

- 10 CFR Part 50, Paragraphs 50.47(b)(4), 50.47(b)(8), and 50.47(b)(9), as well as 10 CFR Part 50, Appendix E, Section IV.E.2, as it relates to the onsite meteorological information available for determining the magnitude and continuously assessing the impact of the releases of radioactive materials to the environment during a radiological emergency.

- 10 CFR Part 50, Appendix I, “Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criteria,” as it relates to meteorological data used in determining the compliance with numerical guides

for design objectives and limiting conditions for operation to meet the requirement that radioactive material in effluents released to unrestricted areas be kept as low as is reasonable achievable (ALARA).

- 10 CFR Part 20, "Standards for Protection Against Radiation," Subpart D, "Radiation Dose Limits for Individual Members of the Public," as it relates to the meteorological data used to demonstrate compliance with dose limits for individual members of the public.

The related acceptance criteria from NUREG-0800, Section 2.3.3 are as follow:

- The pre-operational monitoring program should be described for COLAs that do not reference an early site permit. The operational monitoring program is to be described also. The monitoring program description should include meteorological measurements at the site and any offsite facilities. The description should include: A site map (drawn to scale) showing tower location, true north with respect to man-made structures and topographic features, distances to nearby obstructions of flow in each downwind sector, measurements and elevation of measurements, instrument descriptions and their exposure and performance specifications, instrument calibration and maintenance procedures and frequencies, data output and recording systems, and processing, archiving and analysis procedures.

- Meteorological data should be presented in the form of joint frequency distributions of wind speed and wind direction by atmospheric stability class in the format described in RG 1.23, "Meteorological Monitoring Programs for Nuclear Power Plants," Revision 1, issued March 2007. An hour-by-hour listing of the hourly-averaged parameters should be provided in the format described in RG 1.23. If possible, evidence of how well these data represent long-term conditions at the site should also be presented, possibly through comparison with offsite data.

  At least two consecutive annual cycles (and preferably three or more whole years), including the most recent one year period, should be provided with the COL application. These data should be used by the COL applicant to calculate: (1) The short-term atmospheric dispersion estimates for accident releases discussed in SER Section 2.3.4; and (2) the long-term atmospheric dispersion estimates for routine releases discussed in SER Section 2.3.5.

2.3.3.4 Technical Evaluation

The staff reviewed CPNPP COL FSAR Section 2.3.3 and checked the referenced DCD to ensure that the combination of the DCD and the CPNPP COL FSAR represents the complete scope of information relating to this review topic. The staff's review confirmed that the information in the COL application and incorporated by reference, addresses the required information relating to the onsite meteorological measurements program. The results of the staff's evaluation of the information incorporated by reference in the CPNPP COLA are documented in the FSER Related to the Certification of the US-APWR Standard Design.

The staff also reviewed the information contained in the CPNPP COL FSAR:

US-APWR COL Information Item

- CP COL 2.3(1)

The staff reviewed CP COL 2.3(1) related to the provision of the onsite meteorological measurements program included in Section 2.3.3 of the CPNPP COL FSAR. The COL Information Item in US-APWR DCD, Tier 2, Section 2.3.6.1 states:

> The COL Applicant, whether the plant is to be sited inside or outside the continental US, is to provide site-specific preoperational and operational programs for meteorological measurements, and is to verify that 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.

The staff's evaluation is based on the descriptions provided by the COL applicant in CPNPP COL FSAR Section 2.3.3 and a COL pre-application readiness assessment held on April 16 and 17, 2007.

The purpose of the readiness assessment was to: (1) Become familiar with the prospective COL applicant's site and site selection process, plans, schedules, and initiatives; (2) observe and review the preoperational onsite meteorological monitoring program; and (3) review the prospective COL applicant's plans for its operational onsite meteorological monitoring program.

The CPNPP COL FSAR states that the meteorological monitoring program for CPNPP, Units 3 and 4, is a continuation of the onsite program already in place for CPNPP, Units 1 and 2. Further, based on the CPNPP COL FSAR, the "current meteorological monitoring program is in effect throughout the CPNPP Units 3 and 4 construction, preoperational, and operational phases of the project."

The CPNPP COL FSAR states that the pre-operational phase for the CPNPP, Units 1 and 2, meteorological monitoring program was conducted over the period of May 15, 1972, through May 14, 1976, and was reestablished as an operational system prior to CPNPP, Unit 1 fuel load. This preoperational phase, as stated in the CPNPP COL FSAR (for CPNPP, Units 3 and 4), measured the necessary parameters required to "evaluate the dispersive characteristics of the site" for modeling of both routine radionuclide releases and accidental radionuclide releases. The pre-operational phase for CPNPP, is based on 2001 – 2004 and 2006 data.

2.3.3.4.1 Meteorological Measurement System

The meteorological measurement system consists of a 60 meter (197 foot) primary tower and a 10 meter (33 foot) backup tower. The COL applicant provided a discussion of the location of the meteorological towers, along with a site map (CPNPP COL FSAR Figure 2.3-380) showing the location of the primary and secondary tower enclosure, true north, topographic features, and other features (including the location of existing CPNPP, Units 1 and 2, and proposed CPNPP, Units 3 and 4) that may influence the measurement of atmospheric conditions at the site. Based on CPNPP COL FSAR Figure 2.3-380, the towers are located on a grassy area. The towers are located approximately 450 meters (1476 feet) to the east-southeast of the CPNPP,

Units 1 and 2, reactor complex at an elevation of 255 meters (838.75 feet) above sea level. This elevation is approximately 5.1 meters (16.75 feet) above the CPNPP, Units 3 and 4, nominal plant grade elevation of 250 meters (822 feet) above sea level. Based on CPNPP COL FSAR Figure 2.3-380, the staff determined that CPNPP, Units 3 and 4, are approximately 870 meters (2854 feet) to the west-northwest of the meteorological towers. RG 1.23, Revision 1, Section 3, as referenced by NUREG-0800, indicates that meteorological towers should be sited at least 10 building heights from obstructions. For the existing units, the top of the containment domes are 69 meters (225 feet) in height above the meteorological tower's base elevation and, therefore, does not meet this 10 building height guideline. The CPNPP COL FSAR provides justification indicating that the existing facility does not influence the towers because the meteorological towers are infrequently downwind of CPNPP, Units 1 and 2. The staff concurs with this justification. The new units, assuming a height of approximately 70 meters (229 feet) above the base of the meteorological towers, will satisfy the 10 building height guideline.

Based on the fact that the existing meteorological tower is functioning at an operating nuclear power plant (CPNPP, Units 1 and 2) and the proposed units (CPNPP, Units 3 and 4) are beyond 10 building heights from the meteorological towers, the staff accepts the meteorological tower's site location as suitable for CPNPP, Units 3 and 4.

CPNPP COL FSAR Section 2.3.3.1 describes the positioning of the sensors and the characteristics of the primary and backup towers. As recommended by RG 1.23, Revision 1, both the primary and backup towers are open lattice structures.

The CPNPP COL FSAR indicates that the booms for the meteorological instrument sensors (including the wind speed and direction sensors) are located on the west side of the tower to minimize tower interference. NUREG-0800, Section 2.3.3 indicates that booms should be normal to prevailing wind direction. Data presented in CPNPP COL FSAR Section 2.3.1 and Section 2.3.2 indicate a predominant wind direction from more southerly directions with a northerly secondary peak, which places the booms near perpendicular to the prevailing wind direction. Based on the guidance provided in RG 1.23, Revision 1, the staff finds this to be the acceptable direction to place the booms. In RAI 4608, Question 02.03.03-13, the staff requested that the COL applicant update the CPNPP COL FSAR to include a statement describing the length of the booms that support the meteorological instrumentation. In a June 7, 2010, response to RAI 4608, Question 02.03.03-13, the COL applicant indicated that the booms are approximately 8 feet in length, while the base of the primary tower is 44 inches on each side. Thus, the booms are greater than two times the longest side of the tower (triangular) as recommended by RG 1.23, Revision 1 to sufficiently reduce airflow modification and reduce induced turbulence by the tower structure. The staff notes that the COL applicant has updated the CPNPP COL FSAR as stated in the response to June 7, 2010, RAI 4608, Question 02.03.03-13, therefore, the staff considers this RAI closed.

As requested in NUREG-0800 and RG 1.23, Revision 1, the primary meteorological tower collects wind speed and direction data at two levels, the ambient temperature between two levels, along with precipitation and air temperature. The CPNPP COL FSAR indicates that sigma theta (standard deviation of the horizontal wind direction) is also measured at this tower. The CPNPP COL FSAR provides the following heights of the sensors at the primary tower:

- Wind speed at 10 m and 60 m
- Wind direction at 10 m and 60 m

- Air temperature at 10 m
- Delta-temperature between 10 m and 60 m (redundant channels)
- Sigma-theta at 10 m
- Precipitation near ground level

The backup meteorological tower also measures the following:

- Wind speed at 10 m
- Wind direction at 10 m
- Air temperature at 10 m
- Sigma-theta at 10 m

The CPNPP COL FSAR indicates the backup tower is located 75 feet east of the primary meteorological tower.

Both towers and the meteorological instrumentation building are located in a fenced area.

In the responses to several RAIs, the COL applicant provided information regarding the pre-operational atmospheric moisture monitoring program and a comparison of the data collected with local weather stations. In particular, in a June 7, 2010, response to RAI 4608, Question 02.03.03-10, the COL applicant provided updates to the text in CPNPP COL FSAR Section 2.3.3.1, along with a new CPNPP COL FSAR Table 2.3-351 and CPNPP COL FSAR Figures 2.3-383 through 2.3-386 to address the pre-operational moisture monitoring program. The staff notes that the COL applicant has updated the CPNPP COL FSAR as stated in its response to RAI 4608, Question 02.03.03-10. The staff finds the COL applicant's June 7, 2010, response to RAI 4608, Question 02.03.03-10, acceptable and, therefore, considers this RAI resolved.

The atmospheric moisture monitoring sensor was located on an open lattice tower above the Project Records Center Building at an approximate elevation of 860 feet MSL (30 feet above grade where the grade elevation is approximately 830 feet MSL). Preoperational data was collected for an approximate three and-a-half month period from June 12, 2008, through September 23, 2008. Since the atmospheric moisture data are of primary interest for the cooling towers, and worst case conditions are associated with higher wet bulb temperatures, the summer months would represent an appropriate time for collecting these data.

The instrument used to calculate atmospheric moisture was a Climatronics sensor with an accuracy of plus or minus one percent and range of zero to 100 percent. The staff notes that the accuracy of the instrument satisfies RG 1.23, Revision 1 recommendations. Photographs provided by the COL applicant in response to RAIs show the instrument located above roof level in a naturally aspirated radiation shield. Information from the COL applicant indicates that under low air movement (1 meter per second), the radiation shield temperature is maintained within plus or minus 2.7 °F and maintained at 0.7 °F for wind speeds greater than 3 m/s.

CPNPP COL FSAR Table 2.3-351 provides a comparison of monthly average relative humidity from the site's preoperational monitoring program against data collected at Mineral Wells Airport and Dallas-Fort Worth Airport for the same time period. This comparison indicates that the CPNPP site average relative humidity levels falls between the Dallas-Fort Worth and Mineral Wells, TX averages. Mineral Wells, TX monthly values were slightly above, while Dallas-Fort Worth monthly averages were slightly below the site monthly values. CPNPP COL FSAR

Figures 2.3-383 through 2.3-386 provide a graphical comparison of relative humidity by day for each month covered by the preoperational atmospheric monitoring program. The results demonstrate that all three sites trend closely together. The staff agrees that Mineral Wells Airport data will serve as the best representative site for CPNPP due to its tendency to report higher relative humidity than Dallas-Fort Worth, its closer proximity to the CPNPP site, and Mineral Wells, TX being a more rural site than the Dallas-Fort Worth, TX urban area.

2.3.3.4.2 Instrumentation

Based on the CPNPP COL FSAR, wind speeds at all levels and at both towers are measured with 3-cup anemometers with a starting threshold of 0.45 m/s and range of 0 to 100 mph. Climatological data for Dallas-Fort Worth Airport indicate a maximum 3-second wind speed of 78 mph, well within the upper range of the wind speed instrumentation.

Wind direction at both towers and all levels are measured by wind vanes with a starting threshold of 0.45 m/s. The range of the instrumentation is 0 to 360 degrees.

Temperature measurements are made using a platinum temperature sensor with a range of -20 °F to +120 °F. Data in CPNPP COL FSAR Section 2.3.1 presents a climatological temperature range at Glen Rose of -15 °F to +115 °F, which falls within the range of the CPNPP instrumentation.

Delta-temperature sensors are located at 10 m and 60 m and provide readings in a range of -5 °F to +15 °F. These values fall well within the range of stability classes provided in RG 1.23, Revision 1, Table 1.

Precipitation is measured at the ground with a tipping bucket having a threshold of 0.01 inch.

Supporting meteorological equipment is maintained in an environmentally controlled meteorological instrument building.

During the review of CPNPP COL FSAR Section 2.3.3, the staff determined that the COL applicant had omitted the resolution of the meteorological instrumentation. Therefore, in RAI 3557, Question 02.03.03-11, the staff requested that the COL applicant provide the resolution for the meteorological instrumentation. In an October 19, 2009, response to RAI 3557, Question 02.03.03-5, and a June 7, 2010, response to RAI 4608, Question 02.03.03-11, the COL applicant provided instrument resolution in CPNPP COL FSAR Table 2.3-332 and committed to including the updated table in the next revision of the CPNPP COL FSAR. The staff notes that the COL applicant has since updated the CPNPP COL FSAR as stated in its June 7, 2010, response to RAI 4608, Question 02.03.03-11. Accordingly, the staff finds the COL applicant's responses to RAI 3557, Question 02.03.03-5 and RAI 4607, Question 02.03.03-11, acceptable and, therefore, considers these RAIs resolved.

CPNPP COL FSAR Table 2.3-332 provides measurement resolution of the meteorological tower instruments, which indicates measurement resolutions conform to RG 1.23, Revision 1

In RAI 3557, Question 02.03.03-6, the staff requested that the COL applicant update the CPNPP COL FSAR to include a statement on how often the guyed wires and anchors for the meteorological tower are inspected. In RAI 4608, Question 02.03.03-12, the staff requested that the COL applicant clarify the response provided in RAI 3557, Question 02.03.03-6. In an October 19, 2009, response to RAI 3557, Question 02.03.03-6, and a February 5, 2010,

response to RAI 4608, Question 02.03.03-12, the COL applicant provided information pertaining to the inspection of guyed wires and tower anchors for the CPNPP site meteorological towers. The meteorological towers are supported using guyed wires and tower anchors which are inspected every 5 years. Inspections include "below grade anchor inspection, an evaluation of the condition of the anchor and guyed wires, and performance of any maintenance that is needed on the guyed tower, anchors, and associated parts." The COL applicant stated that because the meteorological system and tower are the same used to support CPNPP, Units 1 and 2, the guyed wires are inspected in accordance with the Second Proposed Revision to RG 1.23 (April 1986), as discussed in CPNPP COL FSAR Section 2.3.3.2. The COL applicant has committed to including information regarding the frequency of inspection of the meteorological tower's guyed wires and tower anchors in the next revision of the CPNPP COL FSAR. The staff notes that the COL applicant has since updated the CPNPP COL FSAR as stated in its February 5, 2010, response to RAI 4608, Question 02.03.03-12. Accordingly, the staff finds the COL applicant's responses to RAI 3557, Question 02.03.03-6, and RAI 4608, Question 02.03.03-12, acceptable and, therefore, considers these RAIs resolved.

2.3.3.4.3 System Accuracy

Instrument accuracy is provided by the COL applicant in CPNPP COL FSAR Tables 2.3-332 and 2.3-333. Consistent with RG 1.23, Revision 1, the COL applicant conducts channel calibrations semi-annually and conducts an annual inspection of the tower structure, as discussed in CPNPP COL FSAR Section 2.3.3.3.

In October 19, 2009, and February 5, 2010, responses to RAI 3557, Question 02.03.03-7, the COL applicant provided a discussion of how system calibrations are performed, along with information on daily channel checks. The COL applicant committed to including these discussions in the next revision of the CPNPP COL FSAR. The staff notes that the COL applicant has since updated the CPNPP COL FSAR as stated in the October 19, 2009, and February 5, 2010, responses to RAI 3557, Question 02.03.03-7. Accordingly, the staff finds the COL applicant's responses to RAI 3557, Question 02.03.03-7, acceptable and, therefore, considers this RAI resolved.

Calibrations of the meteorological tower's instrumentation are conducted following the Quality Related CPNPP common unit Instrument and Control Manual. Calibrations are applied to both individual instruments and the entire channel and are performed semi-annually. Channel checks are performed at least once every 24 hours.

System accuracies are presented in CPNPP COL FSAR Table 2.3.332 for both the digital and paperless digital recorders. CPNPP system accuracies were compared to RG 1.23, Revision 1, Table 2. The staff confirmed that all system accuracies were within the limits of RG 1.23, Revision 1, Table 2, with the exception of delta-temperature for the Paperless Digital recording system. For the delta-temperature from the Paperless Digital recording system, the system accuracy is plus or minus 0.19 °F, just 0.01 °F above the guidance in RG 1.23, Revision 1, Table 2. Based on the COL applicant's October 19, 2009, response to RAI 3557, Question 02.03.03-8, this system is based on those requirements specified for CPNPP, Units 1 and 2, which follow American National Standards Institute and American Nuclear Society (ANSI/ANS) 2.5-1984[7]. Accordingly, the staff finds the COL applicant's October 19, 2009,

[7] ANS,1984. Standard for Determining Meteorological Information at Nuclear Power Sites. ANSI/ANS 2.5-1984. American Nuclear Society, La Grange Park, IL.

response to RAI 3557, Question 02.03.03-8, acceptable and, therefore, considers this RAI resolved.

2.3.3.4.4 Data Recovery

The COL applicant provided data recovery rates for the on-going meteorological monitoring program at CPNPP for the period of 2001 through 2006 in CPNPP COL FSAR Table 2.3-334. As stated in the CPNPP COL FSAR, these recovery rates are based on both individual channels and the data requirements for conducting joint frequency distributions of wind speed, wind direction and stability class. CPNPP COL FSAR Table 2.3-334 indicates that the data recovery rates were greater than or equal to 98 percent for 2001 through 2004 and 2006; these values exceed the RG 1.23, Revision 1 requirement of 90 percent or greater on an annual basis.

Based on the operability of the approved existing CPNPP meteorological monitoring system over a lengthy period of time and its data recovery rates, the staff has determined that the overall system, and its components, are suitable for collecting meteorological data at the CPNPP site. During the 2009 site audit, the CPNPP staff discussed the ways that the 2005 computer problems have been resolved and corrective measures have been taken to avoid a recurrence of the problem.

2.3.3.4.5 Meteorological Data Processing

Consistent with RG 1.23, Revision 1 and information provided by the COL applicant in CPNPP COL FSAR Section 2.3.3, the staff has finds that the CPNPP meteorological monitoring program includes meteorological parameters sufficient to evaluate transport and diffusion of routine releases to the public and potential accidental releases of radioactivity. For non-radiological events as fogging, icing, and drift from cooling towers, the staff finds that sufficient offsite meteorological data are available to supplement onsite data measurements.

2.3.3.4.5.1 Data Acquisition

As detailed in the CPNPP COL FSAR, the meteorological monitoring system includes two separate recording systems: (1) A digital system; and (2) a digital paperless recorder.

The digital system records all data on the Meteorological System Computer (METSYS) located in the CPNPP, Unit 1 Control Room. This computer is supplied with a signal from the Meteorological Instrument Building. Signals from the meteorological instrument building are also supplied to the CPNPP, Units 1 and 2, plant computers, as well as a Yokogawa digital recorder.

Electronic signals from the meteorological data sensors are transmitted by modem to demultiplexers located in the CPNPP, Unit 1 plant computer room.

The Plant Computer system is completely separated from the METSYS computer and software. Data from the Plant Computer system “displays and stores data to support the Operations and Emergency Planning Departments.” The Plant Computer system also provides “displays in the Units 1 and 2 Technical Support Center (TSC)”, the Emergency Operations Facility (EOF), and will provide displays in the CPNPP, Unit 3 TSC and Unit 4 TSC.

A digital paperless recorder is mounted inside the CPNPP, Units 1 and 2 combined Control Room and one will also be located in each of the CPNPP, Units 3 and 4, Control Rooms.

2.3.3.4.5.2 Data Processing

Consistent with RG 1.23, Revision 1, the CPNPP COL FSAR states that all meteorological parameters are sampled every 5 seconds. Using 5 second data, software calculates 15-minute and 1 hour averages of all parameters, except precipitation. Precipitation reported for either the 15-minute period or the 1-hour is based on the precipitation measured over the averaging period being calculated. The staff agrees these methods are consistent with RG 1.23, Revision 1.

The meteorological system software conducts data quality and limit checks as the data are recorded, the results of these checks are also provided with the data when displayed.

CPNPP also conducts a review of all meteorological data every quarter. This review is performed in accordance with CPNPP procedure "2007 Steam Electric Station Radiation Protection Manual Routine Operations of the Meteorological Computer System Instruction No. RPI-309" (Revision No. 8, February 19, 2007). Hourly data are "reviewed, validated, replaced with backup data if necessary, documented, and then archived."

Data collected from the CPNPP meteorological monitoring system, for the period from 2001 through 2004 and 2006, are presented in CPNPP COL FSAR Section 2.3.2. These data are also used for the analysis of atmospheric dispersion estimates for accidental releases in CPNPP COL FSAR Section 2.3.4 and the atmospheric dispersion estimates for routine releases in CPNPP COL FSAR Section 2.3.5. These atmospheric dispersion analyses used both annual joint frequency distributions (of wind speed, wind direction, and stability class) and hourly data as presented in CPNPP COL FSAR Section 2.3.2.

2.3.3.5 Post-Combined License Activities

Part 10 of the COLA contains proposed COL conditions, including inspection, test, analysis, and acceptance criteria (ITAAC). Part 10, Table B-2 of the COLA contains the emergency planning (EP) ITAAC. The following two EP ITAAC involve demonstrating that the operational onsite meteorological monitoring program appropriately supports the CPNPP emergency plan:

- EP Program Element 6.3: The means exists to continuously assess the impact of the release of radioactive materials to the environment, accounting for the relationship between effluent monitor readings, and onsite and offsite exposures and contamination for various meteorological conditions.

- EP Program Element 6.4: The means exists to acquire and evaluate meteorological information.

EP, including EP ITAAC, is addressed in SE Section 13.3, "Emergency Planning."

2.3.3.6 Conclusion

The staff is reviewing the information in US-APWR DCD, Tier 2, Section 2.3.3 under Docket No. 52-021. The results of the staff's technical evaluation of the information related to the site

characteristics incorporated by reference in the CPNPP COL FSAR will be documented in the staff's SE of the DC application for the US-APWR design. The SE for the US-APWR is not yet complete, and is being tracked as part of **Open Item [1-1].** The staff will update Section 2.3.3 of this SE to reflect the final disposition of the DC application.

As set forth above, the COL applicant has presented and substantiated information pertaining to the onsite meteorological monitoring program and the resulting database. The staff has reviewed the information provided and, for the reasons discussed above, concludes that the COL applicant has established consideration of the onsite meteorological monitoring program and the resulting database are acceptable and meet the requirements of 10 CFR 100.20 and 10 CFR 100.21 with respect to determining the acceptability of the site.

The staff finds that the onsite data also provide an acceptable basis for making estimates of atmospheric dispersion for DBA and routine releases from the plant to meet the requirements of 10 CFR 100.21, 10 CFR 100.20, GDC 19, 10 CFR Part 20, and 10 CFR Part 50, Appendix I. Finally, the staff finds the equipment provided for measurement of meteorological parameters during the course of accidents is sufficient to provide reasonable prediction of atmospheric dispersion of airborne radioactive materials in accordance with 10 CFR Part 50, Appendix E.

US-APWR DCD, Tier 2, Revision 3, Section 2.3.6 states that a COL applicant shall address the site-specific onsite meteorological measurements program. The staff finds that the COL applicant has provided a sufficient description to meet the requirements of the DCD. COL Information Item 2.3(1) has been adequately addressed by the COL applicant and which the staff considers closed.

2.3.4 Short-Term Diffusion Estimates (Related to RG 1.206, Section C.III.1, Chapter 2, C.I.2.3.4, "Short-Term Atmospheric Dispersion Estimates for Accident Releases")

2.3.4.1 Introduction

The short-term diffusion estimates are used to determine the amount of airborne radioactive materials expected to reach a specific location during an accident situation. The diffusion estimates address the requirement for conservative atmospheric dispersion (relative concentration) factor (χ/Q value) estimates at the EAB, the outer boundary of the LPZ, and at the control room for postulated design-basis accidental radioactive airborne releases. The staff's review covers the following specific areas: (1) Atmospheric dispersion models to calculate atmospheric dispersion factors for postulated accidental radioactive releases; (2) meteorological data and other assumptions used as input to atmospheric dispersion models; (3) derivation of diffusion parameters (e.g., σ_y and σ_z); (4) cumulative frequency distributions of χ/Q values; (5) determination of conservative χ/Q values used to assess the consequences of postulated design-basis atmospheric radioactive releases to the EAB, LPZ, and control room; and (6) any additional information requirements prescribed in the "Contents of Application" sections of the applicable subparts to 10 CFR Part 52, "Licenses, certifications, and approvals for nuclear power plants."

2.3.4.2 Summary of Application

CPNPP COL FSAR, Revision 3, Section 2.3.4 incorporates by reference US-APWR DCD, Tier 2, Revision 3, Section 2.3.4.

In addition, in CPNPP COL FSAR Sections 2.3.4, the COL applicant provided the following:

US-APWR COL Information Item

- CP COL 2.3(2)

The COL applicant provided additional information in CP COL 2.3(2) to address COL Information Item 2.3(2). The COL applicant provided information on the objective, calculations, relative concentration estimates at the control room emergency intake, hazardous material releases, and representativeness and topographic effects for the CPNPP site. CP COL 2.3(2) addresses provision of site-specific short-term diffusion estimates for the NRC review to ensure that the envelope values (Table 2.0-1 and US-APWR DCD, Appendix 15A) of relative concentrations are not exceeded.

2.3.4.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the DCD.

In addition, the acceptance criteria associated with the relevant requirements of NRC regulations for the short-term atmospheric dispersion estimates are given in NUREG-0800, Section 2.3.4.

The applicable regulatory requirements for CPNPP site-specific short-term atmospheric dispersion estimates for accident releases are as follows:

- 10 CFR Part 50, Appendix A, GDC 19, “Control Room,” as it relates to the meteorological considerations used to evaluate the personnel exposures inside the control room during radiological and airborne hazardous material accident conditions.

- 10 CFR 52.79(a)(1)(vi), as it relates to a safety assessment of the site, including consideration of major structures, systems, and components (SSCs) of the facility and site meteorology, to evaluate the offsite radiological consequences at the EAB and LPZ.

- 10 CFR 100.21(c)(2), as it relates to the atmospheric dispersion characteristics used in the evaluation of EAB and LPZ radiological dose consequences for postulated accidents.

Appropriate sections of the following Regulatory Guides are used by the staff for the identified acceptance criteria:

- RG 1.78, “Evaluating the Habitability of a Nuclear Power Plant Control Room During a Postulated Hazardous Chemical Release,” Revision 1, December 2001.

- RG 1.145, “Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants,” Revision 1, May 2008.

- RG 1.194, "Atmospheric Relative Concentrations for Control Room Radiological Habitability Assessments at Nuclear Power Plants," June 2003.

The related acceptance criteria from NUREG-0800, Section 2.3.4 are as follows:

- A description of the atmospheric dispersion models used to calculate χ/Q values for accidental releases of radioactive and hazardous materials to the atmosphere.

- Meteorological data used for the evaluation (as input to the dispersion models) which represent annual cycles of hourly values of wind direction, wind speed, and atmospheric stability for each mode of accidental release.

- A discussion of atmospheric diffusion parameters, such as lateral and vertical plume spread (σ_y and σ_z) as a function of distance, topography, and atmospheric conditions, should be related to measured meteorological data.

- Hourly cumulative frequency distributions of χ/Q values from the effluent release point(s) to the EAB and LPZ should be constructed to describe the probabilities of these χ/Q values being exceeded.

- Atmospheric dispersion factors used for the assessment of consequences related to atmospheric radioactive releases to the control room for design basis, other accidents, and for onsite and offsite releases of hazardous airborne materials should be provided.

- For control room habitability analysis, a site plan drawn to scale should be included showing true North and potential atmospheric accident release pathways, control room intake, and unfiltered inleakage pathways.

2.3.4.4 Technical Evaluation

The staff reviewed CPNPP COL FSAR Section 2.3.4 and checked the referenced DCD to ensure that the combination of the DCD and the information in the CPNPP COL FSAR represent the complete scope of information relating to this review topic. The staff confirmed that the information contained in the COL application and incorporated by reference addresses the required information related to short-term atmospheric dispersion estimates for accident releases. The staff's technical evaluation of the information, incorporated by reference, related to short-term atmospheric dispersion estimates for accident releases will be documented in the staff SE of the DC application for the US-APWR design.

The staff reviewed the COL information contained in the CPNPP COL FSAR:

US-APWR COL Information Item

- CP COL 2.3(2)

The staff reviewed CP COL 2.3(2) related to the provision of site-specific short-term diffusion estimates for the NRC review, to ensure that the envelope values (CPNPP COL FSAR Table 2.0-1 and US-APWR DCD, Tier 2, Revision 3, Appendix 15A) of relative concentrations

are not exceeded included under CP COL Section 2.3. The specific text of this COL information item in US-APWR DCD, Tier 2, Revision 3, Section 2.3.6 states:

> The COL Applicant is to provide conservative factors as described in SRP 2.3.4 (Reference 2.3-2). 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) (Reference 2.3-3) and the control room dose limits in 10 CFR 50, Appendix A, General Design Criteria 19 (Reference 2.3-4) are met using site-specific χ/Q values.

The staff relied upon the review procedures presented in NUREG-0800, Section 2.3.4, to independently assess the technical sufficiency of the information presented by the COL applicant.

2.3.4.4.1 Calculations of Relative Offsite Concentrations

The CPNPP COL FSAR provided χ/Q values for the EAB and LPZ using the PAVAN computer model (NUREG/CR-2858). This program is based on the dispersion routines specified in RG 1.145. PAVAN is a straight line Gaussian model which provides χ/Q values at specified downwind locations. Based on topographical data discussed above and available meteorological data from CPNPP, the staff agrees with the use of the PAVAN model and conducted its independent review using the PAVAN code.

The staff conducted PAVAN model runs using a joint frequency distribution for 5 years based on hourly onsite meteorological data provided by CPNPP for the years 2001 through 2004 and 2006. This data set was provided for individual years in electronic format consistent with RG 1.23, Revision 1. The staff generated joint frequency distributions of wind speed and wind direction for each of the seven standard atmospheric stability classes (A through G). Wind data was taken from the 10 meter level, while stability class was defined from the 60 meter/10 meter delta-temperature difference. Wind direction sectors were based on the 16 compass directions. Thirteen wind speed ranges were modeled, with calms defined at or below the instrument threshold of 0.45 m/s.

Consistent with the COL applicant's modeling and the guidance provided in RG 1.145, the staff modeled releases as ground level. In addition, building downwash influence was based on a building height of 69.9 meters (229 feet) and a building cross sectional of 2500 square meters (26910 square feet) as provided by the COL applicant. Based on US-APWR DCD, Tier 2, Figure 2.3-1, the diameter of each containment building is approximately 47.9 meters (157.8 feet). Using this diameter and a building height of 69.9 meters (229 feet), the staff calculated a cross-sectional area greater than 2500 square meters (26910 square feet). Since χ/Q values increase with decreasing cross-sectional area, the use of a 2500 square meter (26910 square feet) cross sectional area by the COL applicant is conservative. In RAI 3558, Question 02.03.04-1 the staff requested that the COL applicant provide a reference to the US-APWR DCD for the building dimensions used in the calculations of relative offsite concentrations. In a November 11, 2009, response to RAI 3558, Question 02.03.04-1, the COL applicant provided references from the US-APWR DCD for building dimensions used in selecting the building height of 69.9 meters (229 feet) and the determination of a conservative cross-sectional area of 2500 square meters (26910 square feet). The COL applicant committed to including this information in the next revision of the CPNPP COL FSAR. The staff notes that the COL applicant has updated the CPNPP COL FSAR as stated in its November 11, 2009, response to RAI 3558, Question 02.03.04-1, therefore, the staff considers this RAI resolved.

CPNPP COL FSAR Table 2.3-335, "Minimum Exclusion Area Boundary (EAB) and LPZ Distances," provides the EAB and LPZ distances. From CPNPP COL FSAR Section 2.1.1.2, the CPNPP, Units 3 and 4, EAB extends a half mile (approximately 800 meters (2640 feet)) from the reactor center point. The COL applicant assumed a 200 meter (670 feet) release boundary around the center of the containment structures and calculated the EAB distance from this release boundary. The EAB distance used for the modeling (in all directions) by the COL applicant was 800 meters (2640 feet) minus 200 meters (670 feet). This results in an EAB distance of 600 meters (1970 feet). The LPZ according to CPNPP COL FSAR Figure 2.1-209 is at 3219 meters (2 miles). The staff confirmed these distances based on the figures provided in the CPNPP COL FSAR.

Consistent with RG 1.145, PAVAN calculates and provides cumulative frequencies for the EAB and LPZ for each of the 16 wind directions and for all wind directions combined. From these cumulative frequencies, the user is provided the 2-hour χ/Q value that is exceeded 0.5 percent of the total number of hours for each sector and the 2-hour site χ/Q value that is exceeded 5 percent of the time independent of wind direction. For the EAB, the higher of these two values is selected as the maximum 0 – 2 hour χ/Q value. For the LPZ, PAVAN conducts a logarithmic interpolation between the PAVAN calculated 2-hour χ/Q values and the PAVAN calculated annual χ/Q values to estimate χ/Q values for the following time periods: 0 – 8 hours, 8 - 24 hours, 1 – 4 days, and 4 – 30 days. CPNPP COL FSAR PAVAN modeling results are provided by the COL applicant in CPNPP COL FSAR Table 2.3-337. Site specific χ/Q values in this table were arbitrarily increased, by the COL applicant, by 10 percent to provide an additional margin. These conservative results indicate that all EAB and LPZ χ/Q values are below the US-APWR DCD χ/Q values. In RAI 3558, Question 02.03.04-2, the staff requested that the COL applicant clarify why model derived χ/Q values were not used for comparison with the US-APWR DCD site parameters. In a November 11, 2009, response to RAI 3558, Question 02.03.04-2, the COL applicant updated CPNPP COL FSAR text to clarify that site specific model results, as presented in CPNPP COL FSAR Table 2.3-337, were increased by 10 percent to provide a margin of conservatism. The staff has confirmed both the χ/Q values with and without the 10 percent margin. The COL applicant committed to including this new text in the next revision of the CPNPP COL FSAR. The staff notes that the COL applicant has since updated the CPNPP COL FSAR as stated in the November 11, 2009, response to RAI 3558, Question 02.03.04-2. The staff finds the COL applicant's response acceptable and, therefore, considers the RAI resolved.

The staff conducted independent PAVAN calculations using the 5 years (2001 through 2004 and 2006) of meteorological data provided for the CPNPP site. The staff has confirmed the methodology and results presented by the COL applicant and accepts the information presented in CPNPP COL FSAR Table 2.3-337.

2.3.4.4.2 Relative Concentration Estimates at the Control Room Emergency Intake

The COL applicant used the computer code ARCON96 (NUREG/CR-6331, "Atmospheric Relative Concentrations in Building Wakes") to estimate χ/Q values at the control room and the TSC for potential accidental releases of radioactive material. The ARCON96 model implements the methodology outlined in RG 1.194.

The ARCON96 code estimates χ/Q values for various time-average periods ranging from 2 hours to 30 days. The meteorological input to ARCON96 consists of hourly values of wind speed, wind direction, and atmospheric stability class. The χ/Q values calculated through

ARCON96 are based on the theoretical assumption that material released to the atmosphere will be normally distributed (Gaussian) about the plume centerline. A straight-line trajectory is assumed between the release points and receptors. The diffusion coefficients account for enhanced dispersion under low wind speed conditions and in building wakes.

The meteorological input to ARCON96 used by the COL applicant consisted of wind speed, wind direction, and atmospheric stability data based on hourly onsite data from a 5 year period from 2001 through 2004 and 2006. The wind data were obtained from the 10-meter and 60-meter levels of the onsite meteorological tower, and the stability data were derived from the vertical temperature difference (delta-temperature) measurements taken between the 60-meter and 10-meter levels on the onsite meteorological tower.

Hourly meteorological data are used to calculate hourly χ/Q values. The staff conducted ARCON96 modeling based on hourly onsite meteorological data provided by CPNPP for the years 2001 through 2004 and 2006. The model results are then combined to estimate χ/Q values ranging in duration from 2 hours to 30 days. Cumulative frequency distributions are prepared from the average χ/Q values, along with the χ/Q values that are exceeded no more than five percent of the time for each averaging period.

ARCON96 modeling was conducted by the COL applicant to evaluate impacts at the Control Room emergency intakes and TSC intakes. Consistent with the DCD, sources modeled included: (1) The plant vent; (2) ground level containment releases; (3) main steam relief valve and safety valve releases; (4) steam line break releases; and (5) fuel handling area releases. ARCON96 model results for the different averaging periods are compared with the US-APWR DCD values in CPNPP COL FSAR Table 2.0-1R. ARCON96 0 – 2 and 2 – 8 hour averaging period χ/Q values were conservatively compared with the US-APWR DCD 0 – 8 hour averaging period χ/Q value. This method is considered acceptable by the staff because the 0 – 2 and 2 - 8 hour averaging period χ/Q values will normally result in a more conservative estimate than the 0 – 8 hour averaging period χ/Q values.

In all cases, except one, ARCON96 model χ/Q values were below the US-APWR DCD values. The one exception occurred at the TSC intake, with a release from a main steam line break (west side). Under this scenario, ARCON96 calculated χ/Q value for the 4 – 30 day averaging period is 2.4E-04 s/m^3, while the DCD value is 2.3E-04 s/m^3. In RAI 4613, Question 02.03.04-11, the staff requested that the COL applicant address the exceedance of this US-APWR site characteristic χ /Q value at the CPNPP TSC. In a June 25, 2010, response to RAI 4613, Question 02.03.04-11, the COL applicant clarified that acceptability of this χ/Q value is addressed in CPNPP COL FSAR Chapter 15 which considers onsite and offsite dose consequences of a steam line break. This χ/Q value will be evaluated as part of the staffs' SE for Chapter 15. Accordingly, the staff considers the COL applicant's June 25, 2010, response to RAI 4613, Question 02.03.04-11 acceptable and, therefore, considers this RAI resolved.

During its review, the staff noted that the COL applicant did not model the control room and TSC inleakage cases directly. Therefore, in RAI 4613, Question 02.03.04-12, the staff requested that the COL applicant include in the CPNPP COL FSAR a discussion on the comparison between the onsite control room χ/Q values and the US-ASPWR inleakage χ/Q values. In a June 25, 2010, response to RAI 4613, Question 02.03.04-12, the COL applicant considered inleakage in a more qualitative manner for the three inleak receptors: (1) Electrical room HVAC intakes; (2) the Reactor Building door; and (3) the Auxiliary Building/TSC heating, ventilation, and air conditioning (HVAC) intakes. For the electrical room HVAC intakes, χ/Q values were conservatively based on the closer of the control HVAC intake or electric room HVAC intake as

these two intakes are in "very close proximity" to each other. The staff finds this approach acceptable. However, the COL applicant did not analyze the Reactor Building door as it "is an interior door" and "not exposed to the environment." The staff conducted ARCON96 model runs at the area leading to the Reactor Building door and determined χ/Q values were below the US-APWR DCD inleakage values. For the Auxiliary Building/TSC HVAC intakes and then inleakage through buildings to the control room, the COL applicant stated that these χ/Q values are bounded by the χ/Q values at the HVAC intakes. The staff agrees with this conclusion, and confirmed this by conducting a comparison of the χ/Q values at the TSC intake against US-APWR DCD inleakage values. Additionally, in the June 25, 2010, response to RAI 4613, Question 02.03.04-12, the COL applicant committed to address χ/Q values for the inleakage pathways. The staff notes that the COL applicant has since updated the CPNPP COL FSAR as stated in its June 25, 2010, response to RAI 4613, Question 02.03.04-12. The staff considers the COL applicant's response acceptable and, therefore, considers this RAI resolved.

In RAI 3558, Questions 02.03.04-4 through 02.03.04-6, the staff requested that the COL applicant provide clarifications related to the ARCON96 input and output files. In RAI 4613, Questions 02.03.04-9 and 02.03.04-10, the staff requested that the COL applicant update the CPNPP COL FSAR to include the information provided in the COL applicant's response to RAI 3558. In a November 11, 2009, response to RAI 3558, Questions 02.03.04-4 through 02.03.04-6, and a June 25, 2010, response to RAI 4613, Questions 02.03.04-9 and 02.03.04-10, the COL applicant committed to updating χ/Q values for the control room and TSC habitability analysis based on ARCON96 modeling. The responses also included an update to CPNPP COL FSAR Table 2.0-1R, a comparison to the US-APWR DCD bounding values, and an update to CPNPP COL FSAR Table 2.3-338 (Sheet 3 of 7) with correct reference to release point elevations above grade. The COL applicant's response to RAI 3558, Question 02.03.04-4, did not compare the TSC χ/Q values to the US-APWR DCD bounding values; therefore, in follow-up RAI 4613, Question 02.03.04-9, the staff requested that the COL applicant compare the TSC χ/Q values to the US-APWR DCD bounding values. In a June 25, 2010, response to RAI 4613, Question 02.03.04-9, the COL applicant committed to revising CPNPP COLA FSAR Table 2.0-1R to include the DCD TSC χ/Q values and the corresponding CPNPP, Units 3 and 4, TSC χ/Q site characteristics. The staff notes that the COL applicant has since updated the CPNPP COL FSAR as stated in its response to these RAIs. Accordingly, the staff finds the COL applicant's responses to these RAIs acceptable and, therefore, considers RAI 3558, Questions 02.03.04-4 through 02.03.04-6 and RAI 4613, Questions 02.03.04-9 and 02.03.04-10 resolved.

By letter dated September 21, 2012, Luminant submitted seismic and hydrology closure plans, which described the relocation of the turbine building and design changes to the essential service water pipe tunnel. As a result of these changes, the Main Control Room and TSC X/Q values are expected to change. In these closure plans, Luminant informed the staff that it plans to submit changes to COLA FSAR Sections 2.0 and 2.3 in February 2013. Since the staff has not yet evaluated these changes for these sections, these changes are being tracked as **Open Item 2.3.4**.

2.3.4.4.3 Hazardous Material Releases

Hazardous material releases and control room habitability will be evaluated as part of the staff's SEs for CPNPP COL FSAR Section 2.2 and Section 6.4, respectively.

2.3.4.4.4 Representativeness and Topographic Effects

These issues are addressed above for Sections 2.3.2.4.8 and 2.3.2.4.9 of the CPNPP COL FSAR.

2.3.4.5 Post-Combined License Activities

There are no post-COL activities related to this section.

2.3.4.6 Conclusion

The staff is reviewing the information in US-APWR DCD, Tier 2, Section 2.3.4 of the under Docket No. 52-021. The results of the staff's technical evaluation of the information related to the site characteristics, incorporated by reference, in the CPNPP COL FSAR will be documented in the staff's SE of the DC application for the US-APWR design. The SE for the US-APWR is not yet complete, and is being tracked as part of **Open Item [1-1].** The staff will update Section 2.3.4 of this SE to reflect the final disposition of the DC application.

The staff concludes that the COL applicant's atmospheric dispersion estimates are acceptable and meet the relevant requirements of 10 CFR 100.21(c)(2). This conclusion is based on the conservative assessments of post-accident atmospheric dispersion conditions that have been made by the COL applicant and the staff from the COL applicant's meteorological data and appropriate diffusion models.

These atmospheric dispersion estimates are appropriate for the assessment of consequences from (1) radioactive releases for DBAs in accordance with 10 CFR 52.79(a)(1)(vi), 10 CFR 100.21(c)(2) and (2) onsite and off-site releases of radiological materials in accordance with GDC 19.

US-APWR DCD, Tier 2, Revision 3, Section 2.3.6, states that a COL applicant shall address the site-specific χ/Q values as specified in US APWR DCD, Tier 2, Section 2.3.4. The staff finds that the COL applicant has provided sufficient information to meet the requirements of the DCD.

2.3.5 Long-Term Atmospheric Dispersion Estimates for Routine Releases (Related to RG 1.206, Section C.III.2, Chapter 2, C.I.2.3.5, "Long-Term Atmospheric Estimates for Routine Releases")

2.3.5.1 Introduction

The long-term diffusion estimates are used to determine the amount of airborne radioactive and hazardous materials expected to reach a specific location during normal operations. The diffusion estimates address the requirement concerning atmospheric dispersion and dry deposition estimates for routine releases of radiological effluents to the atmosphere. The review covers the following specific areas: (1)Atmospheric dispersion and deposition models used to calculate concentrations in air and amount of material deposited as a result of routine releases of radioactive material to the atmosphere; (2) meteorological data and other assumptions used as input to the atmospheric dispersion models; (3) derivation of diffusion parameters (e.g., σ_z); (4) atmospheric dispersion (relative concentration) factors (χ/Q values) and deposition factors (D/Q values) used for assessment of consequences of routine airborne radioactive releases; (5) points of routine release of radioactive material to the atmosphere, the characteristics of each release mode, and the location of potential receptors for dose computations; and (6) any

additional information requirements prescribed within the "Contents of Application" sections of the applicable Subparts to 10 CFR Part 52.

2.3.5.2 Summary of Application

CPNPP COL FSAR, Revision 3, Section 2.3.5 incorporates by reference US-APWR DCD, Tier 2, Revision 3, Section 2.3.5.

In addition, in CPNPP COL FSAR Sections 2.3.5.1 and 2.3.5.2, the COL applicant provided the following:

US-APWR COL Information Item

- CP COL 2.3(3)

The COL applicant provided additional information in CP COL 2.3(3) to address COL Information Item 2.3(3), related to the section objective and the calculations for two release pathways to the atmosphere, (plant vent, and evaporation pond). CP COL 2.3(3) addresses long-term χ/Q and D/Q estimates for calculating concentrations in air and the amount of material deposited on the ground as a result of routine releases of radiological effluents to the atmosphere during normal plant operation.

2.3.5.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the DCD.

In addition, the relevant requirements of NRC regulations for the CPNPP long-term atmospheric dispersion estimates for routine releases, and the associated acceptance criteria, are given in NUREG-0800, Section 2.3.5. The applicable regulatory requirements for CPNPP site-specific long-term atmospheric dispersion estimates for routine releases are as follows:

- 10 CFR Part 20, Subpart D, as it relates to demonstrating compliance with dose limits for individual members of the public.

- 10 CFR 50.34a and 10 CFR Part 50, Appendix I, Sections II.B, II.C and II.D, as they relate to the numerical guides for design objectives and limiting conditions for operation to meet the requirements that radioactive material in effluents released to unrestricted areas be kept ALARA.

- 10 CFR 100.21(c)(2), as it relates to establishing atmospheric dispersion site characteristics such that radiological effluent release limits associated with normal operation can be met for any individual located offsite.

Appropriate sections of the following Regulatory Guides are used by the Staff for the identified acceptance criteria:

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

- RG 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I," Revision 1, October 1977.

- RG 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors," Revision 1, July 1977.

- RG 1.112, "Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Power Reactors," Revision 1, March 2007.

The related acceptance criteria from NUREG-0800, Section 2.3.5 are as follows:

- A detailed description of the atmospheric dispersion and deposition models used by the COL applicant to calculate annual average concentrations in air and amount of material deposited as a result of routine releases of radioactive materials to the atmosphere.

- A discussion of atmospheric diffusion parameters, such as vertical plume spread (σ_z) as a function of distance, topography, and atmospheric conditions.

- Meteorological data summaries (onsite and regional) used as input to the dispersion and deposition models.

- Points of routine release of radioactive material to the atmosphere, including the characteristics (e.g., location, release mode) of each release point.

- The specific location of potential receptors of interest (e.g., nearest vegetable garden, nearest resident, nearest milk animal, and nearest meat cow in each 22½-degree direction sector within a 5 mile radius of the site).

- The χ/Q and D/Q values to be used for assessment of the consequences of routine airborne radiological releases as described in RG 1.206, Section 2.3.5.2: (1) Maximum annual average χ/Q values and D/Q values at or beyond the site boundary and at specific locations of potential receptors of interest utilizing appropriate meteorological data for each routine venting location; and (2) estimates of annual average χ/Q values and D/Q values for 16 radial sectors to a distance of 50 miles from the plant using appropriate meteorological data.

2.3.5.4 Technical Evaluation

The staff reviewed CPNPP COL FSAR Section 2.3.5 and checked the referenced DCD to ensure that the combination of the DCD and the information in the CPNPP COL FSAR represent the complete scope of information relating to this review topic. The staff confirmed that the information contained in the COL application and incorporated by reference addresses the required information related to long-term atmospheric dispersion estimates for routine releases. US-APWR DCD, Tier 2, Section 2.3.5 is being reviewed by the staff under Docket No. 52-021. The staff's technical evaluation of the information incorporated by reference related

to long-term atmospheric dispersion estimates for routine releases will be documented in the staff SER of the DC application for the US-APWR design.

The staff reviewed the information in the CPNPP COL FSAR:

US-APWR COL Information Item

- CP COL 2.3(3)

The staff reviewed CP COL 2.3(3) included under CPNPP COL FSAR Sections 2.3.5.1 and 2.3.5.2. This COL information item replaces the US-APWR DCD, Tier 2, Section 2.3.5.1 and adds to US-APWR DCD, Tier 2, Section 2.3.5.2 new Sections 2.3.5.2.1 and 2.3.5.2.2 with information regarding the section objective and the calculations for two release pathways to the atmosphere, (plant vent, and evaporation pond). CP COL 2.3(3) is related to the long-term diffusion estimates included under CPNPP COL FSAR Section 2.3.5. The specific text of this COL information item in US-APWR DCD, Tier 2, Section 2.3.6.5 states:

> 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 SRP 2.3.5 (Reference 2.3-5).

2.3.5.4.1 Atmospheric Dispersion Model

The COL applicant used the NRC-sponsored computer code XOQDOQ (described in NUREG/CR-2919, "XOQDOQ Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations") to estimate χ/Q and D/Q values resulting from routine releases. The XOQDOQ model implements the constant mean wind direction model methodology outlined in RG 1.111, Revision 1.

In RAI 4609, Question 02.03.05-3, the staff requested that the COL applicant justify the use of the XOQDOQ program for modeling long-term dispersion estimates from CPNPP. In a June 7, 2010, response to RAI 4609, Question 02.03.05-3, the COL applicant provided a justification based on the lack of spatial or temporal variations in atmospheric transport and diffusion conditions in the site area. The COL applicant committed to providing this information in the next revision of the CPNPP COL FSAR. The staff notes that the COL applicant has since updated the CPNPP COL FSAR as stated in its June 7, 2010, response to RAI 4609, Question 02.03.05-3. Accordingly, the staff finds the COL applicant's response acceptable and, therefore, considers this RAI resolved.

The XOQDOQ model is a straight-line Gaussian plume model based on the theoretical assumption that material released to the atmosphere will be normally distributed (in a Gaussian fashion) regarding the plume centerline. In predictions of χ/Q and D/Q values for long time periods (i.e., annual averages), the plume's horizontal distribution is assumed to be evenly distributed within the downwind direction sector (e.g., "sector averaging"). A straight-line trajectory is assumed between the release point and all receptors. The staff considers the use of the XOQDOQ model consistent with RG 1.111, Revision 1 as: (1) wind and temperature data presented above for the site are consistent with regional weather stations; (2) there is no evidence of spatial or temporal conditions that would significantly alter the diffusion conditions in the region; (3) and the region is for the most part flat or of rolling terrain.

2.3.5.4.2 Plant Vent

The COL applicant conducted modeling of a combined plant vent location for CPNPP, Units 3 and 4. CPNPP COL FSAR Tables 2.3-335, "Minimum Exclusion Area Boundary (EAB) and LPZ Distances," and 2.3-336, "Receptor Locations Within Five Miles," provided EAB receptor distances, distances to the closest residence within 5 miles of plant vents by direction, and the closest garden within 5 miles of the plant vents by direction. From CPNPP COL FSAR Section 2.1.1.2, the CPNPP, Units 3 and 4 EAB extends approximately 800 meters (0.5 miles) from the each reactor center point. The COL applicant assumed a 200 meter (670 foot) release boundary around the center of the containment structures and calculated the EAB distance from this release boundary. The EAB distance used for the modeling (in all directions) by the COL applicant was 800 meters (2640 feet) (0.5 miles) minus 200 meters (670 feet). This results in an EAB distance of 600 meters (1970 feet). The staff also used the 600 meter (1970 foot) EAB distance for all directions when conducting XOQDOQ modeling, as well as the residence and closest distance to gardens provided in CPNPP COL FSAR Table 2.3-336. The COL applicant also indicated that there were no milk or food animals located within 5 miles of CPNPP.

COL Item 11.3(3) states that the COL applicant is to provide a discussion of the onsite vent design information. Although the plant vent qualified as a mixed-mode release point (part-time ground level and part-time elevated) per RG1.111, the applicant assumed a ground-level release because it is a conservative assumption when compared to a mixed mode release. The staff has confirmed the routine release atmospheric dispersion and deposition estimates using a ground-level release for both the plant vent and the evaporation pond release points.

Using CPNPP COL FSAR Figure 2.1-205, the staff confirmed the EAB distance of 600 meters (1970 feet) used by the COL applicant for modeling the distance to the EAB. This is based on a release boundary of 200 meters (670 feet) around the center of each containment structure. From the CPNPP COL FSAR site plot plan (CPNPP COL FSAR Figure 2.1-201), the staff finds the 200 meter (670 foot) release boundary suitable for estimating χ/Q values at the EAB.

XOQDOQ also generates receptors for the 16 compass directions from 0.25 miles to 1.00 mile at 0.25 mile increments; 1.00 mile to 5.00 miles at 0.50 mile increments; 5.00 miles to 10.00 miles at 2.5 mile increments; and 10.00 miles to 50.00 miles at 5.00 mile increments.

Building wake effects in the XOQDOQ model were utilized by the COL applicant based on a building height of 69.9 meters and minimum building cross sectional area of 2500 square meters. These are the same values used above for the PAVAN modeling. XOQDOQ modeling, as conducted by the staff, was based on the same building parameters to account for building wake effects.

Consistent with NRC guidance, the COL applicant provided the following results in CPNPP COL FSAR Tables 2.3-340 through 2.3-346 for the receptors modeled:

- χ/Q No Decay and Undepleted
- χ/Q No Decay and Depleted
- χ/Q 2.26 Day Decay and Undepleted
- χ/Q 8.00 day Decay and Depleted
- D/Q Dry deposition

Modeling conducted by the COL applicant demonstrated maximum χ/Q and D/Q values of 5.5E-06 s/m^3 and 5.5E-08 m^{-2} at the EAB in the north-northwest direction. XOQDOQ modeling conducted by the staff noted results consistent with those in the CPNPP COL FSAR.

The maximum χ/Q value (of 5.5E-06 s/m^3) is bounded by the US-APWR DCD of 1.6E-05 s/m^3 (EAB annual average), while the maximum D/Q value (of 5.5E-08 m^{-2}) is not bounded by the US-APWR DCD of 4.0E-08 m^{-2} (EAB annual average). In RAI 4609, Question 02.03.05-5, the staff requested that the COL applicant justify the annual average D/Q values presented in the CPNPP COL FSAR. In a June 7, 2010, response to RAI 4609, Question 02.03.05-5, the COL applicant stated that the "purpose of comparing site characteristics with DCD site parameters is to determine if the DCD values are bounding, thereby allowing credit for the DCD evaluations and analyses. Implicit in this approach is the understanding that exceeding the DCD site parameters will require a site-specific evaluation." The COL applicant also stated, "additional site-specific dose analyses provided in FSAR Subsection 11.3.3.1 demonstrate that the regulatory limits of 10 CFR 50, Appendix I are met." Accordingly, the staff finds the COL applicant's June 7, 2010, response to RAI 4609, Question 02.03.05-5 acceptable and, therefore, considers this RAI resolved.

2.3.5.4.3 Evaporation Pond

Analysis of the evaporation pond was also conducted independently by the staff using the XOQDOQ model. The COL applicant provided the distance from the evaporation pond to the EAB in CPNPP COL FSAR Table 2.3-349. These values were confirmed by estimating distances using CPNPP COL FSAR Figures 2.1-201 and 2.1-205. In general, the staff calculated that the evaporation pond to EAB distances (by direction) were slightly greater than those provided in CPNPP COL FSAR Table 2.3-349. For four directions, the staff used the independently calculated distances in the XOQDOQ modeling, while using the distances in CPNPP COL FSAR Table 2.3-349 for the other directions. Modeling conducted by the staff also used the following assumptions as described by the applicant in the CPNPP COL FSAR: (1) Ground level release; (2) no building influence; (3) meteorological data from 2001 through 2004 and 2006; and (4) the evaporation pond conservatively modeled as a point source.

For the evaporation pond, the COL applicant calculated maximum χ/Q and D/Q values of 5.2E-05 s/m^3 and 2.3E-07 m^{-2} at the EAB. Values calculated by the staff were similar to those values given in the CPNPP COL FSAR. Therefore, in RAI 4609, Question 02.03.05-4, the staff requested that the COL applicant justify the annual average χ/Q and D/Q values presented in the CPNPP COL FSAR for the evaporation pond. In a June 7, 2010, response to RAI 4609, Question 02.03.05-4, the COL applicant stated that, because there are no DCD site parameters, a dose evaluation for the evaporation pond is provided in CPNPP COL FSAR Section 11.3.3.1 to evaluate this site specific source. Accordingly, the staff finds the COL applicant's response acceptable and, therefore, considers RAI 4609, Question 02.03.04-5 resolved.

2.3.5.5 Post-Combined License Activities

There are no post-COL activities related to this section.

2.3.5.6 Conclusion

The staff is reviewing the information in US-APWR DCD, Tier 2, Section 2.3.5 under Docket No. 52-021. The results of the staff's technical evaluation of the information related to the site characteristics incorporated by reference in the CPNPP COL FSAR will be documented in the

staff's SE of the DC application for the US-APWR design. The SE for the US-APWR is not yet complete, and is being tracked as part of **Open Item [1-1].** The staff will update Section 2.3.5 of this SE to reflect the final disposition of the DC application.

Based on the meteorological data provided by the COL applicant and an atmospheric dispersion model that is appropriate for the characteristics of the site and release points, the staff concludes that representative atmospheric dispersion and deposition factors have been calculated for 16 radial sectors from the site boundary to a distance of 80 km (50 mi) as well as for specific locations of potential receptors of interest. The characterization of the atmospheric dispersion and deposition conditions are acceptable to meet the relevant requirements of 10 CFR 100.21(c)(1) and are appropriate for the evaluation to demonstrate compliance with the numerical guides for doses contained in 10 CFR Part 20, Subpart D and 10 CFR Part 50, Appendix I.

US-APWR DCD, Tier 2, Revision 3, Section 2.3.6, states that a COL applicant shall address the site-specific diffusion estimates and χ/Q values as specified in US-APWR DCD, Tier 2, Section 2.3.5. The staff finds that the COL applicant has provided sufficient information to meet the requirements of the DCD.