3.0 Design of Structures, Components, Equipment, and Systems

This chapter provides the results of the U.S. Nuclear Regulatory Commission (NRC) staff (hereinafter referred to as the staff) review of the Comanche Peak Nuclear Power Plant (CPNPP), Units 3 and 4, Combined License (COL), Final Safety Analysis Report (FSAR) Chapter 3.0, "Design Of Structures, Components, Equipment, and Systems," submitted by Luminant Generation Company, LLC, hereinafter referred to as the applicant.

The staff is reviewing the information in the United States-Advanced Pressurized-Water Reactor (US-APWR) Design Control Document (DCD), Chapter 3, "Design of Structures, Components, Equipment, and Systems," under Docket Number 52-021. The results of the staff's technical evaluation of the information related to DCD Chapter 3, incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR, will be documented in the staff's safety evaluation (SE) of the design certification (DC) application for the US-APWR design. The SE for the US-APWR is not yet complete and this is being tracked as part of Open Item [1-1]. The staff will update Chapter 3 of this safety evaluation report (SER) to reflect the final disposition of the DC application.

3.1 Conformance with NRC General Design Criteria

Conformance with all the general design criteria (GDCs) of Appendix A, "General Design Criteria for Nuclear Power Plants," to Part 50, "Licensing of," of Title 10, "Energy," of the *Code of Federal Regulations* (10 CFR Part 50) applicable to FSAR, Chapter 3 is discussed in each individual Chapter 3, FSAR section and corresponding SER section to which they are applicable. Therefore, the general discussion in the FSAR was not reviewed.

3.2 Classification of Structures, Systems, and Components

Section 3.2 addresses the classification of structures, systems, and components (SSCs) by safety classification, seismic category, quality group, and codes and standards. This SER section presents a review of the methodology used in the categorization of SSCs in the CPNPP, Units 3 and 4, COL FSAR.

3.2.1 Seismic Classification

3.2.1.1 Introduction

Nuclear power plant systems and components important to safety must be designed to withstand the effects of earthquakes without loss of capability to perform their safety functions. The earthquake against which these plant features are designed is defined as the safe shutdown earthquake (SSE). The SSE is based upon an evaluation of the maximum earthquake potential and is the earthquake which produces the maximum vibratory ground motion for which SSCs important to safety are designed to remain functional. Those plant features that are designed to remain functional if an SSE occurs are designated seismic Category I in NRC Regulatory Guide (RG) 1.29.

The objective of the staff review is to determine whether SSCs important to safety have been appropriately identified, categorized and designed to withstand the effects of earthquakes without loss of capability to perform their safety functions.

3.2.1.2 Summary of Application

Section 3.2.1, "Seismic Classification," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference Section 3.2.1 of the US-APWR DCD, Revision 3.

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.2, "Classification of Structures, Systems, and Components," the applicant provided the following information:

US-APWR COL Information Items

- STD COL 3.2(4) and CP COL 3.2(4)

The applicant provided additional information in STD COL 3.2(4) and CP COL 3.2(4) to satisfy COL Information Item 3.2(4) in the DCD, Revision 3, regarding the site-specific safety-related systems and components designed to withstand earthquakes. STD COL 3.2(4) applies to Section 3.2.1.2, "Classifications," and CP COL 3.2(4) applies to Table 3.2-201, "Classification of Site-Specific Mechanical and Fluid Systems, Components, and Equipment," and Table 3.2-202, "Codes and Standards Applicable to Site-Specific Mechanical and Fluid Systems, Components, and Equipment."

- STD COL 3.2(5) and CP COL 3.2(5)

The applicant provided additional information in STD COL 3.2(5) and CP COL 3.2(5) to satisfy COL Information Item 3.2(5) in the DCD, Revision 3, regarding equipment class and seismic category. STD COL 3.2(5) applies to Section 3.2.2, "System Quality Group Classification," and CP COL 3.2(5) applies to Table 3.2-201.

- STD COL 3.2(6) and CP COL3.2(6)

The applicant provided additional information in STD COL 3.2(6) and CP COL 3.2(6) to satisfy COL Information Item 3.2(6) in the DCD, Revision 3, regarding equipment class and seismic category of risk-significant, nonsafety-related SSCs. STD COL 3.2(6) applies to Section 3.2.2.5, "Other Equipment Classes," and CP COL 3.2(6) applies to Table 3.2-201.

3.2.1.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed within the Final Safety Evaluation Report (FSER) related to the US-APWR DCD.

In addition, the relevant requirements of the Commission's regulations for the seismic classification of SSCs, and the associated acceptance criteria, are given in Section 3.2.1, "Classification of Structures, Systems, and Components," Revision 2, issued March 2007, of NUREG-0800, "Standard Review Plant for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR *[light-water reactor]* Edition," the SRP.

The applicable regulatory requirements for the seismic classification of SSCs are as follows:

1. GDC 1, “Quality Standards and Records,” and the pertinent quality assurance (QA) requirements of 10 CFR Part 50, Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” as they relate to applying QA requirements to activities affecting the safety-related functions of SSCs designated as seismic Category I commensurate with their importance to safety.

2. GDC 2, “Design Bases for Protection Against Natural Phenomena,” which requires that SSCs important to safety be designed to withstand the effects of earthquakes without loss of capability to perform necessary safety functions.

3. GDC 61, “Fuel Storage and Handling and Radioactivity Control,” as it relates to the design of radioactive waste systems, and other systems that may contain radioactivity, to assure adequate safety under normal and postulated accident conditions.

4. 10 CFR Part 100, Appendix A, “Seismic and Geologic Siting Criteria for Nuclear Power Plants,” and 10 CFR Part 50, Appendix S, “Earthquake Engineering Criteria for Nuclear Power Plants,” as they relate to certain SSCs being designed to withstand the SSE and remain functional.

5. 10 CFR 52.80(a), which requires that a COL application (COLA) contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act of 1954, and the NRC's regulations.

The related acceptance criteria are as follows:

1. RG 1.29, “Seismic Design Classification,” Revision 4, issued March 2007, provides an acceptable method of identifying and classifying those plant features that should be designed to withstand the effects of the SSE. GDC 2, Appendix A to 10 CFR Part 100 and Appendix S to 10 CFR Part 50, regarding seismic design classification are met by using guidance provided in RG 1.29.

2. RG 1.143, “Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants,” Revision 2, issued November 2001, provides guidance used to establish the seismic design requirements of radioactive waste management SSCs to meet the requirements of GDC 2 and GDC 61, as they relate to designing these SSCs to withstand earthquakes. The guide identifies several radioactive waste SSCs requiring some level of seismic design consideration.

3. RG 1.151, “Instrument Sensing Lines,” Revision 0, issued July 1983, provides guidance with regard to seismic design requirements and classification of safety-related instrumentation sensing lines.

4. RG 1.189, “Fire Protection for Nuclear Power Plants,” Revision 1, issued March 2007, provides guidance used to establish the design requirements of fire protection to meet the requirements of GDC 2, as it relates to designing these SSCs to withstand earthquakes. This guide identifies portions of fire protection SSCs requiring some level of seismic design consideration.

3.2.1.4 Technical Evaluation

The staff reviewed Section 3.2.1 of the CPNPP, Units 3 and 4 COL FSAR and checked the referenced US-APWR DCD to ensure that the combination of the DCD and the information in the COL represents the complete scope of information relating to this review topic. The staff’s review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to the seismic classification of SSCs. Section 3.2.1 of the DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff’s technical evaluation of the information incorporated by reference related to the seismic classification of SSCs will be documented in the staff’s SER on the DC application for the US-APWR design.

The staff reviewed the information contained in Section 3.2.1 of the CPNPP, Units 3 and 4, COL FSAR:

US-APWR COL Information Items

- STD COL 3.2(4)

The staff reviewed STD COL 3.2(4) related to COL Information Item 3.2(4), included under Section 3.2.1 of the CPNPP, Units 3 and 4, COL FSAR. The applicant replaced the last sentence of first paragraph in DCD Tier 2, Section 3.2.1.2 with the following:

> The site-specific, safety-related systems and components that are designed to withstand the effects of earthquakes without loss of capability to perform their safety function are identified in Table 3.2-201. The industry codes and standards applicable to those components are listed in Table 3.2-202.

- CP COL 3.2(4)

The staff reviewed CP COL 3.2(4) related to COL Information Item 3.2(4), included as Tables 3.2-201 and 3.2-202 of the CPNPP Units 3 and 4 COL FSAR.

- STD COL 3.2(5)

The staff reviewed STD COL 3.2(5) related to COL Information Item 3.2(5), included under Section 3.2.2 of the CPNPP, Units 3 and 4, COL FSAR. The applicant replaced the last sentence of the eleventh paragraph in DCD Tier 2, Section 3.2.2 with the following:

> The equipment class and seismic category of the site-specific safety-related and nonsafety-related fluid systems, components (including pressure retaining), and equipment as well as the applicable industry codes and standards are provided in Table 3.2-201.

- CP COL 3.2(5)

The staff reviewed CP COL 3.2(5) related to COL Information Item 3.2(5), included as Table 3.2-201 of the CPNPP Units 3 and 4 COL FSAR.

- STD COL 3.2(6)

The staff reviewed STD COL 3.2(6) related to COL Information Item 3.2(6), included under Section 3.2.2.5 of the CPNPP, Units 3 and 4, COL FSAR. The applicant replaced the third paragraph in DCD Tier 2, Section 3.2.2.5 with the following:

> DCD methods of equipment classification and seismic categorization of risk-significant, nonsafety-related SSCs based on their safety role assumed in the PRA [probabilistic risk assessment] and treatment by the D-RAP [Design Reliability Assurance Program] described in Chapter 17 are applied to Table 3.2-201.

- CP COL 3.2(6)

The staff reviewed CP COL 3.2(6) related to COL Information Item 3.2(6), included as Table 3.2-201 of the CPNPP, Units 3 and 4, COL FSAR.

The CPNPP, Units 3 and 4, COL FSAR applies the same classification approach as the DCD for seismic classifications. Seismic classification for principal site-specific pressure-retaining systems and their supports with their corresponding equipment class are identified in CPNPP, Units 3 and 4, COL FSAR, Table 3.2-201 with reference notes to codes and standards. The staff determined that additional review was needed to make a reasonable safety conclusion.

For site-specific SSCs that are not identified in DCD Tier 2, Table 3.2-2, "Classification of Mechanical and Fluid Systems, Components, and Equipment," and DCD Tier 2, Table 3D-2, "US-APWR Environmental Qualification Equipment List," the staff reviewed the following areas and determined that additional information was needed to evaluate this COL supplemental information.

Compliance with Regulatory Guidance

The applicant addresses COL Information Item 3.2(4) by providing site-specific SSCs in CPNPP, Units 3 and 4, COL FSAR Table 3.2-201. CPNPP, Units 3 and 4, COL FSAR Tables 1.9-201, "Comanche Peak Nuclear Power Plant Units 3 & 4 Conformance with Division 1 Regulatory Guides," and 9.5.1-1R, "CPNPP Units 3 & 4 Fire Protection Program Conformance with RG 1.189," do not identify any noncompliance to RG 1.189 seismic classification. The seismic categories of the fire protection system SSCs are properly classified according to the guidelines in RG 1.189. The specific guideline in RG 1.189 includes Regulatory Position 3.2.1 for seismic consideration for the water supply for the standpipes and hose connections for manual firefighting in areas containing equipment required for safe shutdown from a normal seismic Category I water system such as the essential service water system (ESWS). Seismic Category I ESWS piping for CPNPP, Units 3 and 4, is used as the supply for the standpipes and hose connections in areas containing equipment required for safe shutdown. On this basis, the classification of the fire protection system site-specific SSCs meets the guidelines in RG 1.189

and the requirements in GDC 2, 10 CFR Part 100, Appendix A, and 10 CFR Part 50, Appendix S, and is acceptable.

Seismic Category I SSCs

Ultimate heat sink (UHS) system site-specific SSCs are included in CPNPP, Units 3 and 4, COL FSAR Table 3.2-201. The safety-related UHS SSCs including the cooling tower basins are properly classified as seismic Category I to ensure that they will remain functional during and after an SSE. The UHS for CPNPP, Units 3 and 4, comprises the cooling towers. The UHS-related structures, which include the UHS cooling towers, are classified as seismic Category I in the US-APWR DCD.

Site-specific UHS ESW pump house ventilation system SSCs are also included in CPNPP, Units 3 and 4, COL FSAR Table 3.2-201. The safety-related UHS ESW pump house ventilation system SSCs are properly classified as seismic Category I to ensure that they will remain functional during and after an SSE. This meets the Regulatory Position C.1 of RG 1.29.

To assure that the design or location of any site-specific seismic Category I SSCs, for example pipe tunnels or duct banks, will not expose those SSCs to possible impact due to the failure or collapse of non-seismic Category I structures, or other SSCs such as heavy haul route loads, transmission towers, nonsafety-related storage tanks, etc., the staff reviewed STD COL 3.7(9) related to COL Information Item 3.7(9), included under Section 3.7.2.8, "Interaction of Non-Seismic Category I Structures with Seismic Category I Structures," of the CPNPP, Units 3 and 4, COL FSAR. In order to address COL Information Item 3.7(9), the applicant replaced the seventh paragraph in US-APWR DCD Section 3.7.2.8 with the following:

> The site-specific Category I SSCs are the UHSRS [UHS-related structures], the ESWPT [essential service water (ESW) pipe tunnels], and the PSFSV [power source fuel storage vault]. The layout design of the site-specific seismic Category I SSCs ensures that there are no adjacent non-seismic Category I structures which may adversely affect these structures, to protect them from structural failure of non-seismic Category I structures.

The applicant's proposed approach to address COL Information Item 3.7(9) will ensure that function of seismic Category I SSCs will not be reduced by the failure of non-seismic Category I SSCs. This meets the Regulatory Position C.2 of RG 1.29, and is acceptable.

List of SSCs Needed for Continued Operation

Appendix S to 10 CFR Part 50, Section IV(a)(2)(i)(B)(I), states that SSCs necessary for continued operation without undue risk to the health and safety of the public must remain functional and within applicable stress, strain, and deformation limits when subject to the effects of the Operating Basis Earthquake (OBE) ground motion. SRP Section 3.2.1 states that, if the applicant has set the OBE ground motion to a value of one-third of the SSE ground motion, then the applicant should also provide a list of SSCs necessary for continued safe operation that must remain functional without undue risk to the health and safety of the public and within applicable stress, strain and deformation, during and following the OBE. CPNPP, Units 3 and 4, COL FSAR Section 3.7.1.1, "Design Ground Motion," states that the value of the OBE ground motion that serves as the basis for defining the criteria for shutdown of the plant is one-third of the site-specific SSE ground motion. In request for additional information (**RAI) 2758, Question 03.02.01-1**, the staff requested the applicant to provide the list of site-specific SSCs

necessary for continued operation. If there are no site-specific SSCs necessary for continued operation, the staff requested the applicant to state that in the CPNPP, Units 3 and 4, COL FSAR. In its response to **RAI 2758, Question 03.02.01-1,** dated October 19, 2009, the applicant indicated that the site-specific SSCs necessary for continued operation are classified as Equipment Class 1, 2 and 3 in CPNPP, Units 3 and 4, COL FSAR Table 3.2-201. The staff finds the response acceptable since the applicant has adequately addressed the need for the list. Accordingly, **RAI 2758, Question 03.02.01-1, is resolved and closed.**

3.2.1.5 Post Combined License Activities

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

3.2.1.6 Conclusions

The staff reviewed the application and checked the referenced US-APWR DCD. The staff's review confirmed that the applicant addressed the required information relating to seismic classification of SSCs, and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is reviewing the information in US-APWR DCD Tier 2, Section 3.2.1 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to the seismic classification of SSCs incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's SE on the DC for the US-APWR design. The SE on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.2.1 of this SER to reflect the final disposition of the US-APWR DC application.

The staff concludes that the relevant information presented within the CPNPP, Units 3 and 4, COL FSAR is acceptable and meets the requirements of GDC 1, 2, and 61, 10 CFR Part 50, Appendix B, 10 CFR Part 50, Appendix S, 10 CFR Part 100, Appendix A, and 10 CFR 52.80(a) regarding seismic classification in accordance with the regulatory guidance in RG 1.29 and SRP Section 3.2.1. The staff based its conclusion on the following:

- STD COL 3.2(4), CP COL 3.2(4), STD COL 3.2(5), CP COL 3.2(5), STD COL 3.2(6) and CP COL 3.2(6) as they relate to implementing the seismic classification are acceptable because site-specific SSCs have been classified consistent with RG 1.29.

- On the basis of its review of CPNPP, Units 3 and 4, COL FSAR, Section 3.2.1, the applicable simplified piping and instrumentation diagrams (P&IDs), and other supporting information in the CPNPP, Units 3 and 4, COL FSAR, the staff concludes that the CPNPP, Units 3 and 4, safety-related site-specific SSCs, including their supports, are properly classified as seismic Category I, in accordance with Regulatory Position 1 of RG 1.29. In addition, the staff finds that the CPNPP, Units 3 and 4, COL FSAR includes acceptable consistency with Regulatory Position 2 of RG 1.29 that the necessary site-specific SSCs are properly classified as Seismic Category II. Finally the staff finds that necessary site-specific fire protection system SSCs are properly classified as seismic Category II-SSE, consistent with the guidance in RG 1.189.

3.2.2 System Quality Group Classification

3.2.2.1 Introduction

Nuclear power plant systems and components important to safety should be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed. The classification of fluid systems important to safety identifies the safety function to be performed and its importance to safety. Once the safety function performed by the fluid system is identified and its importance to safety is determined, applicable construction codes and standards are identified. This is the approach used for the US-APWR.

The objective of the staff's review is to determine whether SSCs important to safety have been identified and appropriately categorized and whether appropriate codes and standards for design, erection, fabrication and testing have been selected commensurate with their importance to safety in accordance with the requirements of GDC 1 and the positions in RG 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants" Revision 4, issued March 2007.

3.2.2.2 Summary of Application

Section 3.2.2, "System Quality Group Classification," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates, by reference, Section 3.2.2 of the US-APWR DCD, Revision 3.

In addition, in CPNPP, Units 3 and 4, COL FSAR, Section 3.2.2, the applicant provided the following information:

US-APWR COL Information Items

- STD COL 3.2(5) and CP COL3.2(5)

The applicant provided additional information in STD COL 3.2(5) and CP COL 3.2(5) to satisfy COL Information Item 3.2(5), regarding equipment class and seismic category. STD COL 3.2(5) applies to Section 3.2.2, and CP COL 3.2(5) applies to Table 3.2-201, "Classification of Site-Specific Mechanical and Fluid Systems, Components, and Equipment."

- STD COL 3.2(6) and CP COL3.2(6)

The applicant provided additional information in STD COL 3.2(6) and CP COL 3.2(6) to satisfy COL Information Item 3.2(6) in the DCD, Revision 3, regarding equipment class and seismic category of risk-significant, nonsafety-related SSCs. STD COL 3.2(6) applies to Section 3.2.2.5, "Other Equipment Classes," and CP COL 3.2(6) applies to Table 3.2-201.

3.2.2.3 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 the Commission's regulations pertaining to system quality group (QG) classification, and the associated acceptance criteria, are given in

Section 3.2.2, “System Quality Group Classification,” Revision 2, issued March 2007, of NUREG-0800.

The applicable regulatory requirements for the system quality group classification are as follows:

> GDC 1, and 10 CFR 50.55a, as they relate to SSCs important to safety being designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed.

The related acceptance criteria are as follows:

1. RG 1.26 provides an acceptable method of meeting the requirements of GDC 1 and 10 CFR 50.55a. This guide describes an acceptable method for determining quality standards for QG B, C, and D, water- and steam-containing components important to safety in light-water-cooled nuclear power plants.

2. RG 1.206, “Combined License Applications for Nuclear Power Plants (LWR Edition),” issued June 2007, Section C.I.3.2.2, “System Quality Group Classification,” states that the applicant should identify those fluid systems or portions thereof that are important to safety and outside the scope of the referenced certified design, as well as the applicable industry codes and standards for each pressure-retaining component.

3. RG 1.143, “Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants,” Revision 2, issued November 2001, and RG 1.151, “Instrument Sensing Lines,” Revision 0, issued July 1983, as discussed in SRP Section 3.2.2, Appendix A.

3.2.2.4 Technical Evaluation

The staff reviewed Section 3.2.2 of the FSAR and checked the referenced US-APWR DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic. The staff’s review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to system QG classification. Section 3.2.2 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff’s technical evaluation of the information incorporated by reference related to system QG classification will be documented in the staff’s SER on the DC application for the US-APWR design.

The staff reviewed the information contained in Subsection 3.2.2 of the CPNPP, Units 3 and 4, COL FSAR:

US-APWR COL Information Item

- STD COL 3.2(5)

The staff reviewed STD COL 3.2(5) related to COL Information Item 3.2(5) included under Section 3.2.2 of the CPNPP, Units 3 and 4, COL FSAR. The applicant replaced the last sentence of the eleventh paragraph in DCD Section 3.2.2 with the following:

> The equipment class and seismic category of the site-specific safety-related and nonsafety-related fluid systems, components (including pressure retaining), and equipment as well as the applicable industry codes and standards are provided in Table 3.2-201.

- CP COL 3.2(5)

The staff reviewed CP COL 3.2(5) related to COL Information Item 3.2(5), included as Table 3.2-201 of the CPNPP, Units 3 and 4, COL FSAR.

- STD COL 3.2(6)

The staff reviewed STD COL 3.2(6) related to COL Information Item 3.2(6), included under Section 3.2.2.5 of the CPNPP, Units 3 and 4, COL FSAR. The applicant replaced the third paragraph in DCD Tier 2, Section 3.2.2.5 with the following:

> DCD methods of equipment classification and seismic categorization of risk-significant, nonsafety-related SSCs based on their safety role assumed in the PRA and treatment by the D-RAP described in Chapter 17 are applied to Table 3.2-201.

- CP COL 3.2(6)

The staff reviewed CP COL 3.2(6) related to COL Information Item 3.2(6), included as Table 3.2-201 of the CPNPP, Units 3 and 4, COL FSAR.

The CPNPP, Units 3 and 4, COL FSAR applies the same classification approach as the DCD for QG classifications. QGs for principal site-specific pressure retaining systems and their supports with their corresponding Equipment Class are identified in CPNPP, Units 3 and 4, COL FSAR Table 3.2-201 with reference notes to codes and standards. The staff determined that additional information was needed to make a reasonable safety conclusion. In various RAIs the applicant was requested to provide sufficient information regarding the QG classification of site-specific SSCs.

Codes and Standards

Section 50.55a of 10 CFR Part 50 identifies specific editions of codes that are to be applied to systems and components classified as QG A, B and C. RG 1.206 states that the applicant should provide a table showing compliance with the NRC's regulations in 10 CFR 50.55a. This table should identify the piping system and associated supports.

SRP Section 3.2.2 provides that the staff should review applications using the newest codes and standards that have been endorsed by the NRC and unapproved editions will be reviewed on a case-by-case basis. CPNPP, Units 3 and 4, COL FSAR Table 3.2-201 and its notes do not define editions for codes and standards or applicable codes and standards for certain SSCs, such as the UHS ESW pump house ventilation system. In **RAI 2757, Question 03.02.02-1**, the staff requested the applicant to clarify which editions of codes and standards apply to the SSCs included in CPNPP, Units 3 and 4, COL FSAR, Table 3.2-201 and, for SSCs that refer to codes and standards defined in the design bases, to identify what commercial codes and standards

apply. If this information is to be determined later, the applicant was requested to advise when this information will be available.

In its response to **RAI 2757, Question 03.02.02-1**, dated November 5, 2009, the applicant submitted a list of codes and standards including their editions that apply to the SSCs listed in CPNPP, Units 3 and 4, COL FSAR Table 3.2-201, but the CPNPP, Units 3 and 4, COL FSAR was not revised to reflect these codes and standards editions. The response stated that additional codes and standards may be identified during the detailed design and fabrication. The response also stated that a more definitive list will be available onsite during the detailed design phase. The codes and standards identified in the response is a fairly comprehensive list of recent editions of commonly used industrial codes and standards. To support the review of specific editions on a case by case basis, the staff believes that these editions of codes and standards should be referenced in the CPNPP, Units 3 and 4, COL FSAR, although it is understood that editions may be updated during detailed design and procurement. Therefore, the staff closed, as unresolved, **RAI 2757, Question 03.02.02-1,** and in follow-up **RAI 5090, Question 03.02.02-5,** the staff requested the applicant to either reference specific editions of codes and standards included in other FSAR sections or revise the FSAR to include the specific code editions described in the RAI response. The follow-up RAI question further requested the applicant to identify any other sections of the DCD and FSAR in which pertinent codes and standards and their editions are cited.

In its response to **RAI 5090, Question 03.02.02-5**, dated November 18, 2010, the applicant submitted a list of codes and standards including the revision dates that applied to SSCs listed in CPNPP, Units 3 and 4, COL FSAR, Table 3.2-201. The applicant also added a new table, CPNPP, Units 3 and 4, COL FSAR, Table 3.2-202, "Codes and Standards Applicable to Site-Specific Mechanical and Fluid Systems, Components, and Equipment," which contains a list of major codes and standards applicable to the design of SSCs in CPNPP, Units 3 and 4, COL FSAR, Table 3.2-201. In addition, the applicant revised CPNPP, Units 3 and 4, COL FSAR, Section 3.2.1.2 to reference CPNPP, Units 3 and 4, COL FSAR, Table 3.2-202. The staff confirmed that the FSAR changes were incorporated in CPNPP, Units 3 and 4, COL FSAR, Revision 3. Accordingly, **RAI 5090, Question 03.02.02-5, is resolved and closed.**

Piping and Instrumentation Diagrams

RG 1.206 states that the classifications should be marked/noted on drawings at valves or other appropriate locations in each fluid system where the respective classification changes in terms of the NRC group classification letters (for example, from A to B, B to C, C to D, as well as other combinations) or, alternatively, in terms of corresponding classification notations that can be referenced with those classification groups in RG 1.26, RG 1.143, and RG 1.151, as applicable.

SRP Section 3.2.2 indicates that the review includes the applicant's presentation on suitable P&IDs of the system QG classifications. Site-specific system P&IDs, such as CPNPP, Units 3 and 4, COL FSAR Figure 9.2.1-1R, "Essential Service Water System Piping and Instrumentation Diagram," for the ESWS, do not appear to show the system QG classifications or boundaries. (The staff notes that DCD Tier 2, Figure 9.2.1-1, "Essential Service Water System Piping and Instrumentation Diagram," was incorporated by reference in CPNPP, Units 3 and 4, COL FSAR, Revision 3 so CPNPP, Units 3 and 4, COL FSAR Figure 9.2.1-1R is no longer used.) In **RAI 2757, Question 03.02.02-2**, the staff requested the applicant to show the QG classifications and boundaries on these figures or otherwise clarify if the final P&IDs will be available for audit.

In its response to **RAI 2757, Question 03.02.02-2**, dated November 5, 2009, the applicant clarified that system QG and boundaries are not shown on P&IDs, but equipment classes and boundaries are shown and the corresponding QG can be determined from the description in DCD Tier 2, Section 3.2.2, DCD Tier 2, Table 3.2-2, "Classification of Mechanical and Fluid Systems, Components, and Equipment," and CPNPP, Units 3 and 4, COL FSAR Table 3.2-201. The availability for audit of the final P&IDs is evaluated and resolved below under **RAI 2757, Question 03.02.02-4**. Therefore, the staff finds the response acceptable since equipment classes that correspond to QGs are shown on P&IDs. Accordingly, **RAI 2757, Question 03.02.02-2, is resolved and closed.**

Circulating Water System Classification

Although the circulating water system (CWS) does not have safety-related functions, the failure of the CWS piping may have adverse consequences on important to safety SSCs due to its location or large size. This system is also important for continued plant operation. Therefore, the CWS is normally constructed to industry quality standards that are intended to minimize the potential for such a failure. SRP Section 10.4.5, "Circulating Water System," Revision 3, issued March 2007, identifies that the CWS is designed to QG D. The CWS is not classified in CPNPP, Units 3 and 4, COL FSAR Table 3.2-201 or DCD Tier 2, Table 3.2-1, "Non-Safety Components Required for Normal Shutdown," and it is not clear what quality standards including codes and standards are applied to the design and construction of this piping. In **RAI 2757, Question 03.02.02-3**, the staff requested the applicant to identify the QG and appropriate codes and standards that apply to the design and construction of this CWS piping.

In its response to **RAI 2757, Question 03.02.02-3**, dated November 5, 2009, the applicant stated that the DCD Tier 2, Section 3.2.2 and Table 3.2-1 have been revised to reflect current US-APWR classifications and that the CWS and its components have been classified as Equipment Class 9 and QG N/A. The response further clarified that failure of the CWS or its components will have no detrimental effect on any safety-related equipment. In addition, none of the CWS components contain radioactive material. Therefore, the CWS is not designed to any QG standards, but the CWS components meet the intent of the QG D standards based on the following design features described in DCD Tier 2, Section 10.4.5, "Circulating Water System":

> CWS above ground piping is carbon steel and designed and constructed to ASME B31.1 Power Piping Code.
>
> The underground CWS piping are constructed of pre-stressed concrete.
>
> CWS pumps and cooling towers are built to applicable industry and manufacturer's standards.

Although the QG is not consistent with SRP Section 10.4.5, it is reasonable that the CWS in a pressurized water reactor (PWR) will not contain measurable amounts of radioactive material and therefore need not be QG D. Since the above ground piping is designed to ASME B31.1 consistent with QG D, the design of the above ground piping is equivalent to the guidelines of SRP Section 10.4.5 and it is acceptable to not assign QG D to the CWS. Therefore, the staff finds the response acceptable. Accordingly, **RAI 2757, Question 03.02.02-3, is resolved and closed.**

Auditable Information

10 CFR Part 52 requires, in part, that, prior to granting a COL which references a standard DC, that information normally contained in certain specifications be available for audit if such information is needed to make the determination that the application is consistent with the certified design. In **RAI 2757, Question 03.02.02-4,** the staff requested the applicant to confirm that design information contained in procurement specifications concerning the QG classification of all important to safety SSCs and the basis for the classification is available for NRC audit or establish when such design information will be available. In addition, the applicant was requested to clarify what design basis classification information, such as design specifications, P&IDs, and Q-List (the list of SSCs subject to 10 CFR 50 Appendix B), is available for audit.

In its response to **RAI 2757, Question 03.02.02-4**, dated November 5, 2009, the applicant stated that the design information contained in procurement specifications of all important to safety SSCs will be available throughout the procurement and construction phases of the project. The response further stated that the basis for the QG classification is available in CPNPP, Units 3 and 4, COL FSAR Table 3.2-201.

Although the specific QG classification is shown in CPNPP, Units 3 and 4, COL FSAR Table 3.2-201 to be consistent with RG 1.26, the actual component safety function basis for QG classification is not specifically identified in CPNPP, Units 3 and 4, COL FSAR Table 3.2-201. For example, nonsafety-related systems that may contain radioactive material should either be QG D or be consistent with RG 1.143, but the startup steam generator blowdown system does not have a QG classification or RG 1.143 assigned. The staff finds the response acceptable on the basis that the information will not be available until later during the procurement and construction process, inspections, tests, analyses, and acceptance criteria (ITAAC) exist to confirm that ASME piping and component design reports have been prepared. Accordingly, **RAI 2757, Question 03.02.02-4, is resolved and closed.**

3.2.2.5 Post-Combined License Activities

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

3.2.2.6 Conclusion

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to the system QG classification, and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is reviewing the information in DCD Tier 2, Section 3.2.2 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to the system QG classification, incorporated by reference, in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's SER on the DC application for the US-APWR design. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.2.2 of this SER to reflect the final disposition of the DC application.

The staff concludes that the relevant information presented within the CPNPP, Units 3 and 4, COL FSAR Section 3.2.2, is acceptable and meets the requirements of GDC 1, and 10 CFR 50.55a.

The staff based its conclusion on the following:

- STD COL 3.2(5), CP COL 3.2(5), STD COL 3.2(6) and CP COL 3.2(6), as they relate to implementing the system QG classification, are acceptable because site-specific SSCs have been classified consistent with RG 1.26 and conform to the guidelines in SRP Section 3.2.2 and RG 1.206.

3.3 Wind and Tornado Loadings

3.3.1 Wind Loadings

3.3.1.1 Introduction

This section discusses the design of structures that must withstand the effects of the plant's design wind speed.

3.3.1.2 Summary of Application

Section 3.3, "Wind and Tornado Loadings," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, Section 3.3 of the US-APWR DCD, Revision 3. Section 3.3 of the DCD includes Section 3.3.1, "Wind Loadings."

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.3.1, the applicant provided the following information:

US-APWR COL Information Items

- CP COL 3.3(1)

The applicant provided additional information in Comanche Peak (CP) COL 3.3(1) to address COL Information Item 3.3(1) in the DCD, Revision 3 regarding site-specific wind speed requirements. CP COL 3.3(1) applies to Section 3.3.1.1, "Design Wind Velocity and Recurrence Interval."

- CP COL 3.3(4)

The applicant provided additional information in CP COL 3.3(4) to address COL Information Item 3.3(4) in the DCD, Revision 3 regarding site-specific wind load design methods and importance factors and their validation against potential site-specific features promoting channeling effects or buffeting in the wake of upwind obstructions. CP COL 3.3(4) applies to Section 3.3.1.2, "Determination of Applied Forces."

3.3.1.3 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 the Commission's regulations pertaining to wind loadings and the associated acceptance criteria are addressed in Section 3.3.1, "Wind Loadings," Revision 3, issued March 2007, of NUREG-0800.

The applicable regulatory requirements for wind loadings are as follows:

> GDC 2, as it relates to the ability of SSCs important to safety, without loss of capability to perform their safety functions, to withstand the effects of natural phenomena and the appropriate combinations of all loads.

Acceptance criteria adequate to meet the above requirements include:

1. American Society of Civil Engineers (ASCE)/Structural Engineering Institute (SEI) Standard 7-05, "Minimum Design Loads for Buildings and Other Structures," as it relates to design wind speed.

2. SRP Section 2.3.1, "Regional Climatology," Revision 3, issued March 2007, as it relates to application of the 1.15 importance factor to adjust the velocity pressure to an annual probability of exceedance to 0.01 (mean recurrence interval of 100 years).

3.3.1.4 Technical Evaluation

The staff reviewed Section 3.3.1 of the FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to wind loadings. Section 3.3.1 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff's technical evaluation of the information, incorporated by reference, related to wind loadings will be documented in the staff's FSER on the DC application for the US-APWR design.

The staff reviewed the information contained in the Section 3.3.1 of the CPNPP, Units 3 and 4, COL FSAR:

US-APWR COL Information Items

- CP COL 3.3(1)

The staff reviewed CP COL 3.3(1) related to COL Information Item 3.3(1) included under Section 3.3.1.1 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the last sentence of the second paragraph in DCD Section 3.3.1.1, Revision 3, with the following:

> The site-specific, basic wind speed of 96 mph corresponds to a 3-second gust at 33 ft. above ground for Exposure Category C, with the same recurrence interval as described above, and is therefore enveloped by the basic wind speed used for the design of the standard plant. Site-specific structures, systems, and components (SSCs) are designed using the site-specific basic wind speed of 96 mph, or higher.

The staff determined that the 96 mph (43 m/s) basic wind speed corresponding to a 3-second gust at 33 ft (10 m) above ground in open terrain represents meteorological conditions for the north Texas region of the continental United States where the CPNPP is located. The staff also determined that the COL applicant used the 96 mph (43 m/s) basic wind speed as the design basis for determining wind loading effects on seismic Category I buildings and structures described in the CPNPP, Units 3 and 4, COL FSAR and that the basic wind speed is multiplied by an importance factor of 1.15.

Review of basic wind speed data presented in ASCE/SEI Standard 7-05, "Minimum Design Loads for Buildings and Other Structures," Figure 6-1, which represents nominal design 3-second gust speeds at 33 ft (10 m) above ground for Exposure Category C (open terrain), suggests that the maximum basic wind speed at the CPNPP site does not exceed 96 mph (43 m/s). Application of the 1.15 importance factor adjusts the velocity pressure to an annual probability of exceedance to 0.01 (mean recurrence interval of 100 years) and is consistent with guidance in SRP Section 2.3.1, "Regional Climatology," Revision 3, issued March 2007.

The staff also determined that the use of the 96 mph (43 m/s) basic wind speed and an importance factor of 1.15 for the site-specific seismic Category 1 buildings and structures in the CPNPP is within the envelope of local basic wind speeds used as the design basis for nonsite-specific buildings and structures in the US-APWR standard plant described in DCD Tier 2, Revision 3.

- CP COL 3.3(4)

The staff reviewed CP COL 3.3(4) related to COL Information Item 3.3(4) included under Section 3.3.1.2 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the last paragraph in DCD Section 3.3.1.2, Revision 3, with the following:

> Specific descriptions of wind load design method and importance factors for US-APWR site-specific plant structures are as follows:
>
> - The UHSRS (seismic Category I) are analyzed using method 2 of American Society of Civil Engineers (ASCE)/Structural Engineering Institute (SEI) 7-05 (Reference 3.3-1) and an importance factor of 1.15. FSAR Figures 2.5.1-215 and 2.5.5-204 show that the site does possess natural features such as escarpments or hills near the UHSRS that may promote channeling effects or the creation of wakes, but not to the extent that special consideration is warranted. Method 2 of ASCE/SEI 7-05 provides a topographic factor, K_{zt}, in Section 6.5.7 "Topographic Effects," to address this issue when calculating the design wind loading. Also, the other buildings on the site are not of the height, plan dimension, or location relative to the UHSRS such that channeling effects or the creation of wakes or other non-standard wind effects are produced that extend beyond the provisions of the ASCE/SEI 7-05 method 2 procedure. FSAR Table 3KK-2 states that the minimum natural frequency of the UHSRS is 7.1 Hz for the east-west direction, which is the lowest fundamental frequency in any orthogonal direction for any of the soil conditions considered. This means that the UHSRS are rigid with respect to wind loading. As shown in FSAR Figures 3.8-206 through 3.8-211, the

UHSRS complex is comprised of relatively low-rise, nearly rectangular structures that do not include any unusual or irregular geometric shapes and are constructed of reinforced concrete walls, floors, and roofs. Therefore, based on the configuration and properties of the UHSRS complex, method 2 of ASCE/SEI 7-05 is an appropriate method of wind load design.

- The exposed portions of the ESWPT (seismic Category I) and power source fuel storage vaults (PSFSVs) (seismic Category I) are analyzed using method 1 of ASCE/SEI 7-05 (Reference 3.3-1) and an importance factor of 1.15.

- CPNPP Units 3 and 4 do not have site-specific seismic Category II buildings and structures. FSAR Figures 2.5.1-215 and 2.5.5-204 show that the site location does not have features promoting channeling effects or buffeting in the wake of upwind obstructions that warrant special design consideration. Therefore the wind design methods used for standard plant buildings are valid for the site.

The staff determined that the applicant used methods 1 and 2 described in ASCE/SEI 7-05 to convert basic wind speed into design loads for the site-specific seismic Category I buildings and structures in the CPNPP. According to requirements in ASCE/SEI 7-05, Section 6.4, method 1 can be used for the design of main wind-force resisting systems (MWFRS) that satisfy all eight of the conditions listed in Section 6.4.1.1. According to requirements in ASCE/SEI 7-05, Section 6.5, method 2 can be used for the design of MWFRS that satisfy the two conditions listed in Section 6.5.1. The staff further determined that the applicant used an importance factor of 1.15 to design all site-specific seismic Category I buildings and structures in the CPNPP.

The staff also determined that the UHSRS are low-profile buildings with a minimum natural frequency of 7.1 Hz making them rigid with respect to wind loads. They also have large openings or vents, but the size of these openings is not sufficient to classify the UHSRS as open or partially enclosed buildings based on definitions in ASCE/SEI 7-05, Section 2.

The staff reviewed information about the UHSRS presented in the CPNPP, Units 3 and 4, COL FSAR, Revision 0, and determined that the UHSRS satisfies method 2, condition 1 in ASCE/SEI 7-05, Section 6.5.1. To verify compliance with method 2, condition 2, in **RAI 2818, Question 03.03.01-2**, the staff requested the applicant to describe the response characteristics and site locations for the UHSRS. In its response to **RAI 2818, Question 03.03.01-2**, dated October 26, 2009, the applicant stated that the site does not possess any natural features such as ravines or hills near the UHSRS complex that would promote significant channeling effects or the creation of wakes. Also, the other buildings on the site are not of the heights, plan dimensions, or locations relative to the UHSRS structures that would promote channeling or the creation of wakes or other non-standard wind effects that are beyond the provisions of the method 2 procedure.

The applicant also responded to **RAI 2818, Question 03.03.01-2,** by stating that the minimum natural frequency of the UHSRS is 7.1 Hz for the east-west direction, which is the lowest fundamental frequency in any orthogonal direction for any of the soil conditions considered. This demonstrates that the UHSRS are rigid with respect to wind loading. In addition, the UHSRS complex is comprised of relatively low-rise, nearly rectangular structures that do not

include any unusual or irregular geometric shapes and are constructed of reinforced concrete walls, floors, and roofs. Based on the configuration and properties of the UHSRS complex, the complex does not fall within the limitations of Section C6.5.2 of the ASCE/SEI 7-05 Commentary. Therefore, the UHSRS are not considered to have response characteristics that make them subject to unusual wind effects such as across wind loading, vortex shedding, or instability due to galloping or flutter, and condition 2 of Section 6.5.1 is satisfied.

The COL applicant further responded to **RAI 2818, Question 03.03.01-2,** by stating that ASCE/SEI 7-05 Section 6.2 defines an enclosed building as a building that does not comply with the requirements for open or partially enclosed buildings. Because the UHSRS do not meet the definitions of open or partially enclosed buildings, the UHSRS are defined as enclosed buildings for the purpose of basic wind loading analysis.

Based on the applicant's response to **RAI 2818, Question 03.03.01-2**, the staff determined that the UHSRS are low-profile buildings with a minimum natural frequency of 7.1 Hz making them rigid with respect to wind loads. These features and response characteristics mean that the UHSRS are not subject to across wind loading, vortex shedding, or other unusual wind effects which might require investigation using Method 3 - Wind Tunnel Procedure of ASCE/SEI 7-05. Further, the site does not possess any natural features such as ravines or hills near the UHSRS that would promote channeling or buffeting effects that require special consideration. Although the UHSRS have large openings, the size of these openings is not sufficient to classify the UHSRS as open or partially enclosed buildings based on definitions in ASCE/SEI 7-05, Section 2. Because the UHSRS do not meet the definitions for open or partially enclosed buildings, the UHSRS are defined as enclosed buildings. Therefore, the staff determined that response is acceptable and the applicant is justified in using method 2 to analyze the UHSRS. Accordingly, **RAI 2818, Question 03.03.01-2, is resolved and closed.**

The staff determined that the PSFSVs are underground reinforced concrete structures that house the safety-related and nonsafety-related fuel oil tanks. The ESWPT is an underground reinforced concrete structure that is divided into two sections by an interior concrete wall. This wall provides separation of the piping trains with each section containing both supply and return lines. The top of the tunnel is approximately 12.25 ft (3.734 m) below grade. The applicant used method 1 to analyze the ESWPT and the PSFSVs.

The staff reviewed information about the ESWPT and the PSFSVs presented in the CPNPP, Units 3 and 4, COL FSAR and determined that all eight conditions in ASCE/SEI 7-05, Section 6.4.1.1 are satisfied. Therefore, the staff determined that the applicant is justified in using method 1 to analyze the ESWPT and the PSFSVs.

The applicant also used the methods described in ASCE/SEI 7-05 to convert basic wind speed into design loads for other site-specific seismic Category I buildings and structures in the CPNPP. In order for the staff to evaluate the applicability of the method used to analyze these structures, in **RAI 2818, Question 03.03.01-1,** the staff requested the applicant to identify which method applies to the reinforced concrete duct banks (solid) and reinforced concrete chases (hollow) that house the yard piping.

In its supplemental response to **RAI 2818, Question 03.03.01-1**, dated November 8, 2010, the applicant stating that seismic Category I shallow-embedded duct banks and pipe chases were included in FSAR Chapter 3, Revision 0 in the anticipation that such items would be needed. However, as the design progressed, it became apparent that these structures were no longer necessary, and the applicant stated that there are no seismic Category I shallow embedded

duct banks or pipe chases planned for CPNPP, Units 3 and 4. The staff finds the response acceptable since shallow embedded duct banks or pipe chases are no longer in the design. Accordingly, **RAI 2818, Question 03.03.01-1, is resolved and closed**.

3.3.1.5 Post-Combined License Activities

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

3.3.1.6 Conclusion

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to wind loadings, and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is currently reviewing the information in DCD Tier 2, Section 3.3.1 under Docket Number 52-021. The results of the staff's technical evaluation of the information relating to wind loadings incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's SER on the US-APWR DCD. The SE on the US-APWR DCD is not complete to date, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.3.1 of SE to reflect the final disposition of the DC application.

The staff concludes that the relevant information presented within the CPNPP, Units 3 and 4, COL FSAR is acceptable and meets the requirements of GDC 2. The staff based its conclusion on the following:

- CP COL 3.3(1), as it relates to site-specific wind speed requirements, is acceptable because the applicant used a basic wind speed of 96 mph (43 m/s) as the design basis for site-specific seismic Category I buildings and structures in the CPNPP. A basic wind speed of this magnitude represents meteorological conditions for the north Texas area where the CPNPP is located and is acceptable to the staff because it is based on proven industry standards and data that have been reviewed by and are acceptable to the staff. The applicant also used an importance factor of 1.15 to adjust the resulting wind velocity pressure to an annual probability of exceedance to 0.01 (mean reoccurrence interval of 100 years). The staff concludes that the wind design parameters selected by the applicant are consistent with acceptance criteria in SRP Sections 2.3.1 and 3.3.1.

- CP COL 3.3(4), as it relates to site-specific wind load design methods and importance factors, is acceptable because the applicant used methods 1 and 2 described in ASCE/SEI 7-05 to convert basic wind speed into design loads for the site-specific seismic Category I buildings and structures in the CPNPP. The applicant also used an importance factor of 1.15 to design all site-specific seismic Category I buildings and structures in the CPNPP. The staff concludes that the procedures used by the applicant to determine wind loads on structures are acceptable because these procedures are used to design conventional structures and are proven to provide an adequate basis which together with other engineering design considerations ensures that the structures will withstand such environmental forces. In addition, the staff concludes that these design procedures are consistent with acceptance criteria in SRP Section 3.3.1. Finally,

the staff notes that the site does not possess any natural features that would promote channeling or buffeting effects that require special consideration.

3.3.2 Tornado and Hurricane Loadings

3.3.2.1 Introduction

This section discusses the design of structures that must withstand the effects of the plant's design-basis tornado and hurricane.

3.3.2.2 Summary of Application

Section 3.3, "Wind and Tornado Loadings," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference Section 3.3 of the US-APWR DCD. Section 3.3 of the DCD, Revision 3, includes Section 3.3.2, "Tornado Loadings."

Note that DCD Tier 2, Section 3.3.2, Revision 3 and CPNPP, Units 3 and 4, COL FSAR, Revision 3, only addressed tornado loadings. In its response to **DCD RAI 908-6327, Question 03.03.02-6 and RAI 907-6321, Question 02-3**, dated September 24, 2012, the DCD applicant provided information that addressed design-basis hurricane and hurricane-generated missiles for the US-APWR DCD. The US-APWR applicant also expanded COL Information Items, COL 3.3(2), COL 3.3(3), to include hurricane effects and created a new COL Information Item, COL 3.3(6). In response to **RAI 6342, Question 03.03.02-9**, the COL applicant addressed the expanded and new COL Information Items dealing with hurricane effects and provided an associated markup to be included CPNPP, Units 3 and 4, COL FSAR, Revision 4. The discussion below includes these additions.

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.3.2, the applicant provided the following information:

US-APWR COL Information Items

- CP COL 3.3(2)

The applicant provided additional information in CP COL 3.3(2) to address COL Information Item 3.3(2) regarding site-specific tornado and hurricane effects. CP COL 3.3(2) applies to Section 3.3.2.1, "Applicable Design Parameter," Subsection 3.3.2.2.1, "Tornado and Hurricane Velocity Forces," and Subsection 3.3.2.2.4, "Combined Tornado or Hurricane Effects."

- STD COL 3.3(3)

The applicant provided additional information in STD COL 3.3(3) to address standard COL Information Item 3.3(3) regarding site-specific structures not designed for tornado and hurricane loads. STD COL 3.3(3) applies to Section 3.3.2.3, "Effect of Failure of Structures or Components Not Designed for Tornado and Hurricane Loads."

- CP COL 3.3(5)

The applicant provided additional information in CP COL 3.3(5) to address COL Information Item 3.3(5) regarding vented and unvented requirements for site-specific buildings and structures. CP COL 3.3(5) applies to Subsection 3.3.2.2.2, "Tornado Atmospheric Forces."

- CP COL 3.3(6)

The applicant provided additional information in CP COL 3.3(6) to address COL Information Item 3.3(6) regarding the site-specific design-basis hurricane effects enveloped by the design-basis hurricane effects provided in the DCD. CP COL 3.3(6) applies to Section 3.3.2.1.

3.3.2.3 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 the Commission's regulations for the tornado and hurricane loadings, and the associated acceptance criteria, are given in Section 3.3.2, "Tornado Loadings," Revision 3, issued March 2007, of NUREG-0800.

The applicable regulatory requirements for tornado and hurricane loadings are as follows:

> GDC 2, as it relates to the ability of SSCs important to safety, without loss of capability to perform their safety function, to withstand the effects of natural phenomena, such as tornadoes and hurricanes, and the appropriate combination of all loads.

Acceptance criteria adequate to meet the above requirements include:

1. SRP Section 3.5.1.4, "Missiles Generated by Tornadoes and Extreme Winds," Revision 3, issued March 2007.

2. RG 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," Revision 1, issued March 2007, as it relates to designing to withstand tornado-generated missiles and their associated wind speeds

3. RG 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," issued October 2011, as it relates to designing for hurricanes, which have been recognized as an important extreme wind storm whose wind speed may exceed that of tornado in some areas of the United States.

4. ASCE/ SEI Standard 7-05, 2005, "Minimum Design Loads for Buildings and Other Structures," as it relates to designing for tornado effects.

3.3.2.4 Technical Evaluation

The staff reviewed Section 3.3.2 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to tornado and hurricane loadings. Section 3.3.2 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The

staff's technical evaluation of the information incorporated by reference related to tornado and hurricane loadings will be documented in the staff FSER on the DC application for the US-APWR design.

It is to be noted that the current SRP Section 3.3.2 addresses only tornado loadings without hurricane loadings. However, hurricane has been recognized as an important extreme wind whose design-basis wind speed may exceed that of tornado in some areas of the United States. This concern resulted in the staff issuing RG 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," in October 2011.

In its response to **DCD RAI 908-6327, Question 03.03.02-6 and RAI 907-6321, Question 02-3**, dated September 24, 2012, the DCD applicant provided information that addressed design-basis hurricane and hurricane-generated missiles for the US-APWR in consideration of the guidance provided in RG 1.221. As part of the response to **DCD RAI 908-6327, Question 03.03.02-6 and RAI 907-6321, Question 02-3**, the US-APWR applicant also expanded COL Information Items COL 3.3(2) and COL 3.3(3) to include hurricane effects and created a new COL Information Item, COL 3.3(6). The staff issued **RAI 6342, Question 03.03.02-9,** requesting the applicant to provide information that addresses the design-basis hurricane and hurricane-generated missiles for the CPNPP, Units 3 and 4, site and their impact on the safety of the site-specific seismic Category I SSCs. In its response to **RAI 6342, Question 03.03.02-9**, dated September 14, 2012, and supplemented on May 13, 2013, the applicant addressed the expanded and new COL information items dealing with hurricane effects and provided an associated markup to be included CPNPP, Units 3 and 4, COL FSAR, Revision 4. The discussion below includes these additions.

The staff reviewed the information contained in Section 3.3.2 of the CPNPP, Units 3 and 4, COL FSAR.

US-APWR COL Information Items

- CP COL 3.3(5)

The staff reviewed CP COL 3.3(5) related to COL Information Item 3.3(5) included under Subsection 3.3.2.2.2 of the CPNPP, Units 3 and 4, COL FSAR, Revision 2. The applicant replaced the last paragraph in DCD Section 3.3.2.2.2, Revision 3, with the following:

> Site-specific seismic Category I structures are the UHSRS, ESWPT, and the PSFSVs.
>
> The UHSRS, including the pump houses and transfer pump rooms, are configured with large openings and/or vents. The UHS basins and cooling tower enclosures are designed as vented with respect to tornado atmospheric differential pressure loading. Venting of the pump houses and transfer pump rooms is anticipated during a tornado event, however, for the purpose of structural design, the external walls, internal walls, and slabs of the pump houses and transfer pumps rooms are conservatively designed as unvented and the full tornado atmospheric differential pressure loading is applied. Since the full pressure differential for the structural elements is considered, a depressurization model is not used for the structural design.

The ESWPT and PSFSV structures are designed as unvented because they do not have openings that permit depressurization during a tornado.

The staff determined that the applicant used Method 2 (analytical procedure) described in ASCE/SEI 7-05, Section 6.5, to design the UHSRS, PSFSV, and ESWPT for effects of tornado-generated wind loads. The UHSRS consists of the UHS basins and cooling tower enclosures and the ESW pump houses and transfer pump rooms. The staff reviewed information about the UHSRS presented in the FSAR, Revision 0, and determined that these structures are designed as vented structures with respect to wind loading and tornado atmospheric differential pressure loading because they have large openings or vents. The PSFSVs and the ESWPT are underground reinforced concrete structures that are classified as enclosed (unvented) structures because they do not have openings that permit depressurization during a tornado.

To ensure compliance with GDC 2, the staff requested the applicant to provide additional design details for the UHSRS, PSFSVs, and ESWPT. The staff needed this information to verify that the designs for these site-specific seismic Category I structures are capable of resisting appropriate combinations of tornado wind, atmospheric pressure change, and tornado-generated missile impact effects consistent with guidance in SRP Section 3.3.2.

In **RAI 2819, Question 03.03.02-5**, the staff requested the applicant to provide additional information about the approach used for determining the most adverse combination of total tornado effects on the ESWPT and PSFSVs including the analytical techniques used to ensure that the combination of tornado effects for the ESWPT and PSFSVs are established in a conservative manner. The staff also requested information about the analytical techniques used by the applicant to verify that the most adverse combination of tornado wind load effects, atmospheric pressure change effects, and tornado missile impact effects are identified and considered.

In its response to **RAI 2819, Question 03.03.02-5**, dated November 5, 2009, the applicant stated that the same methods described for standard plant SSCs were used to design the exposed portions of the ESWPT and PSFSVs for tornado loading and combined tornado effects. These combinations are in accordance with SRP Section 3.3.2 and are supplemented by the design criteria and procedures provided in the Bechtel Topical Report BC-TOP-3-A, Revision 3, “Tornado and Extreme Wind Design Criteria for Nuclear Power Plants". These load combinations ensure that tornado effects are combined conservatively for the ESWPT and PSFSVs.

The staff reviewed the applicant’s response to **RAI 2819, Question 03.03.02-5,** and determined that tornado effects are combined conservatively for the ESWPT and PSFSVs because the COL applicant used the design criteria and procedures provided in the Bechtel Topical Report BC-TOP-3-A, Revision 3, “Tornado and Extreme Wind Design Criteria for Nuclear Power Plants" to supplement the guidance in SRP Section 3.3.2. Therefore, the staff found the response acceptable. Accordingly, **RAI 2819, Question 03.03.02-5, is resolved and closed.**

In **RAI 2819, Question 03.03.02-6,** the staff requested the applicant to provide information about the depressurization model used to analyze air flow patterns and characteristics through the vents and openings in the UHSRS and to provide an assessment of the atmospheric pressure change effects on the structural performance of the UHSRS. The staff also requested the applicant to provide a description of the analytical techniques used to verify that the most

adverse combination of tornado wind load effects, atmospheric pressure change effects, and tornado missile impact effects on the UHSRS are identified and considered.

In its response to **RAI 2819, Question 03.03.02-6**, dated November 5, 2009, the applicant stated that the UHS basins are uncovered and have no ability to maintain pressure differential. Each UHS cooling tower has a large-diameter opening at the top and has substantial openings on each side to allow air flow for the cooling process. Since this configuration is open to air flow, a pressure differential cannot occur and a depressurization model was not judged to be necessary. The applicant also stated that venting of the pump houses and transfer pump rooms is anticipated during a tornado event due to the ventilation openings present. For purposes of structural design, the external walls of the pump houses and transfer pump rooms are conservatively designed as unvented and the full tornado atmospheric pressure differential is included in the structural design. The applicant further stated that guidance in SRP Section 3.3.2 was used to establish total tornado loads thus ensuring that tornado effects are combined conservatively for the UHSRS.

The staff reviewed the applicant's response to **RAI 2819, Question 03.03.02-6,** and determined that the applicant used a conservative depressurization model to assess atmospheric pressure change effects because the external walls of the pump houses and transfer pump rooms are considered to be unvented and were designed for the full tornado atmospheric pressure differential. In addition, the staff determined that tornado effects are combined conservatively for the UHSRS because the applicant used the design criteria provided in the guidance in SRP Section 3.3.2. Therefore, the staff found the response acceptable. The staff confirmed that technical information addressed in the applicant's response to **RAI 2819, Question 03.03.02-6** is reflected in Section 3.3.2.2.2 of the updated CPNPP, Units 3 and 4, COL FSAR, Revision 2. Accordingly, **RAI 2819, Question 03.03.02-6, is resolved and closed.**

- CP COL 3.3(2)

The staff reviewed CP COL 3.3(2) related to COL Information Item 3.3(2) included under Sections 3.3.2.1, 3.3.2.2.1, and 3.3.2.2.4 of the CPNPP, Units 3 and 4, COL FSAR, including information provided in response to **RAI 6342, Question 03.03.02-9**.

The applicant added the following after the last paragraph in DCD Subsection 3.3.2.1:

> The design-basis hurricane wind speed for site-specific seismic category I structures is 145 mph, which corresponds to a 3-second gust at 33 ft. above ground for exposure category C, with the same recurrence interval as described above, and is therefore enveloped by the basic wind speed used for the design of the standard plant. Site-specific SSCs are designed using the site-specific design basis wind speed of 145 mph, or higher.

The applicant also added the following after the third paragraph in DCD Subsection 3.3.2.2.1:

> Hurricane velocity pressures for site-specific seismic category I structures are determined by converting hurricane wind speeds into effective velocity pressures in accordance with procedures accepted by SRP 3.3.2. Design hurricane loads for seismic category I structures are determined for enclosed and partially enclosed buildings using the analytical procedure method 1 or method 2 provided in Subsection 3.3.1.2, where:

V is the maximum hurricane wind speed = 145 mph

For the design basis hurricane, wind pressure varies with respect to height: therefore, adjustment for wind speed variation with respect to height applies.

The applicant replaced the first and second sentences of the last paragraph in DCD Section 3.3.2.2.4, Revision 3, with the following:

Site-specific seismic Category I structures, i.e., the UHSRS and exposed portions of the ESWPT and PSFSVs, are designed for the same tornado or hurricane loadings and combined tornado or hurricane effects using the same methods for qualification described for standard plant SSCs.

The staff determined that the hurricane design parameters and the method to convert hurricane wind and missile impact effects to design loads used by the applicant are consistent with ASCE/SEI 7-05 and RG 1.221 and thus are acceptable. The design-basis hurricane missile spectrum selected by the applicant for CPNPP, Units 3 and 4, conforms to guidelines in SRP Section 3.5.1.4, "Missiles Generated by Tornadoes and Extreme Winds" and RG 1.221, Table 1 and the design-basis hurricane missile velocities for CPNPP, Units 3 and 4, conform to guidelines in SRP Section 3.5.1.4 and RG 1.221, Table 2 and thus are acceptable to the staff. Therefore, the staff finds the response to **RAI 6342, Question 03.03.02-9,** acceptable regarding COL Information Item 3.3(2). **RAI 6342, Question 03.03.02-9, is being tracked as a confirmatory item.**

The staff determined that the applicant used the tornado parameters and tornado missile spectrum in RG 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," Revision 1, issued March 2007, for Region 1 as the design basis for the UHSRS, PSFSV, and ESWPT. Tornado parameters and the design-basis tornado-generated missile spectrum in RG 1.76, Revision 1 are generally acceptable to the staff for defining the design-basis tornado for a nuclear power plant. The staff also determined that the applicant used acceptance criteria in SRP Section 3.3.2, Subsection II for procedures to transform tornado parameters into equivalent loads for these structures. These acceptance criteria include references to industry standards and data for evaluating tornado loads on structures that have been reviewed by the staff and found to be acceptable.

To ensure compliance with GDC 2, the staff requested information from the applicant needed to verify that site-specific seismic Category I structures are designed to withstand tornado effects without loss of capability to perform their safety functions.

In **RAI 2819, Question 03.03.02-1,** the staff requested the applicant to provide an analysis that compares the maximum design-basis tornado characteristics listed in Table 1 of RG 1.76, Revision 1 for Region 1 and the tornado characteristics for the CPNPP site in northern Texas. The staff requested this information to verify that the site-specific tornado characteristics for the CPNPP are enveloped by the maximum design-basis tornado characteristics listed in Table 1 of the RG 1.76, Revision 1 for Region 1.

In its response to **RAI 2819, Question 03.03.02-1**, dated November 5, 2009, the applicant stated that between 1950 and 2006, 158 tornadoes touched down in the vicinity of the CPNPP site (Bosque, Erath, Hood, and Johnson Counties). These historical data reflect a low annual frequency of a tornado striking a particular point in the immediate vicinity of the CPNPP site, which is located in Hood and Somervell counties at about 32 degrees north latitude, with a

mean recurrence interval of 5883 years. However, the frequency increases northward until "tornado alley" is entered north of Dallas. In the area north of about 34 degrees north latitude, there is a greater frequency of large tornadoes with wide paths and long trajectories. The expected maximum tornado wind speed and upper limit (95 percentile) of the expected wind speed based on a two degree longitude and latitude box centered on the CPNPP site are tabulated in Subsection 2.3.1.2.3 of the CPNPP, Units 3 and 4, COL FSAR. Based on these tabulated values, the upper limit (90 percent) of the expected tornado wind speed is 212 mph (94.8 m/s) for a tornado with a probability of exceedance of 10^{-7}. This site-specific tornado wind speed is within the bounds of the site design parameters used for the standard US-APWR.

The staff reviewed the COL applicant's response to **RAI 2819, Question 03.03.02-1,** and determined that the upper limit (90 percent) of the expected tornado wind speed is 212 mph (94.8 m/s) for a tornado with a probability of exceedance of 10^{-7}. The staff also determined that the site-specific tornado wind speed is within the bounds of the parameters used to design the standard US-APWR to resist tornado wind effects and is within the envelope of the applicable tornado wind speed listed in RG 1.76, Revision 1 for Region 1 where the CPNPP is located. Therefore, the staff found the response acceptable. Accordingly, **RAI 2819, Question 03.03.02-1, is resolved and closed.**

In **RAI 2819, Question 03.03.02-2,** the staff requested the applicant to provide information about all potential tornado-generated missiles and fragments identified by the applicant that could produce tornado-generated missile impact effects more severe than those produced by the missiles included in the missile spectrum defined in Table 2 of RG 1.76, Revision 1 for Region 1.

In its response to **RAI 2819, Question 03.03.02-2**, dated November 5, 2009, the applicant stated that "Impact Effect of Fragments Striking Structural Elements" (DCD Reference 3.3-6) outlines a method used to obtain an equivalent static load for use in a structural analysis, but it does not specify a tornado-generated missile spectrum. DCD Tier 2, Section 3.5.1.4, "Missiles Generated by Tornadoes and Extreme Winds," which is incorporated by reference into the COLA, provides the tornado-generated missile spectrum. The design-basis spectrum of tornado missiles considered by the applicant conforms to the spectrum of missiles defined in Table 2 of RG 1.76, Revision 1 for a Region I tornado.

The staff reviewed the applicant's response to **RAI 2819, Question 03.03.02-2,** and determined that the spectrum of tornado-generated missiles selected by the applicant as the design basis for CPNPP, Units 3 and 4, conforms to guidelines in SRP Section 3.5.1.4 Revision 3, issued March 2007, and RG 1.76, Revision 1 for Region I. Tornado-generated missiles and their associated wind speeds that are acceptable to the staff are identified in Table 2 of RG 1.76, Revision 1. The staff further determined that use of tornado wind speeds that equal or exceed those in Table 2 of RG 1.76, Revision 1 for Region I reflect a more conservative design basis because the design-basis tornado missile velocity values listed in RG 1.76, Revision 1 for Region I are based on a tornado wind speed of 230 mph (103 m/s) rather than the 212 mph (94.8 m/s) expected at the CPNPP site. Therefore, the staff found the response acceptable. Accordingly, **RAI 2819, Question 03.03.02-2, is resolved and closed.**

In **RAI 2819, Question 03.03.02-3**, the staff requested the applicant to provide information about the shape of the UHSRS and their response characteristics due to tornado-generated wind to verify that the UHSRS comply with conditions 1 and 2 for ASCE/SEI 7-05, Section 6.5, method 2.

In its response to **RAI 2819, Question 03.03.02-3**, dated November 5, 2009, the applicant stated that the site does not possess any natural features such as ravines or hills near the UHSRS complex that would promote significant channeling effects or the creation of wakes. Also, the other buildings on the site are not of the height, plan dimension, or location relative to the UHSRS structures that would promote channeling or the creation of wakes or other non-standard wind effects that are beyond the provisions of the method 2 procedure.

The applicant further stated that the minimum natural frequency of the UHSRS is 7.1 Hz for the east-west direction, which is the lowest fundamental frequency in any orthogonal direction for any of the soil conditions considered. This demonstrates that the UHSRS are rigid with respect to wind loading. The UHSRS complex is comprised of relatively low-rise, nearly rectangular structures that do not include any unusual or irregular geometric shapes and are constructed of reinforced concrete walls, floors, and roofs. Based on the configuration and properties of the UHSRS complex, the complex does not fall within the limitations of Section C6.5.2 of the ASCE/SEI 7-05 Commentary. Therefore, the UHSRS are not considered to have response characteristics that make them subject to unusual wind effects such as across wind loading, vortex shedding, or instability due to galloping or flutter, and condition 2 of Section 6.5.1 is satisfied.

The staff reviewed the applicant's response to **RAI 2819, Question 03.03.02-3,** and determined that the UHSRS are low-profile buildings with a minimum natural frequency of 7.1 Hz making them rigid with respect to tornado-generated wind loads. These features and response characteristics mean that the UHSRS are not subject to across wind loading, vortex shedding, or other unusual wind effects which might require investigation using method 3 - Wind Tunnel Procedure of ASCE/SEI 7-05. Further, the site does not possess any natural features such as ravines or hills near the UHSRS that would promote channeling or buffeting effects that require special consideration. For these reason, the staff concludes that the UHSRS satisfy condition 2 of Section 6.5.1 and can be analyzed using ASCE/SEI 7-05, method 2. Therefore, the staff found the response acceptable. Accordingly, **RAI 2819, Question 03.03.02-3, is resolved and closed.**

- STD COL 3.3(3)

The staff reviewed STD COL 3.3(3) related to COL Information Item 3.3(3) included under Section 3.3.2.3 of the CPNPP, Units 3 and 4, COL FSAR. The applicant replaced the last paragraph of DCD Tier 2, Section 3.3.2.3, with the following:

> Other miscellaneous NS buildings and structures in the plant yard are located and/or anchored such that their failure will neither jeopardize safety-related SSCs nor generate missiles not bounded by those discussed in Subsection 3.5.1.4. Further, any site-specific or field routed safety-related SSCs in the plant yard are evaluated prior to their installation to determine if structural reinforcement and/or missile barriers are required to ensure their function and integrity.

The staff noted that the applicant included in the CPNPP, Units 3 and 4, FSAR, Revision 0 site-specific seismic Category I yard piping and conduits that are routed within reinforced concrete duct banks (solid) or reinforced concrete chases (hollow). The duct banks and chases have shallow embedments and are buried partially or wholly below grade within structurally engineered and compacted backfill that extends down to the top of the limestone at nominal elevation 782 ft (238 m).

To ensure compliance with GDC 2, in **RAI 2819, Question 03.03.02-4,** the staff requested the applicant to provide information needed to verify that site-specific seismic Category I reinforced concrete duct banks and pipe chases are designed to withstand tornado effects without loss of capability to perform their safety functions.

In its response to **RAI 2819, Question 03.03.02-4**, dated November 8, 2010, the applicant stated that seismic Category I shallow-embedded duct banks and pipe chases were included in CPNPP, Units 3 and 4, FSAR Chapter 3, "Design of Structures, Systems, Components, and Equipment," Revision 0, in the anticipation that such items would be needed. However, as the design progressed, it became apparent that these structures were no longer necessary, and the applicant stated that there are no seismic Category I shallow embedded duct banks or pipe chases planned for CPNPP, Units 3 and 4. The staff finds the response acceptable since the applicant addressed the issue by removing the embedded duct banks or pipe chases from the design. Accordingly, **RAI 2819, Question 03.03.02-4, is resolved and closed.**

In **RAI 2819, Question 03.03.02-7,** the staff requested the applicant to identify the method used to transform wind speed into wind forces applied to each site-specific seismic Category II structure including the applicable importance factor. The staff needed this information to verify that seismic Category II structures and components are designed for the same tornado wind loads as seismic Category I structures to preclude impact on the function and integrity of safety-related SSCs. The staff also requested design details about each site-specific seismic Category II structure needed to evaluate compliance with the conditions for method 1, 2, or 3 defined in ASCE/SEI 7-05, Sections 6.4.1.1, 6.5.1, or 6.6.2, as applicable.

In its response to **RAI 2819, Question 03.03.02-7**, dated November 5, 2009, the applicant stated that the auxiliary building and turbine building (T/B) are seismic Category II buildings and structures in the US-APWR standard plant and that there are no site-specific seismic Category II buildings or structures for CPNPP, Units 3 and 4.

The staff reviewed the applicant's response to **RAI 2819, Question 03.03.02-7,** and determined that the applicant provided sufficient information to demonstrate that failure of US-APWR standard plant structures and components not designed for tornado loads do not jeopardize the function and integrity of safety-related SSCs. In addition, the staff determined that there are no site-specific seismic Category II buildings or structures at the CPNPP site. Therefore, the staff found the response acceptable. Accordingly, **RAI 2819, Question 03.03.02-7, is resolved and closed.**

To further ensure compliance with GDC 2, in **RAI 4397, Question 03.03.02-8** the staff requested the applicant to provide a description of the tornado-generated missiles that could be produced by failure of the T/B and access building (AC/B) and an analysis or test data showing that these missiles are not capable of producing tornado missile impact effects that are more severe than those produced by the missiles included in the missile spectrum defined in Table 2 of RG 1.76, Revision 1 for Region 1.

In its response to **RAI 4397, Question 03.03.02-8**, dated April 5, 2010, the applicant stated that DCD Tier 2, Section 3.5.1.4, which is incorporated by reference into the COLA, provides the tornado-generated missile spectrum and that the design-basis spectrum of tornado missiles considered by the applicant conforms to the spectrum of missiles defined in Table 2 of RG 1.76, Revision for a Region I tornado.

The applicant also stated that potential tornado-induced failure of the T/B or AC/B does not generate any missiles greater than the representative missiles listed in DCD Tier 2 Section 3.5.1.4 and localized failure of wind girts and other exposed SSCs that become dislodged are enveloped by the missiles addressed in DCD Subsection 3.5.1.4. In addition, nonsafety-related structures at the CPNPP site are located such that their collapse or displacement due to tornado-generated wind effects will not have any interaction with or effect on adjacent seismic Category I structures.

The staff reviewed the applicant's response to **RAI 4397, Question 03.03.02-8,** and determined that a conservatism is achieved in establishing design-basis tornado loadings because the design-basis tornado missile velocity values are based on a tornado wind speed of 230 mph (103 m/s) specified in Table 1 of RG 1.76, Revision 1 for Region 1 rather than the 212 mph (94.8 m/s) expected at the CPNPP site. This determination is supported by tornado-generated missiles and their associated wind speeds that are identified in Table 2 of RG 1.76, Revision 1 and acceptable to the staff. Therefore, the staff found the response acceptable. Accordingly, **RAI 4397, Question 03.03.02-8, is resolved and closed.**

- CP COL 3.3(6)

The staff reviewed CP COL 3.3(6) related to COL Information Item 3.3(6) included under Section 3.3.2.1 of the FSAR, including information provided in response to **RAI 6342, Question 03.03.02-9**. The applicant added the following after the last paragraph in DCD Tier 2, Section 3.3.2.1:

> The design-basis hurricane wind speed for site-specific seismic category I structures is 145 mph, which corresponds to a 3-second gust at 33 ft. above ground for exposure category C, with the same recurrence interval as described above, and is therefore enveloped by the basic wind speed used for the design of the standard plant. Site-specific SSCs are designed using the site-specific design basis wind speed of 145 mph, or higher.

The staff reviewed the information provided by the applicant to address COL Information Item 3.3(6) and determined that the site-specific design-basis hurricane wind speed of 145 mph (64.8 m/s) and exposure category C are enveloped by the corresponding design-basis hurricane wind speed of 160 mph (71.5 m/s) and exposure category C used in the US-APWR DCD. Therefore, the staff finds the response to **RAI 6342, Question 03.03.02-9,** acceptable regarding COL Information Item 3.3(6). Since there are pending FSAR changes, **RAI 6342, Question 03.03.02-9, is being tracked as a Confirmatory Item.**

3.3.2.5 Post-Combined License Activities

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

3.3.2.6 Conclusion

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to tornado and hurricane loadings, and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is currently reviewing the information in DCD Tier 2, Section 3.3.2 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to tornado and hurricane loadings incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's SER on the US-APWR DCD. The SE on the US-APWR DCD is not complete to date, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.3.2 of SE to reflect the final disposition of the DC application.

Pending the verification of the confirmatory item for **RAI 6342, Question 03.03.02-9**, the staff concludes that the relevant information presented within the CPNPP, Units 3 and 4, COL FSAR is acceptable and meets the requirements of GDC 2. The staff based its conclusion on the following:

- CP COL 3.3(5), as it relates to vented and unvented requirements for site-specific buildings and structures, is acceptable because the applicant used a conservative depressurization model to assess atmospheric pressure change effects for the UHSRS. In this model, the external walls of the pump houses and transfer pump rooms were considered to be unvented and the applicant designed them for the full tornado atmospheric pressure differential. In addition, the applicant designed the ESWPT and PSFSVs as unvented structures because they do not have openings that permit depressurization during a tornado. The staff concludes that tornado effects are combined conservatively for the UHSRS, ESWPT, and PSFSVs because the applicant used the design criteria and procedures for combining tornado loads provided in the Bechtel Topical Report BC-TOP-3-A, Revision 3, "Tornado and Extreme Wind Design Criteria for Nuclear Power Plants," issued August 1974, to supplement the guidance in SRP Section 3.3.2.

- CP COL 3.3(2), as it relates to site-specific tornado or hurricane loadings and combined tornado or hurricane effects, is acceptable because the design basis for the seismic Category I structures includes a tornado wind speed of 230 mph (103 m/s) rather than the 212 mph (94.8 m/s) expected at the CPNPP site and the tornado parameters and tornado missile spectrum defined in RG 1.76, Revision 1 for Region 1. The spectrum of tornado-generated missiles selected by the applicant as the design basis for the CPNPP conforms to guidelines in SRP Section 3.5.1.4. In addition, the applicant used the design criteria and procedures for combining tornado loads provided in the Bechtel Topical Report BC-TOP-3-A, Revision 3 to supplement the guidance in SRP Section 3.3.2. The site-specific design-basis hurricane wind speed, hurricane-generated missile spectrum and associated velocities, and methodology used in converting hurricane effects to design loads are acceptable because the site-specific hurricane wind speed is consistent with design-basis hurricane wind speeds published in RG 1.221 for the region where the CPNPP is located, the hurricane-generated missile spectrum and associated velocities conform to guidelines in SRP Section 3.5.1.4 and RG 1.221, and the methodology for calculating hurricane wind loads follows the guidance in ASCE/SEI 7-05 and RG 1.221.

- STD COL 3.3(3), as it relates to site-specific structures not designed for tornado and hurricane loads, is acceptable because the spectrum of tornado- and hurricane-generated missiles selected by the applicant as the design basis for

the CPNPP conforms to guidelines in SRP Section 3.5.1.4 and RG 1.221. In addition, localized failure of wind girts and other exposed SSCs that are dislodged during a tornado and tornado-induced failure of the T/B or AC/B do not generate any missiles that are not enveloped by this spectrum. Furthermore, nonsafety-related structures at the CPNPP site are located such that their collapse or displacement due to tornado- or hurricane-generated wind effects will not have any interaction with or effect on adjacent seismic Category I structures. Because there are no site-specific seismic Category II buildings or structures at CPNPP, Units 3 and 4, the staff concludes that analysis of these buildings and structures for tornado and hurricane loads is not required.

- CP COL 3.3(6), as it relates to verifying that the site-specific hurricane design parameters are enveloped by the hurricane design parameters used in the US-APWR DCD, is acceptable because the site-specific design-basis hurricane wind speed of 145 mph (64.8 m/s) and exposure category C are enveloped by the corresponding design-basis hurricane wind speed of 160 mph (71.5 m/s) and exposure category C used in the US-APWR DCD.

3.4 Water Level (Flood) Design

3.4.1 Internal Flood Protection for Onsite Equipment Failures

[This section is still under review and the SE will be provided at a later time]

3.4.1.1 Introduction

3.4.1.2 Summary of Application

3.4.1.3 Regulatory Basis

3.4.1.4 Technical Evaluation

3.4.1.5 Post-Combined License Activities

3.4.1.6 Conclusions

3.4.2 Analysis Procedures

3.4.2.1 Introduction

This section discusses analysis procedures for the design of seismic Category I structures to withstand the effects of the highest flood and groundwater levels specified for the plant.

3.4.2.2 Summary of Application

Section 3.4, “Water Level (Flood) Design,” of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, Section 3.4 of the US-APWR DCD, Revision 3. Section 3.4 of the DCD includes Section 3.4.2, “Analysis Procedures.”

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.4.2, the applicant provided the following information:

US-APWR COL Information Item

- STD COL 3.4(6)

The applicant provided additional information in STD COL 3.4(6) to address COL Information Item 3.4(6) regarding the applicability of site-specific physical models to the site.
STD COL 3.4(6) applies to Section 3.4.2.

3.4.2.3 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 the Commission's regulations pertaining to flooding analysis procedures and the associated acceptance criteria are given in Section 3.4.2, "Analysis Procedures," Revision 3, issued March 2007, of NUREG-0800.

The applicable regulatory requirements for flooding analysis procedures are as follows:

> GDC 2, which requires that SSCs important to safety be designed to withstand the effects of natural phenomena without loss of capability to perform their safety functions. The design bases for these SSCs must reflect appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena.

3.4.2.4 Technical Evaluation

The staff reviewed Section 3.4.2 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and, incorporated by reference, addresses the required information relating to analysis procedures. Section 3.4.2 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff's technical evaluation of the information incorporated by reference related to analysis procedures will be documented in the staff's FSER on the DC application for the US-APWR design.

The staff reviewed the information contained in Section 3.4.2 of the CPNPP, Units 3 and 4, COL FSAR:

COL Information Item

- STD COL 3.4(6)

The staff reviewed STD COL 3.4(6) related to COL Information Item 3.4(6) included under Section 3.4.2 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the last paragraph of DCD Tier 2, Revision 3, Section 3.4.2, with the following:

No site-specific physical models are used to predict prototype performance of hydraulic structures and systems, since there are no unusual design or configuration or design or operating bases involving thermal and erosion problems.

DCD Tier 2, Section 3.4.2 requires a COL applicant to identify any site-specific physical models used to predict prototype performance of hydraulic structures and systems involving an unusual design or configuration, or for a design or operating bases involving thermal and erosion problems. The staff determined that CPNPP, Units 3 and 4, does not include any site-specific hydraulic structures or systems involving an unusual design or configuration or design or operating bases involving thermal and erosion problems and therefore no site-specific physical models are needed.

The staff notes that the highest flood level at the CPNPP, Units 3 and 4, site as addressed in Section 2.4.3, "Probable Maximum Flood (PMF) on Streams and Rivers," of CPNPP, Units 3 and 4, FSAR does not exceed the design-basis flooding level for the US-APWR standard design. The staff also notes that the highest groundwater level at the CPNPP, Units 3 and 4, site as addressed in Section 2.4.12, "Groundwater," of CPNPP, Units 3 and 4, FSAR does not exceed the groundwater level considered in the US-APWR standard design. The confirmation of the flood and groundwater levels in Sections 2.4.3 and 2.4.12 is being tracked as **Confirmatory Item 3.4.2-1**. No specific RAI was issued by the staff for this section of the CPNPP, Units 3 and 4, COL FSAR.

Therefore, pending confirmation of staff's findings in the SE on Sections 2.4.3 and 2.4.12 of CPNPP, Units 3 and 4, FSAR, the staff determines that the analysis procedures used for CPNPP, Units 3 and 4, with respect to the static and dynamic effects of the highest flood and groundwater levels are bounded by the analysis procedures addressed in US-APWR DCD Section 3.4.2.

3.4.2.5 Post-Combined License Activities

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

3.4.2.6 Conclusion

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to analysis procedures for the determination of static and dynamic loadings due to highest flood and groundwater levels at the CPNPP, Units 3 and 4, site and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is currently reviewing the information in DCD Tier 2, Section 3.4.2, under Docket Number 52-021. The results of the staff's technical evaluation of the information relating to analysis procedures incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's SER on the US-APWR DCD. The SE on the US-APWR DCD is not complete to date, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.4.2 of the SE to reflect the final disposition of the DC application.

Pending confirmation of findings in the staff's SERs on Section 2.4.3 and Section 2.4.12 of CPNPP, Units 3 and 4, COL FSAR concerning the highest flood and groundwater levels at the

CPNPP, Units 3 and 4, site, the staff determines that the analysis procedures addressed in Section 3.4.2 of US-APWR DCD bound the analysis procedures for the determination of static and dynamic loadings due to highest flood and groundwater levels at the CPNPP, Units 3 and 4, site. The staff is tracking this as **Confirmatory Item 3.4.2-1**.

3.5 Missile Protection

3.5.1 Missile Selection and Description

3.5.1.1 Internally Generated Missiles outside Containment

3.5.1.1.1 Introduction

This section addresses the protection of SSCs important to safety against internally-generated missiles outside the containment. GDC 4 requires that safety-related SSCs located outside containment be protected from internally-generated missiles. Credible internally-generated missiles include those produced from component overspeed failures, failures in high-energy fluid systems, and missiles caused by gravitation effects. Also discussed in this section is the adequacy of methods of protection from internally-generated missiles for SSCs necessary to perform functions required to attain and maintain a safe shutdown, prevent significant uncontrolled release of radioactivity, or to mitigate the consequences of an accident.

3.5.1.1.2 Summary of Application

Section 3.5, "Missile Protection," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates, by reference, Section 3.5 of the US-APWR DCD, Revision 3. Section 3.5 of the DCD includes Section 3.5.1.1, "Internally Generated Missiles (Outside Containment)."

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.5.1.1, the applicant provided the following information:

US-APWR COL Information Items

- STD COL 3.5(1)

The applicant provided additional information in Standard (STD) COL 3.5(1) to address COL Information Item 3.5(1) in the DCD, Revision 3, regarding the prevention of unsecured equipment from becoming potential hazards. STD COL 3.5(1) applies to Subsection 3.5.1.1.4, "Gravitational Missiles."

Supplemental Information

- CP SUP 3.5(1)

The applicant provided supplemental information in CP SUP 3.5 (1) regarding potential sources of internal missiles from high-speed rotating equipment. CP SUP 3.5 (1) applies to Subsection 3.5.1.1.2, "High-Speed Rotating Equipment."

3.5.1.1.3 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 the Commission's regulations pertaining to internally-generated missiles (outside containment), and the associated acceptance criteria, are given in Section 3.5.1.1, "Internally Generated Missiles (Outside Containment)," Revision 3, issued March 2007, of NUREG-0800.

The applicable regulatory requirements for internally-generated missiles outside containment are as follows:

> GDC 4, as it relates to the protection of SSCs against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions inside the nuclear power unit.

3.5.1.1.4 Technical Evaluation

The staff reviewed Section 3.5.1.1 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference, addresses the required information relating to internally-generated missiles (outside containment). Section 3.5.1.1 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff's technical evaluation of the information incorporated by reference related to internally-generated missiles (outside containment) will be documented in the staff SER on the DC application for the US-APWR design.

The staff reviewed the information contained in Section 3.5.1.1 of the CPNPP, Units 3 and 4, COL FSAR.

STD COL Information Item

- STD COL 3.5(1)

The staff reviewed STD COL 3.5(1) related to COL Information Item 3.5(1) included under Section 3.5.1.1 of the CPNPP, Units 3 and 4, COL FSAR. The applicant replaced the last paragraph of DCD Section 3.5.1.1.4 with the following:

> Procedures will be issued prior to fuel load in accordance with Subsection 13.5.2.2 to require unsecured equipment, including portable pressurized gas cylinders, located inside or outside containment for maintenance or undergoing maintenance to be removed from containment prior to operation, moved to a location where it is not a potential hazard to SSCs important to safety, or seismically restrained to prevent it from becoming a missile.

The staff finds the applicants' proposal to address COL Information Item COL 3.5(1) acceptable, because the applicant commits to implement the above cited procedural controls prior to fuel load, and confirms unsecured equipment will be addressed and not become a source of missiles.

Supplemental Information

- CP SUP 3.5(1)

Section 3.5.1.1.2 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, provides site-specific supplemental information for potential sources of internal missiles from high-speed rotating equipment in the UHS ESW pump house, and associated design considerations. This supplemental information states that the potential sources of internal missiles from high-speed rotating equipment are assessed for the UHS ESW pump house. It also states that internally-generated missiles from ventilation fans, pumps and cooling tower fans are not considered credible. A list of design considerations that support the assumption that internally-generated missiles from ventilation fans, pumps and cooling tower fans are not credible sources of internal missiles was also added as part of COL SUP 3.5(1).

The staff reviewed the supplemental information and finds it acceptable because the information added confirms safety-related SSCs contained in the UHS ESW pump house are protected from internally-generated missiles, and therefore satisfy the requirements of GDC 4.

3.5.1.1.5 Post Combined License Activities

As discussed above, having the above cited procedures issued prior to fuel load to address COL Information Item 3.5(1) is the only post-COL activity related to CPNPP, Units 3 and 4, COL FSAR, Revision 3, Section 3.5.1.1.

3.5.1.1.6 Conclusions

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to internally-generated missiles (outside containment), and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is currently reviewing the information in DCD Tier 2, Section 3.5.1.1 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to internally-generated missiles (outside containment) incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff SER on the US-APWR DCD. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.5.1.1 of the SER to reflect the final disposition of the DC application.

In addition, the staff has compared the additional COL information within the application to the relevant NRC regulations, acceptance criteria defined in SRP Section 3.5.1.1, and other NRC RGs and concludes that the relevant information presented within the CPNPP, Units 3 and 4, COL FSAR is acceptable and meets the requirements of GDC 4 as it relates to the protection of SSCs important to safety from internally-generated missiles since it conforms to the guidelines of SRP Section 3.5.1.1. The staff based its conclusion on the following:

- CP COL 3.5(1), as it relates to equipment removed from containment prior to operation, is acceptable because procedural control will be established prior to fuel load to ensure that unsecured equipment will be constrained or removed from containment, prior to operation. This action will prevent these items from

becoming missiles that could potentially impact SSCs important to safety, therefore complies with GDC 4.

- COL SUP 3.5(1), as it relates to potential sources of internal missiles from high-speed rotating equipment in the UHS ESW pump house, is acceptable because the information added confirms safety-related SSCs contained in the UHS ESW pump house are protected from internally-generated missiles, and therefore satisfy the requirements of GDC 4.

3.5.1.2 Internally Generated Missiles (Inside Containment)

This section discusses operations and performance requirements for SSCs inside containment, identification of SSCs necessary for the safe shutdown of the reactor and the failure of SSCs that could cause a significant release of radioactivity. Also discussed is the adequacy of methods of protection from internally-generated missiles for SSCs necessary to perform functions required to attain and maintain a safe shutdown or to mitigate the consequences of an accident.

Section 3.5, "Missile Protection," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, with no departures or supplements, Section 3.5.1.2, "Internally Generated Missiles (Inside Containment)," of the US-APWR DCD, Revision 3. The staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review. The NRC staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in US-APWR DCD Tier 2, Section 3.5.1.2, under Docket Number 52-021. The results of the staff's technical evaluation of the information related to missile protection incorporated by reference in the CPNPP Units 3 and 4 COL FSAR will be documented in the staff's FSER of the DC application for the US-APWR. The SE for the US-APWR DC application is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.5.1.2 of this SE to reflect the final disposition of the DC application design.

3.5.1.3 Turbine Missiles

3.5.1.3.1 Introduction

GDC 4 requires that SSC's important to safety shall be designed and protected against the effects of missiles that might result from equipment failures. The failure of a rotor in a large steam turbine may result in the generation of high-energy missiles that could affect safety-related SSCs. The probability of a strike by a turbine missile should be sufficiently low such that the risk from turbine missiles on safety-related SSCs is acceptably small.

3.5.1.3.2 Summary of Application

Section 3.5, "Missile Protection," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference Section 3.5 of the US-APWR DCD, Revision 3. Section 3.5 of the DCD includes Section 3.5.1.3, "Turbine Missiles."

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.5.1.3, the applicant provided the following information:

US-APWR COL Information Items

- CP COL 3.5(2)

The applicant provided additional information in CP COL 3.5(2) to address COL Information Item 3.5(2) in the DCD, Revision 3 regarding maintaining the probability of missile occurrence, P_1, within this acceptable limit. CP COL 3.5(2) applies to Section 3.5.1.3.2, "Evaluation."

- CP COL 3.5(6)

The applicant provided additional information in CP COL 3.5(6) to address COL Information Item 3.5(6) in the DCD, Revision 3 regarding assessing the orientation of the turbine generator of this and other unit(s) at multi-site. CP COL 3.5(6) applies to Subsection 3.5.1.3.1, "Geometry."

3.5.1.3.3 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 the Commission's regulations pertaining to turbine missiles and the associated acceptance criteria are addressed in Section 3.5.1.3, "Turbine Missiles," Revision 3, issued March 2007, of NUREG-0800.

The applicable regulatory requirements for turbine missiles are as follows:

> GDC 4, which requires in part that SSCs important to safety shall be protected against environmental and dynamic effects, including the effects of missiles that may result from equipment failure.

Acceptance criteria adequate to meet the above requirement include:

1. RG 1.115, Revision 1, issued July 1977, "Protection against Low-Trajectory Turbine Missiles," as it relates to the identification of low-trajectory missiles resulting from turbine failure.

2. RG 1.117, Revision 1, issued April 1978, "Tornado Design Classification," as it relates to SSCs that should be protected from missile hazards.

3.5.1.3.4 Technical Evaluation

The staff reviewed Section 3.5 of the CPNPP, Units 3 and 4, COL FSAR and the referenced DCD to ensure that the combination of the DCD and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to turbine missiles. Section 3.5.1.3 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff's technical evaluation

of the information incorporated by reference related to turbine missiles is documented in the staff's FSER on the DC application for the US-APWR design.

The staff reviewed the information contained in Section 3.5.1.3 of the CPNPP, Units 3 and 4, COL FSAR.

US-APWR COL Information Items

- CP COL 3.5(6)

The staff reviewed CP COL 3.5(6) related to COL Information Item 3.5(6) included under Section 3.5.1.3 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the third paragraph in DCD Tier 2, Revision 3, Subsection 3.5.1.3.1 with the following:

> The CPNPP site plan (Figure 1.2-1R) reflects the placement of CPNPP Units 3 and 4 in relation to existing Units 1 and 2. The location of CPNPP Units 3 and 4 is such that CPNPP Units 1 and 2 are outside the low-trajectory turbine missile strike zone inclined at 25 degrees to the turbine, and therefore no postulated low-trajectory turbine missiles affect CPNPP Units 1 and 2. Similarly, no postulated low trajectory turbine missiles from CPNPP Units 1 and 2 will affect CPNPP Units 3 and 4. The placement of CPNPP Units 3 and 4, however, does generate an unfavorable orientation, as defined in NUREG-0800, Section 3.5.1, of the turbine generator (T/G) in relationship with safety-related SSCs of the adjacent US-APWR Unit. (See Subsection 3.5.1.3.2 for impact to P_4).

It should be noted that DCD Tier 2, Revision 3, Subsection 3.5.1.3.1 refers to DCD Tier 2, Figure 1.2-1, "Typical US-APWR Site Arrangement Plan," for the building structure orientation with respect to the T/B and the nuclear island. DCD Tier 2, Figure 1.2-1 illustrates the US-APWR plant as a single unit. DCD Tier 2, Subsection 3.5.1.3.1 states that the turbine generator is located south of the nuclear island with its shaft oriented along the north-south axis so that safety-related systems are located outside the high-velocity, low trajectory missile strike zone. With this information, the US-APWR design is considered to favorably orient the T/B with respect to safety-related SSCs as defined in RG 1.115, "Protection Against Low-Trajectory Turbine Missiles," Revision 1, issued July 1977.

However, the CPNPP, Units 3 and 4, site has two US-APWR units situated side-by-side, as shown in Figure 1.2-1R, "Comanche Peak Units 3 & 4 Site Plan," of the CPNPP, Units 3 and 4, COL FSAR. With this site plan, the turbine generators are oriented unfavorably with respect to the other nuclear island which contains safety-related SSCs. Therefore, the staff concludes that an individual US-APWR turbine generator is favorably oriented with respect to its nuclear island, but when two or more US-APWR units are situated side-by-side, the turbine generators are oriented unfavorably with respect to the other nuclear island which contains safety-related SSCs. Therefore, staff agrees with the applicant's designation that the CPNPP, Unit 3, turbine generator is unfavorably oriented to CPNPP, Unit 4, safety-related SSCs, and vice versa.

Potential turbine missiles from CPNPP, Units 1 and 2, are evaluated in Section 3.5.1.5 of this report.

- CP COL 3.5(2)

The staff reviewed CP COL 3.5(2) related to COL Information Item 3.5(2) included under Section 3.5.1.3 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the third paragraph in DCD Tier 2, Revision 3, Subsection 3.5.1.3.2 with the following:

> Mathematically, $P_4 = P_1 \times P_2 \times P_3$, where RG 1.115 (Reference 3.5-6) considers an acceptable risk rate for *P4* as less than 10^{-7} per year. For unfavorably oriented T/Gs determined in Subsection 3.5.1.3, the product of P_2 and P_3 is estimated as 10^{-2} per year, which is a more conservative estimate than for a favorably oriented single unit. CPNPP Unit 3 and 4 procedures will be implemented 6 months prior to delivery of the T/G [turbine generator] to require inspection intervals established in Technical Report, MUAP-07028-NP, "Probability of Missile Generation From Low Pressure Turbines" (Reference 3.5-17), and to require a turbine valve test frequency per Technical Report, MUAP-07029-NP, "Probabilistic Evaluation of Turbine Valve Test Frequency" (Reference 3.5-18), and other actions to maintain P_1 within acceptable limits as outlined in NUREG-0800, Standard Review Plan (SRP) 3.5.1.3, Table 3.5.1.3-1 (Reference 3.5-7). These inspection intervals maintain the probability of turbine failure resulting in the ejection of turbine rotor (or internal structure) fragments through the turbine casing, P_1, as less than 10^{-5} per year. The acceptable risk rate $P_4 = P_1 \times P_2 \times P_3$ is therefore maintained as less than 10^{-7} per year.

To meet the guidance of RG 1.115 and SRP Section 3.5.1.3 for an unfavorable turbine generator orientation, the probability of generating a turbine missile must be equal to or less than $1x10^{-5}$ per year. CP COL 3.5(2) in the CPNPP, Units 3 and 4, COL FSAR, Subsection 3.5.1.3.2, provides information that states the inspection of the turbine rotor is based on the probability ($P_1 < 1 \times 10^{-5}$) of generating a missile from the US-APWR turbine generator as calculated in the DCD applicant's applicable bounding turbine missile analysis report, MUAP-07028, "Probability of Missile Generation from Low Pressure Turbines," Revision 1, issued January 2011. This report is also referenced in DCD Tier 2, Sections 3.5.1.3 and 10.2.3, "Turbine Rotor Integrity." However, the staff notes that DCD Tier 2, Sections 3.5.1.3 and 10.2.3 also reference the DCD applicant's Technical Report MUAP-07029, "Probabilistic Evaluation of Turbine Valve Test Frequency," Revision 2, issued January 2011, for the analysis of turbine missile generation probability due to the failure of the overspeed protection system. This analysis is used to determine the turbine valve test frequency in order to minimize turbine missiles due to destructive overspeed events caused by the failure of overspeed protection system. Therefore, in **RAI 2664, Question 03.05.01.03-1**, the staff requested the applicant to include in the FSAR, that the Mitsubishi Report MUAP-07029, "Probabilistic Evaluation of Turbine Valve Test Frequency," will be used to establish the turbine valve test intervals to maintain $P_1 < 1 \times 10^{-5}$ to ensure the limits as outlined in RG 1.115 and SRP Section 3.5.1.3 are maintained. In addition, the applicant should include in the FSAR the valve test frequency that will be used in order to maintain $P_1 < 1 \times 10^{-5}$ for the unfavorably oriented turbines for CPNPP, Units 3 and 4.

In its response to **RAI 4846, Question 10.02.03-2**, dated August 9, 2010, the applicant proposed to revise CPNPP, Units 3 and 4, COL FSAR Section 10.2.3 to state that the turbine maintenance and inspection procedure will be consistent with the inspection program and inspection intervals identified in DCD Tier 2, Section 10.2.3.5, "Inservice Inspection." The applicant also proposed to revise CPNPP, Units 3 and 4, COL Part 10, "ITAAC and Proposed License Conditions," Section 3, "Specific Proposed License Conditions," to specify that the turbine inspection program will be implemented prior to fuel load per the operational program license condition (item 2.D(11)). In its response to **RAI 2664, Question 03.05.01.03-1**, dated August 24, 2009, the applicant proposed to revise CPNPP, Units 3 and 4, COL FSAR,

Subsection 3.5.1.3.2 to state that the inservice inspection and test intervals will be established by MUAP-07028 and MUAP-07029. The staff confirmed that the proposed changes were incorporated into CPNPP, Units 3 and 4, COL FSAR, Revision 2, including that the that the inspection and test procedures will be implemented six months prior to delivery of the turbine generator. The staff finds the response acceptable since the applicant references the DCD with the associated turbine inspection and test program and the inspection and test intervals established by MUAP-07028 and MUAP-07029. The staff also finds the timeline for implementation of the inspection and test procedures to be acceptable since it will ensure the inspection and testing program is implemented prior to fuel load, in order to maintain $P_1 < 1 \times 10^{-5}$ as outlined in RG 1.115 and SRP Section 3.5.1.3. Based on the above, **RAI 2664, Question 03.05.01.03-1, is resolved and closed.**

The staff finds that CP COL 3.5(2) is acceptable since the probability of generating a turbine missile meets the guidance in SRP Section 3.5.1.3 and the requirements of GDC 4 since the probability of a missile striking a safety-related component is acceptably low (i.e., $P_1 < 1 \times 10^{-5}$).

Therefore, the staff finds that the effects of turbine missiles on safety-related SSCs are acceptably small for the co-located US-APWR plants for CPNPP, Units 3 and 4, because the probability of generating a turbine missile is less than 1×10^{-5} per year, which meets the guidance of RG 1.115 and SRP Section 3.5.1.3 for plants with unfavorable turbine orientation.

3.5.1.3.5 Post Combined Operating License Activities

There are no follow-up actions identified for the COL Licensee during the construction stage related to turbine missiles. However, see section 10.2.5 of this report for information on follow-up actions identified for the COL Licensee related to the turbine rotor.

3.5.1.3.6 Conclusion

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to turbine missiles and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is currently reviewing the information in DCD Tier 2, Section 3.5.1.3 under Docket Number 52-021. The results of the staff's technical evaluation of the information relating to turbine missiles incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's SER on the US-APWR DCD. The SE on the US-APWR DCD is not complete to date, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.5.1.3 of the SE to reflect the final disposition of the DC application.

The staff concludes that the relevant information presented within the CPNPP, Units 3 and 4, COL FSAR is acceptable and meets the requirements of GDC 4 regarding turbine missiles in accordance with the guidelines of SRP Section 3.5.1.3. The staff based its conclusion on the following:

- CP COL 3.5(2), as it relates to maintaining the probability of missile occurrence, P_1, within this acceptable limit, is acceptable because it documents that the turbine orientation is unfavorable using the guidance in RG 1.115.

- CP COL 3.5(6), as it relates to assessing the orientation of the turbine generator of this and other unit(s) at multi-site, is acceptable because it ensures that the turbine missile evaluation for co-located US-APWR units meets the guidance of SRP Section 3.5.1.3 in that the probability of a strike by a turbine missile on safety-related SSCs is acceptably small, and therefore ensures that the requirements of GDC 4 are met for protecting safety-related SSCs against the effects of turbine missiles.

3.5.1.4 Missiles Generated by Tornadoes, Hurricanes, and Extreme Winds

3.5.1.4.1 Introduction

This section discusses possible hazards attributable to missiles generated by high-speed winds, such as tornados, hurricanes, and any other extreme winds. Because of the higher wind speed and the resulting higher kinetic energy, the design for wind-generated missiles is governed by tornado and hurricane missiles.

3.5.1.4.2 Summary of Application

Section 3.5, "Missile Protection," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, Section 3.5 of the US-APWR DCD, Revision 3. Section 3.5 of the DCD includes Section 3.5.1.4, "Missiles Generated by Tornadoes and Extreme Winds."

Note that CPNPP, Units 3 and 4, COL FSAR, Revision 3 is entirely incorporated by reference. In its response to **DCD RAI 908-6327, Question 03.03.02-6 and RAI 907-6321, Question 02-3**, dated September 24, 2012, the DCD applicant provided information that addressed design-basis hurricane and hurricane-generated missiles for the US-APWR DCD. The US-APWR applicant also expanded COL Information Item, COL 3.5(5), to include hurricane missiles. In its response to **RAI 6342, Question 03.03.02-9**, dated September 14, 2012, and its supplemental response dated May 13, 2013, the applicant addressed the expanded COL Information Item dealing with hurricane missiles by adding new Section 3.5.1.4 and provided an associated markup to be included CPNPP, Units 3 and 4, COL FSAR, Revision 4. The discussion below includes these additions.

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.5.1.4, the applicant provided the following information:

US-APWR COL Information Item

- CP COL 3.5(5)

In a mark-up to CPNPP, Units 3 and 4, COL FSAR, Revision 3, the applicant provided additional information to address COL Information Item 3.5(5) regarding other potential site-specific missiles. CP COL 3.5(5) applies to Section 3.5.1.4.

3.5.1.4.3 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 the Commission's regulations for the missiles generated by extreme winds, and the associated acceptance criteria, are given in Section 3.5.1.4, "Missiles Generated by Tornadoes and Extreme Winds," Revision 3, issued March 2007, of NUREG-0800.

The applicable regulatory requirements for the COL information item described above are as follows:

1. GDC 2, as it relates to the ability of important-to-safety SSCs, to withstand the effects of natural phenomena, such as earthquakes, tornadoes and hurricanes, without loss of capability to perform their safety functions.

2. GDC 4, as it relates to the protection of important-to-safety SSCs against the effects of missiles that may result from events and conditions outside the nuclear power unit.

3.5.1.4.4 Technical Evaluation

The staff reviewed Section 3.5.1.4 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference, addresses the required information relating to missiles generated by extreme winds. Section 3.5.1.4 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff's technical evaluation of the information incorporated by reference related to missiles generated by extreme winds will be documented in the staff's FSER on the DC application for the US-APWR design.

The staff reviewed the information contained in Section 3.5.1.4 of the CPNPP, Units 3 and 4, COL FSAR.

US-APWR COL Information Items

- CP COL 3.5(5)

The staff reviewed CP COL 3.5(5), related to the COL Information Item 3.5(5), included in the markup Section 3.5.1.4 of the CPNPP, Units 3 and 4, COL FSAR. In its response to **RAI 6342, Question 03.03.02-9**, dated September 14, 2012, the applicant proposed to add additional information after the last paragraph of DCD Tier 2, Subsection 3.5.1.4. This information includes a site-specific design-basis hurricane wind speed of 145 mph (64.8 m/s), and the velocities associated with the appropriate missile spectrum.

The staff has determined the methodologies used to establish a site-specific design-basis hurricane wind speed and hurricane missile velocities are consistent with RG 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," issued October 2011. The staff finds the applicant's proposal to address COL 3.5(5) acceptable because the determination of site-specific design-basis hurricane wind meets RG 1.221. Also, the staff finds that the CPNPP, Units 3 and 4, design does not change the conclusion reached in the SE for the DCD, and therefore meets the GDC 2 and GDC 4 requirements. **RAI 6342, Question 03.03.02-9, is being tracked as a Confirmatory Item.**

3.5.1.4.5 Post-Combined License Activities

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

3.5.1.4.6 Conclusions

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to missiles generated from extreme winds, and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is currently reviewing the information in DCD Tier 2, Section 3.5.1.4 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to missiles generated from extreme winds incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff SER on the US-APWR DCD. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.5.1.4 of this SER to reflect the final disposition of the DC application.

In addition, the staff has compared the additional COL information within the application to the relevant NRC regulations, acceptance criteria defined in SRP Section 3.5.1.4, and other NRC RGs. Pending the verification of the confirmatory item for **RAI 6342, Question 03.03.02-9**, the staff concludes that relevant information presented within the CPNPP, Units 3 and 4, FSAR is acceptable and meets the requirements of GDC 2 as it relates to the ability of SSCs without loss of capability to perform their safety function to withstand the effects of natural phenomena, and GDC 4 as it relates to the protection of SSCs important to safety from missile generation from conditions outside the nuclear power unit. The staff based its conclusion on the following:

- CP COL 3.5(5), as it relates to site-specific hurricane missiles, is acceptable because the site-specific design-basis hurricane winds have been defined and is consistent with the guidance of RG 1.221.

3.5.1.5 Site Proximity Missiles (Except Aircraft)

3.5.1.5.1 Introduction

This section discusses that the design is based on tornado missiles and that the COL applicant will establish the site-specific missile spectra.

GDC 4 requires, in part, that SSCs important to safety be protected against the dynamic effects, including the effects of missiles that may result from events and conditions outside the nuclear power unit.

The potential threat to the plant from site proximity missiles is site-specific and cannot be assessed at the DC stage. Missiles generated from nearby facilities are identified as a COL information item in the US-APWR DCD Tier 2, Table 1.8-2, "Compilation of All Combined License Applicant Items for Chapters 1-19," (Item 3.5(3)). A COL applicant that references the US-APWR DCD will evaluate the potential for site proximity explosions and missiles generated by these explosions for their potential impact on missile protection design features.

3.5.1.5.2 Summary of Application

Section 3.5, “Missile Protection,” of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, Section 3.5 of the US-APWR DCD, Revision 3. Section 3.5 of the DCD includes Section 3.5.1.5, “Site Proximity Missiles (Except Aircraft).”

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.5.1.5, the applicant provided the following site information:

US-APWR COL Information Items

- CP COL 3.5(3)

The applicant provided additional information in CP COL 3.5(3) to address COL Information Item 3.5(3) in the DCD, Revision 3 regarding the presence of potential hazards and effects in vicinity of the site, except aircraft and the effects of potential accidents in the vicinity of the site. CP COL 3.5(3) applies to Section 3.5.1.5.

3.5.1.5.3 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 the Commission’s regulations for site proximity missiles (except aircraft), and the associated acceptance criteria, are given in Section 3.5.1.5, ‘Site Proximity Missiles (Except Aircraft),” Revision 4, issued March 2007, of NUREG-0800.

The applicable regulatory requirements for missiles generated by site proximity missiles (except aircraft) are as follows:

1. GDC 4, as it relates to the protection of SSCs against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit.

2. 10 CFR Part 100, “Reactor Site Criteria,” 10 CFR 100.10, “Factors to be Considered When Evaluating Sites,” 10 CFR 100.20, “Factors to be Considered When Evaluating Sites,” 10 CFR 100.21, “Non-seismic Site Criteria,” and 10 CFR Part 52, as they relate to reactors reflecting through their design, construction, and operation an extremely low probability of accidents that could result in the offsite release of significant quantities of radioactivity.

3. 10 CFR 100.10 and 10 CFR 100.20, as they relate to the site assuring a low risk of public exposure, that is to have a potential accident probability of site proximity missiles (except aircraft) having the potential for radiological consequences greater than 10 CFR 50.34(a)(1) exposure guidelines as required by 10 CFR Part 100 is less than an order of magnitude of 1×10^{-7} per year.

3.5.1.5.4 Technical Evaluation

The staff reviewed Section 3.5.1.5 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL

FSAR represents the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to site proximity missiles (except aircraft). Section 3.5.1.5 of the US-APWR DCD is being reviewed by the staff under Docket No. 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff's technical evaluation of the information incorporated by reference related to site proximity missiles (except aircraft) will be documented in the staff FSER on the DC application for the US-APWR design.

The staff reviewed the information contained in Section 3.5.1.5 of the CPNPP, Units 3 and 4, COL FSAR:

US-APWR COL Information Items

- CP COL 3.5(3)

The staff reviewed CP COL 3.5(3) related to COL Information Item 3.5(3) included under Section 3.5.1.5 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the paragraph of DCD Section 3.5.1.5 with the following:

> Externally initiated missiles considered for design are based on tornado missiles as described in DCD Subsection 3.5.1.4. As described in Section 2.2, no potential site-proximity missile hazards including turbine missiles from CPNPP, Units 1 and 2, are identified except aircraft, which are evaluated in Subsection 3.5.1.6. Subsection 3.5.1.3.1 provides further discussion on the assessment of a turbine missile from CPNPP, Units 1 and 2.

The staff reviewed the APWR COL information CP COL 3.5(3) related to missiles generated by events near the site included under Sections 3.5.1.5 of the CPNPP, Units 3 and 4, respectively.

The applicant discussed and evaluated external events in CPNPP, Units 3 and 4, COL FSAR, Section 2.2.3, "Evaluation of Potential Accidents," that have potential for the missile generation. In CPNPP, Units 3 and 4, COL FSAR, Section 2.2, "Nearby Industrial, Transportation, and Military Facilities," the applicant concluded that none of the potential site-specific external event hazards resulted in an unacceptable effect important to the safe operation of CPNPP, Units 3 and 4.

The supporting information considered by the applicant in the evaluations of site-specific external hazards that may have the potential for the missile generation, was not provided adequately in the CPNPP, Units 3 and 4, COL FSAR. Therefore, as a part of review of CPNPP, Units 3 and 4, COL FSAR Section 2.2.3, the staff requested additional information in RAIs 2843, 2844, and 2864, to allow the staff to perform confirmatory analyses and to complete the review of CPNPP, Units 3 and 4, COL FSAR Section 2.2.3. Based on the review of the information provided by the applicant in CPNPP, Units 3 and 4, COL FSAR Section 2.2.3, and the applicant's RAI responses provided in a letter dated October 15, 2009, and based on confirmatory calculations, the staff concludes that the applicant's information and approach is applicable and a conclusion of no unacceptable effects due to external hazards is reasonable, as the information satisfies the requirements and the NRC guidance. The staff's review of CPNPP, Units 3 and 4, COL FSAR Section 2.2.3 and evaluation of RAIs 2843, 2844, and 2864 is discussed in Section 2.2.3 of this report.

In addition, in **RAI 2875, Question 03.05.01.05-1**, the staff requested the applicant to address the potential turbine missile effects from CPNPP, Units 1 and 2, as external hazards on the operation of CPNPP, Units 3 and 4. In its response to **RAI 2875, Question 03.05.01.05-1,** dated October 15, 2009, the applicant stated that no potential site-proximity missile hazards, including turbine missiles from CPNPP, Units 1 and 2, are identified. The applicant proposed to revise CPNPP, Units 3 and 4, COL FSAR Section 3.5.1.5 to clearly state this. The staff finds the applicant's response acceptable, as it clarified that there are no potential site-proximity missile hazards, including turbine missiles from CPNPP, Units 1 and 2, and thus it meets the SRP Section 3.5.1.5 acceptance criteria. The staff also confirmed the incorporation of the applicant's revision to CPNPP, Units 3 and 4, COL FSAR Section 3.5.1.5. Accordingly, **RAI 2875, Question 03.05.01.05-1 is resolved.**

3.5.1.5.5 Post-Combined License Activities

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

3.5.1.5.6 Conclusion

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to site proximity missiles (except aircraft), and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is reviewing the information in DCD Section 3.5.1.5 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to site proximity missiles (except aircraft) incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff SER on the US-APWR DCD. The SER on the US-APWR is not yet complete to date, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.5.1.5 of this SER to reflect the final disposition of the DC application.

In addition, the staff concludes that the relevant information presented in the CPNPP, Units 3 and 4, COL FSAR is acceptable and meets the regulatory requirements of 10 CFR 100, 10 CFR 100.20, 10 CFR 100.21 and 10 CFR 52, and GDC 4 as they relate to site proximity missiles, and satisfies the guidance provided in SRP Section 3.5.1.5. The staff based its conclusion on the following:

- CP COL 3.5(3), as it relates to the presence of potential hazards and effects in vicinity of the site, except aircraft and the effects of potential accidents in the vicinity of the site is acceptable because it meets the acceptance criteria provided in SRP Section 3.5.1.5.

3.5.1.6 Aircraft Hazards

3.5.1.6.1 Introduction

This section discusses aircraft hazards to demonstrate that the plant is located such that aircraft hazards are not required to be considered as part of the design basis. The COL applicant verifies the site parameters with respect to aircraft hazards. Additional analyses may be required as appropriate.

The potential threat to the plant from aircraft hazards is site-specific and cannot be assessed at the DC stage. A COL applicant that references the US-APWR DC will evaluate site-specific aircraft hazards and their potential impact on plant SSCs.

3.5.1.6.2 Summary of Application

Section 3.5, "Missile Protection," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, Section 3.5 of the US-APWR DCD, Revision 3. Section 3.5 of the DCD includes Section 3.5.1.6, "Aircraft Hazards."

Note that in CPNPP, Units 3 and 4, COL FSAR, Revision 3, Update Tracking Report Revision 0, the applicant modified CPNPP, Units 3 and 4, COL FSAR, Section 3.5.1.6 to update the aircraft hazards evaluation to reflect changes in plant layout. The plant layout changes are described in, "Comanche Peak Nuclear Power Plant, Units 3 and 4, Docket Numbers 52-034 and 52-035, Updates to the Integrated Seismic Closure Plan and the Integrated Hydrology Closure Plan," dated September 21, 2012. The discussion below includes this modification.

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.5.1.6, the applicant provided the following information:

US-APWR COL Information Items

- CP COL 3.5(4)

The applicant provided additional information in CP COL 3.5(4) to address COL Information Item 3.5(4) in the DCD, Revision 3 regarding site interface parameters for aircraft crashes and air transportation accidents. CP COL 3.5(4) applies to Section 3.5.1.6.

3.5.1.6.3 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 the Commission's regulations for aircraft hazards, and the associated acceptance criteria, are given in Section 3.5.1.6, "Aircraft Hazards," Revision 4, issued March 2010, of NUREG-0800.

The applicable regulatory requirements for aircraft hazards are as follows:

1. GDC 3, "Fire Protection," requires that SSCs important to safety be appropriately protected against the effects of fires.

2. GDC 4 requires that SSCs important to safety be appropriately protected against the effects of missiles that may result from equipment failures and from events and conditions outside the nuclear power unit.

3. 10 CFR Part 100, 10 CFR 100.10, 10 CFR 100.20, 10 CFR 100.21, and 10 CFR 52.79, "Contents of Applications; Technical Information in Final Safety Analysis Report," as they relate to the reactors reflect through their design, construction, and operation an extremely low probability for accidents that could result in the release of significant quantities of radioactive fission products.

4. 10 CFR Part 100, 10 CFR 100.10, and 10 CFR 100.20, as they relate to the site assuring a low risk of public exposure, that is to have a potential aircraft crash probability, having the potential for radiological consequences greater than 10 CFR 50.34(a)(1) exposure guidelines as required by 10 CFR Part 100 is less than an order of magnitude of 1×10^{-7} per year.

3.5.1.6.4 Technical Evaluation

The staff reviewed Section 3.5.1.6 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL FSAR represents the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference, addresses the required information relating to aircraft hazards. Section 3.5.1.6 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff's technical evaluation of the information incorporated by reference related to aircraft hazards will be documented in the staff's SER on the DC application for the US-APWR design.

The staff reviewed the information contained in Section 3.5.1.6 of the CPNPP, Units 3 and 4, COL FSAR:

US-APWR COL Information Items

- CP COL 3.5(4)

The staff reviewed CP COL 3.5(4) related to COL Information Item 3.5(4) included under Section 3.5.1.6 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced paragraph of DCD Section 3.5.1.6 with site interface parameters for aircraft crashes and air transportation accidents.

The applicant addressed and evaluated potential aircraft hazards following the approach and methodology outlined in SRP Section 3.5.1.6, and estimated an aircraft crash into the effective plant areas of the safety-related structures on the site. The probability of aircraft accidents resulting in radiological consequences greater than the 10 CFR Part 100 exposure guidelines was assessed by the applicant in CPNPP, Units 3 and 4, FSAR Section 3.5.1.6 based on the following:

The plant is within five statute miles from the nearest edge of military training route VR-158. Due to the close proximity of the military training route VR-158 to the CPNPP site, the acceptance criteria identified in SRP Section 3.5.1.6, requiring the plant to be at least five statute miles from the nearest edge of military training routes is not met. Therefore, the applicant performed the aircraft accident probability analysis. The applicant stated in the CPNPP, Units 3 and 4, COL FSAR Subsection 2.2.2.7.2, "Airways," that the VR-158 air route is used by T-38C aircraft for training purposes with 300-400 deployments annually. Based on the guidance provided in SRP Section 3.5.1.6, the applicant estimated the number of flight operations is required to be less than 35,300 per year to meet the acceptable total probability of an aircraft accident of 1×10^{-7} per year. The military training operations addressed in CPNPP, Units 3 and 4, FSAR Section 2.2.2.7.2 are much less than the estimated flight operations. Therefore, the applicant concluded that an aircraft accident is not required to be considered as part of the design basis.

The staff obtained the latest five years (2004-2008) of flight operations data within 10 miles of the CPNPP site from the Federal Aviation Administration. Using this data, the NRC staff determined the maximum annual number of total military flight operations within 10 miles of the CPNPP to be 11,192 for the year 2006, and found it to be lower than the applicant's estimated value of 35,300. On the basis of the staff's confirmatory analysis, it is concluded that the aircraft accident probability is lower than the acceptable criterion of 1×10^{-7} per year.

3.5.1.6.5 Post-Combined License Activities

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

3.5.1.6.6 Conclusions

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to aircraft hazards, and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is currently reviewing the information in DCD Section 3.5.1.6 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to aircraft hazards incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff SER on the US-APWR DCD. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.5.1.6 of this SER to reflect the final disposition of the DC application.

In addition, the staff concludes that the relevant information presented in the CPNPP, Units 3 and 4, COL FSAR is acceptable and meets the regulatory requirements of 10 CFR 100.20, 10 CFR 100.21, 10 CFR 52.79, GDC 3, and GDC 4 as they relate to aircraft hazards, and satisfies the guidance provided in SRP Section 3.5.1.6. The staff based its conclusion on the following:

- CP COL 3.5(4), as it relates to site interface parameters for aircraft crashes and air transportation accidents is acceptable because it meets the acceptance criteria provided in SRP Section 3.5.1.6.

3.5.2 Structures, Systems, and Components to be Protected from Externally Generated Missiles

3.5.2.1 Introduction

The design basis are reviewed to ensure that SSCs to be protected from externally generated missiles are identified based on site-specific parameters in CPNPP, Units 3 and 4, COLA.

3.5.2.2 Summary of Application

Section 3.5, "Missile Protection," of the CPNPP, Units 3 and 4, COL FSAR incorporates by reference, Section 3.5 of the US-APWR DCD, Revision 3. Section 3.5 of the DCD includes Section 3.5.2, "Structures, Systems, and Components to be Protected from Externally Generated Missiles."

In addition, in CPNPP, Units 3 and 4, FSAR Section 3.5.2, the applicant provided the following information:

US-APWR COL Information Item

- CP COL 3.5(5)

The applicant provided additional information in CP COL 3.5(5) to address COL Information Item 3.5(5) in the DCD, Revision 3 regarding other potential site-specific missiles.
CP COL 3.5(5) applies to Section 3.5.2.

3.5.2.3 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 the Commission's regulations for the SSCs to be protected from externally-generated missiles, and the associated acceptance criteria, are given in Section 3.5.2, "Structures, Systems, and Components to be Protected from Externally Generated Missiles," Revision 3, issued March 2007, of NUREG-0800.

The applicable regulatory requirements for SSCs to be protected from externally-generated missiles are as follows:

1. GDC 2, which requires SSCs important to safety be designed to withstand the effects of natural phenomena such as tornado, and hurricanes without loss of ability to perform their safety function.

2. GDC 4, as it relates to the protection of important-to-safety SSCs against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit.

3. 10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act of 1954, and the NRC's regulations.

3.5.2.4 Technical Evaluation

The staff reviewed Section 3.5.2 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference addresses the required information relating to SSCs to be protected from externally generated missiles. Section 3.5.2 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-0021. The SER on the US-APWR is not yet complete, and this is being tracked as

part of Open Item [1-1]. The staff's technical evaluation of the information incorporated by reference related to SSCs to be protected from externally generated missiles will be documented in the staff FSER on DC application for the US-APWR design.

The staff reviewed the information contained in Section 3.5.2 of the CPNPP, Units 3 and 4, COL FSAR:

US-APWR COL Information Items

- CP COL 3.5(5)

The staff reviewed CP COL 3.5(5) related to COL Information Item 3.5(5) included under Section 3.5.2 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the second sentence of the second paragraph in DCD Tier 2, Revision 3, Section 3.5.2, with the following:

> As determined in FSAR Section 2.2, Subsection 3.5.1.5 and Subsection 3.5.1.6, no site-specific hazards for external events produce missiles more energetic than tornado missiles identified for the US-APWR standard plant design. The design basis for externally generated missiles is therefore bounded by the standard plant design criteria for tornado-generated missiles in Subsection 3.5.1.4.

The staff reviewed the information provided in the CPNPP, Units 3 and 4, COL FSAR. While the response addresses tornado missiles, the staff found that the response made no mention that site-specific hurricane missiles were considered or evaluated as specified in RG 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," issued October 2011.

In **RAI 6342, Question 03.03.02-09**, the staff requested the applicant to address site-specific design-basis hurricane and hurricane missiles. The staff's evaluation of this RAI is in Section 3.3.2 of this report.

As part of the response to **RAI 6342, Question 03.03.02-09**, dated September 14, 2012, the applicant provided a markup to CPNPP, Units 3 and 4, COL FSAR, Section 3.5.2, to include hurricane missiles as follows:

> As determined in FSAR Section 2.2, Subsection 3.5.1.5 and Subsection 3.5.1.6, no site-specific hazards for external events produce missiles more energetic than tornado missiles and hurricane missiles identified for the US-APWR standard plant design. The design basis for externally generated missiles is therefore bounded by the standard plant design criteria for tornado-generated missiles and hurricane-generated missiles in Subsection 3.5.1.4.

The staff finds the applicant's proposed resolution of COL Information Item 3.5(5) acceptable because an assessment of site-specific hazards was performed and determined there are no site-specific hazards from external events that may produce missiles more energetic than tornado and hurricane missiles. Accordingly, **RAI 6342, Question 03.03.02-09 is being tracked as a Confirmatory Item** pending the revision of the CPNPP, Units 3 and 4, COL FSAR.

3.5.2.5 Post Combined License Activities

There are no post COL actives related to this section.

3.5.2.6 Conclusions

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to SSCs to be protected from externally-generated missiles, and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is currently reviewing the information in DCD Tier 2, Section 3.5.2 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to SSCs to be protected from externally-generated missiles incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's SER on the US-APWR DCD. The SE on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.5.2 of this SE to reflect the final disposition of the DC application.

In addition, the staff concludes, pending the verification of the confirmatory item for **RAI 6342, Question 03.03.02-09**, that the relevant information presented within the CPNPP, Units 3 and 4, COL FSAR is acceptable and meets the requirements of GDC 2 and 10 CFR 52.80(a) as it relates to SSCs important to safety being designed to withstand the effects of natural phenomena since it conforms to the guidelines of SRP Section 3.5.2. The staff based its conclusion on the following:

- CP COL 3.5(5), as it relates to other potential site-specific missiles, is acceptable because an assessment of site-specific hazards was performed and determined there are no site-specific hazards for external events that may produce missiles more energetic than tornado and hurricane missiles. Therefore, the staff concludes that the applicant has provided adequate protection and protective features for CPNPP, Units 3 and 4, to protect SSCs important to safety against externally-generated missiles, and the requirements of GDC 2, GDC 4, and 10 CFR 52.80(a) as it pertains to SSCs important to safety being designed to withstand external missiles, are satisfied.

3.5.3 Barrier Design Procedures

This section discusses procedures utilized in the design of Seismic Category I structures, shields, and barriers to withstand the effects of missile impact.

Section 3.5, "Missile Protection," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, with no departures or supplements, Section 3.5.3, "Barrier Design Procedures," of the US-APWR DCD, Revision 3. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review. The NRC staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in US-APWR DCD Tier 2, Section 3.5.3, under Docket Number 52-021. The results of the staff's technical evaluation of the information related to

missile protection incorporated by reference, in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's FSER of the DC application for the US-APWR. The SE for the US-APWR DC application is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.5.3, of this SE to reflect the final disposition of the DC application design.

3.6 Protection against Dynamic Effects Associated with Postulated Rupture of Piping

3.6.1 Postulated Plant Design for Protection against Postulated Piping Failures in Fluid Systems Outside Containment

3.6.1.1 Introduction

The design basis and criteria are described to demonstrate that safety-related systems are protected from pipe ruptures. This section enumerates the high- and moderate-energy systems, that are potential sources of the dynamic effects associated with pipe ruptures.

3.6.1.2 Summary of Application

Section 3.6, "Protection Against Dynamic Effects Associated with the Postulated Rupture of Piping," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference Section 3.6, "Protection Against the Dynamic Effects Associated with the Postulated Rupture of Piping," of the US-APWR DCD, Revision 3. Section 3.6 of the DCD includes Subsection 3.6.1, "Plant Design for Protection against Postulated Piping Failure in Fluid Systems Inside and Outside Containment."

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.6.1, the applicant provided the following information.

- STD COL 3.6(1)

The applicant provided additional information in STD COL 3.6(1) to address COL Information Item 3.6(1) in the DCD, Revision 3, regarding postulated failures associated with site-specific piping. STD COL 3.6(1) applies to Section 3.6.1.3, "Postulated Failures Associated with Site-Specific Piping."

In CPNPP, Units 3 and 4, COL FSAR Section 3.6.2, the applicant provided the following information.

- STD COL 3.6(4)

The applicant provided additional information in STD COL 3.6(4) to address COL Information Item 3.6(4) in the DCD, Revision 3, regarding criteria used to define break and crack location and configuration for site-specific piping. STD COL 3.6(4) applies to Section 3.6.2.1, "Criteria used to Define Break and Crack Location and Configuration."

3.6.1.3 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 the Commission's regulations for the protection against postulated pipe breaks in high- and moderate-energy piping, and the associated acceptance criteria are given in Section 3.6.1, "Plant Design for Protection against Postulated Piping Failure in Fluid Systems Inside and Outside Containment," Revision 3, issued March 2007, of NUREG-0800.

The applicable regulatory requirements for the protection against postulated pipe breaks in high- and moderate-energy piping are as follows:

1. GDC 2, as it relates to protection against natural phenomena, such as seismically-induced failures of non-seismic piping. The application of GDC 2 to this section is to incorporate environmental effects of full-circumferential ruptures of non-seismic moderate-energy piping in areas where effects are not already bounded by failures of high-energy piping. Acceptance is based on conformance to Branch Technical Position (BTP) 3-3.

2. GDC 4, as it relates to SSCs important to safety being designed to accommodate the effects of, and to be compatible with, the environmental conditions associated with postulated pipe rupture. Acceptance is based on conformance to BTP 3-3.

3. 10 CFR 52.80(a), which requires that a COLA include the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act of 1954, and the NRC's regulations.

Acceptance criteria adequate to meet the above requirements include:

1. BTP 3-3, "Protection Against Postulated Piping Failures in Fluid Systems Outside Containment," Revision 3, issued March 2007.

2. BTP 3-4, "Postulated Rupture Locations in Fluid System Piping Inside and Outside Containment," Revision 2, issued March 2007.

3.6.1.4 Technical Evaluation

The staff reviewed Section 3.6.1 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference addresses the relevant information related to plant design for protection against postulated piping failure in fluid systems inside and outside containment. Section 3.6.1 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The NRC staff's technical evaluation of the information incorporated by reference related to plant design for

protection against postulated piping failure in fluid systems inside and outside containment will be documented in the staff's FSER on the DC application for the US-APWR design.

The staff reviewed the information contained in Section 3.6.1 of the CPNPP, Units 3 and 4, COL:

US-APWR COL Information Items

- STD COL 3.6(1)

The staff reviewed STD COL 3.6(1) related to COL Information Item 3.6(1) included under Section 3.6.1.3 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the paragraph in DCD Tier 2, Revision 3, Section 3.6.1.3, with the following:

> The site-specific systems or components that are safety-related or required for safe shutdown are limited to the essential service water system (ESWS) and the ultimate heat sink (UHS) system. There is no site-specific high-energy piping within the protective walls of the ESWPT [essential service water pipe tunnel] and UHSRSs [ultimate heat sink related structures] and therefore, high-energy pipe breaks are not postulated for site-specific piping within these protective walls. The site-specific moderate-energy piping systems are the ESWS and the fire protection water supply system (FSS).
>
> A qualitative evaluation of site-specific moderate-energy piping systems to assess environmental and flooding impacts is provided below.
>
> The ESWS and the UHS consist of four independent trains with each train providing fifty percent (50%) of the cooling capacity required for a design basis accident and subsequent placement of the plant in the safe shutdown condition. Each train of the ESWS in the ESWPT is physically separated from the other trains by concrete walls and floors, and piping penetrations to other buildings are sealed. The failure in the piping of one ESWS train will not affect the other trains of the ESWS from an environmental and flooding perspective. Therefore, the consequences of failures in site-specific ESWS piping does not affect the ability to safely shut down the plant.
>
> The failure in the FSS piping will not affect the safety function of the ESWS and the UHS from an environmental perspective because the FSS water temperature is approximately room temperature. From a flooding perspective, the ESWS is safe from a FSS pipe failure because FSS piping does not exist in the ESWPT, and the ESWPT piping penetrations prevent intrusion from any postulated FSS spillage in other buildings. Therefore, the consequences of the failure in site-specific FSS piping does not affect the ability to safely shut down the plant. The as-designed pipe hazards analysis report to include the impact of all site-specific high and moderate piping system is to be updated.

In CPNPP, Units 3 and 4, COL FSAR, Revision 3, STD COL 3.6(1) provides a qualitative evaluation that concludes that essential SSCs are protected from the impacts of site-specific pipe breaks.

The staff found STD COL 3.6(1) to be insufficient to completely address COL Information Item 3.6(1). DCD Tier 2, Sections 3.6.1 and 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping," describe the approved methodology used to evaluate the impact of pipe failure and the postulated pipe break locations. STD COL 3.6(1) provides a qualitative evaluation and the staff determined that this approach is not acceptable. Additionally, the applicant addressed the impact of site-specific pipe failure on the site-specific safety-related SSCs; however, the applicant did not take into consideration the impact of design generic pipe failure on site-specific safety-related SSCs or the impact of site-specific piping failure on design generic safety-related SSCs. Furthermore, the applicant did not provide a description of the layout of all piping systems where physical arrangement of the piping systems provides the required protection, the design basis of structures and compartments used to protect nearby essential systems or components, or the arrangements to assure the operability of safety-related features where neither separation nor protective enclosures are practical. Additionally, the COL applicant did not provide the failure modes and effect analyses that verifies the consequences of failures in site-specific high-energy and moderate-energy piping does not affect the ability to safely shut down the plant. Therefore, the staff finds that the applicant did not fully address COL Information Item 3.6(1) in CPNPP, Units 3 and 4, COL FSAR, Revision 3.

In addition, in its response to **DCD RAI 795-5884, Question 03.06.01-9**, dated October 26, 2011, the DCD applicant modified the COL Information Item 3.6(1) to add the following:

> The COL Applicant is to update the as-design pipe hazards analysis report to include the impact of all site-specific high and moderate piping systems.

The staff determined that this portion of the COL Information Item 3.6(1) is also not addressed in CPNPP, Units 3 and 4, COL FSAR, Revision 3. In **RAI 6628, Question 03.06.01-1**, the staff requested the applicant to (a) modify the response to COL Information Item 3.6(1) in order to address all the items identified in COL Information Item 3.6(1) and (b) to address the COL Information Item 3.6(1) changes introduced in response to **DCD RAI 795-5884, Question 03.06.01-9**.

In its response to **RAI 6628, Question 03.06.01-1**, dated September 26, 2012, the applicant proposed to delete references to a qualitative evaluation in CPNPP, Units 3 and 4, COL FSAR, Section 3.6.1, and to replace it with a description of the as-designed pipe break hazards analysis that will be performed on the site-specific moderate-energy piping system. The applicant stated that there are no high-energy site-specific piping systems. The as-designed pipe break hazards analysis will be completed in accordance with the criteria outlined in DCD Tier 2, Subsections 3.6.1.2.2, "Basic Protection Measures," 3.6.1.2.3, "Specific Protection Measures," and 3.6.2.

Additionally, the applicant proposed a new License Condition and a new site-specific ITAAC. The following license condition is proposed to be included in COLA Part 10 as License Condition 2.D(14), "Site-specific or Licensee-specific Conditions," Item vi:

> Before commencing installation of individual piping segments and connected components in their final locations, Luminant [Luminant Generation Company, LLC.] shall complete the as-designed pipe break hazards analysis for compartments (rooms) containing those segments in accordance with the criteria outlined in the US-APWR DCD (Subsections 3.6.1.2.2, 3.6.1.2.3, and 3.6.2), and shall inform the Director of NRO

[New Reactors Office], or the Director's designee, in writing upon the completion of this analysis and the availability of the as-designed pipe break hazards analysis reports.

The license condition requires the completion of an as-designed pipe break hazards analysis for the site-specific piping in accordance with the methodology described in US-APWR DCD Tier 2, Sections 3.6.1.2.2, 3.6.1.2.3, and 3.6.2, and that the report for a particular compartment (room) shall be completed prior to commencing installation of individual piping segments and connected components located in that compartment (room). The license condition also stipulates that the applicant needs to inform the staff that the reports are completed and available for possible audits. The new proposed ITAAC, located in COLA Part 10, Appendix A.7 "Pipe Break Hazards Analysis," Item 1, requires the completion of an as-built pipe hazards analysis for the site-specific moderate-energy piping in accordance with the evaluation criteria described in DCD Tier 2, Sections 3.6.1 and 3.6.2.

The staff reviewed the applicant proposed changes to the FSAR and found that the completion of a pipe break hazards analysis prior to installation of the piping components and the final verification after installation will ensure that essential shutdown and safety-related SSCs will be protected from pipe breaks. Therefore, the staff finds acceptable the applicant's proposed approach to follow the previously approved methodology described in the DCD, which will ensure that the analyses will yield acceptable results. Based on the above, the staff finds the RAI response acceptable regarding STD COL 3.6(1). Pending the incorporation of the proposed FSAR and COLA changes, **RAI 6628, Question 03.06.01-1 is being tracked as a Confirmatory Item.** With the proposed FSAR and COLA changes, the staff finds STD COL 3.6(1) acceptable.

- STD COL 3.6(4)

The staff reviewed STD COL 3.6(4) related to COL Information Item 3.6(4) included under Section 3.6.2.1 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the second paragraph in DCD Tier 2, Revision 3, Section 3.6.2.1, with the following:

> As noted in Subsection 3.6.1.3, there is no site-specific high-energy piping within the protective walls of the ESWPT and UHSRSs. The site-specific moderate-energy piping systems are the ESWS and the FSS. A crack in the moderate-energy piping ESWS and FSS does not affect the safety function of the ESWS and the UHS that are required for a design basis accident and for safe shutdown, as described in Subsection 3.6.1.3.

In its response to **RAI 6628, Question 03.06.01-1,** the applicant proposed to replace STD COL 3.6(4) with the following:

> As noted in Subsection 3.6.1.3, there is no site-specific high-energy piping located near safety-related SSCs. Site-specific moderate-energy piping systems are addressed in an as-designed pipe break hazards analysis. The completed as-designed pipe break hazards analysis will implement the criteria for defining leakage crack locations and configurations for site-specific moderate-energy piping systems described in DCD Subsection 3.6.2.1. The as-designed pipe break hazard analysis report will include identifying the postulated break location for site-specific moderate-energy piping systems.

The as-built reconciliation of the pipe break hazards analysis will be performed to verify the as-built configuration of site-specific moderate-energy piping systems is consistent with the design intent.

As discussed above, in the evaluation of STD COL 3.6(1), the staff reviewed the applicant proposed changes to the FSAR and determined that the as-designed pipe break hazards analysis report will be completed after issuance of the COL, and will be addressed by the new proposed license condition in COLA Part 10, License Condition 2.D(14), Item vi, and by a new site-specific ITAAC in COLA Part 10, Appendix A.7, Item 1. Therefore, the staff finds the applicant has proposed an approach that will ensure that essential shutdown and safety-related SSCs will be protected from pipe breaks. Based on the above, the staff finds the RAI response acceptable regarding STD COL 3.6(4). Pending the incorporation of the proposed FSAR and COLA changes, **RAI 6628, Question 03.06.01-1, is being tracked as a Confirmatory Item.** With the proposed FSAR and COLA changes, the staff finds STD COL 3.6(4) acceptable.

3.6.1.5 Post Combined License Activities

In COLA Part 10, the applicant has proposed License Condition, 2.D(14), "Site-specific or License-specific Conditions," Item (vi) that the staff accepts as **License Condition 3.1**.

- **License Condition (3-1)** – Before commencing installation of individual piping segments and connected components in their final locations, Luminant shall complete the as-designed pipe break hazards analysis for compartments (rooms) containing those segments in accordance with the criteria outlined in the US-APWR DCD, Subsections 3.6.1.2.2, 3.6.1.2.3, and 3.6.2, and shall inform the Director of NRO, or the Director's designee, in writing, upon the completion of this analysis and the availability of the as-designed pipe break hazards analysis reports.

In COLA Part 10, Appendix A.7, Item 1, the applicant has proposed a new site-specific ITAAC that also requires the completion of an as-built pipe hazards analysis for the site-specific moderate-energy piping in accordance with the evaluation criteria described in DCD Section 3.6.1 and 3.6.2.

As noted in Section 3.6.1.4 of this report, the incorporation of the proposed site-specific ITAAC and the licensed condition described in the response to **RAI 6628, Question 03.06.01-1, is being tracked as a Confirmatory Item.**

3.6.1.6 Conclusions

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to protection against postulated pipe breaks in high- and moderate-energy piping, and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is currently reviewing the information in DCD Tier 2, Section 3.6.1, under Docket No. 52-021. The results of the staff's technical evaluation of the information related to protection against postulated pipe breaks in high- and moderate-energy piping incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's SER on the US-APWR DCD. The SE on the US-APWR DCD is not yet complete and is being tracked as

part of Open Item [1-1]. The staff will update Section 3.6.1 of this SER to reflect the final disposition of the DC application.

The staff concludes that the relevant information presented within the CPNPP, Units 3 and 4, COL FSAR, pending the verification of the confirmatory items, is acceptable and meets the requirements of GDC 2, and 4, and 10 CFR 52.80(a).

The staff based its conclusion on the following:

- STD COL 3.6(1), as it relates to postulated failures associated with site-specific piping, is acceptable, pending the verification of the confirmatory items, because the applicant's proposed approach to follow the previously approved methodology described in the DCD, along with the proposed license condition and ITAAC, will ensure that the analyses will yield acceptable results.

- STD COL 3.6(4), as it relates to criteria used to define break and crack location and configuration for site-specific piping, is acceptable, pending the verification of the confirmatory items, because the applicant's proposed approach, along with the proposed license condition and ITAAC, will ensure that essential shutdown and safety-related SSCs will be protected from pipe breaks.

3.6.2 Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping

3.6.2.1 Introduction

This section addresses the criteria for defining break and crack location and methods of analysis for evaluating the dynamic effects associated with postulated breaks and cracks in high-energy and moderate-energy piping systems inside and outside containment. The criteria and methods of analysis are to ensure that the plant can be safely shut down or the consequences of a postulated pipe rupture can be mitigated. The criteria for determining pipe rupture locations and methods of analysis are discussed in the staff's BTP 3-4, "Postulated Rupture Locations in Fluid System Piping Inside and Outside Containment," Revision 2, issued March 2007.

3.6.2.2 Summary of Application

Section 3.6, "Protection Against Dynamic Effects Associated with Postulated Rupture of Piping," of CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, Section 3.6 of the US-APWR DCD, Revision 3. Section 3.3 of the DCD includes Section 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping."

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.6.2, the applicant provided the following information:

US-APWR COL Information Items

- STD COL 3.6(4)

The applicant provided additional information in STD COL 3.6(4) to address COL Information Item 3.6(4) in the DCD, Revision 3, regarding criteria used to define break and crack location and configuration for site-specific piping. STD COL 3.3(4) applies to Section 3.6.2.1, "Criteria used to Define Break and Crack Location and Configuration."

3.6.2.3 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 the Commission's regulations for the determination of rupture locations and dynamic effects associated with the postulated rupture of piping, and the associated acceptance criteria, are given in Section 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping," Revision 2, issued March 2007, of NUREG-0800, as summarized below.

The applicable regulatory requirements for the determination of rupture locations and dynamic effects associated with the postulated rupture of piping are as follows:

1. GDC 4, as it relates to SSCs important to safety being designed to accommodate the dynamic effects associated with postulated pipe rupture.

2. 10 CFR 52.80(a), which requires that a COL application include the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act of 1954, and the NRC's regulations.

Acceptance criteria and guidelines adequate to meet the above requirements include:

BTP 3-4, "Postulated Rupture Locations in Fluid System Piping Inside and Outside Containment," Revision 2, issued March 2007.

3.6.2.4 Technical Evaluation

The staff reviewed Section 3.6.2 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference, addresses the required information relating to the determination of rupture locations and dynamic effects associated with the postulated rupture of piping. Section 3.6.2 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff's technical evaluation of the information incorporated by reference related to determination of rupture locations and dynamic effects associated with the postulated rupture of piping will be documented in the staff's FSER on the DC application for the US-APWR design.

The staff reviewed the information contained in Section 3.6.2 of the CPNPP, Units 3 and 4, COL FSAR.

US-APWR COL Information Items

- STD COL 3.6(4)

The staff reviewed STD COL 3.6(4) related to COL Information Item 3.6(4) included under Section 3.6.2.1 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the second paragraph in DCD Tier 2, Revision 3, Section 3.6.2.1, with the following:

> As noted in Subsection 3.6.1.3 [Postulated Failures Associated with Site-Specific Piping], there is no site-specific high-energy piping within the protective walls of the ESWPT [essential service water pipe tunnel] and UHSRSs [ultimate heat sink related structures]. The site-specific moderate-energy piping systems are the ESWS [essential service water system] and the FSS [fire protection water supply system]. A crack in the moderate-energy piping ESWS and FSS does not affect the safety function of the ESWS and the UHS that are required for a design basis accident and for safe shutdown, as described in Subsection 3.6.1.3.

In its response to **RAI 6628, Question 03.06.01-1**, dated September 26, 2012, the applicant proposed to modify STD COL 3.6(4) to state the following:

> As noted in Subsection 3.6.1.3, there is no site-specific high-energy piping located near safety-related SSCs. Site-specific moderate-energy piping systems are addressed in an as-designed pipe break hazards analysis. The completed as-designed pipe break hazards analysis will implement the criteria for defining leakage crack locations and configurations for site-specific moderate-energy piping systems described in DCD Subsection 3.6.2.1. The as-designed pipe break hazard analysis report will include identifying the postulated break location for site-specific moderate-energy piping systems.
>
> The as-built reconciliation of the pipe break hazards analysis will be performed to verify the as-built configuration of site-specific moderate-energy piping systems is consistent with the design intent.

As discussed in Section 3.6.1 of this report, in the evaluation of STD COL 3.6(1) and STD COL 3.6(4), the staff reviewed the applicant proposed changes to the FSAR and determined that the as-designed pipe break hazards analysis report will be completed after issuance of the COL, and will be addressed by the new proposed license condition in COLA Part 10, License Condition 2.D(14), Item vi, and by a new site-specific ITAAC in COLA Part 10, Appendix A.7, Item 1. This new proposed ITAAC also requires the completion of an as-built pipe hazards analysis for the site-specific moderate-energy piping in accordance with the evaluation criteria described in DCD Sections 3.6.1 and 3.6.2. Therefore, the staff finds the applicant has proposed an approach that will ensure that essential shutdown and safety-related SSCs will be protected from pipe breaks. Based on the above, the staff finds the RAI response acceptable regarding STD COL 3.6(4). Pending the incorporation of the proposed FSAR and COLA changes, **RAI 6628, Question 03.06.01-1, is being tracked as a Confirmatory Item.** With the proposed FSAR and COLA changes, the staff finds STD COL 3.6(4) acceptable.

3.6.2.5 Post-Combined License Activities

In COLA Part 10 of the application, the applicant has proposed License Condition 2.D(14), "Site-specific or License-specific Conditions," Item (vi) that the staff accepts as **License Condition 3.1**.

- **License Condition (3-1)** – Before commencing installation of individual piping segments and connected components in their final locations, Luminant shall complete the as-designed pipe break hazards analysis for compartments (rooms) containing those segments in accordance with the criteria outlined in the US-APWR DCD, Subsections 3.6.1.2.2, 3.6.1.2.3, and 3.6.2, and shall inform the Director of NRO, or the Director's designee, in writing, upon the completion of this analysis and the availability of the as-designed pipe break hazards analysis reports.

In COLA Part 10, Appendix A.7, Item 1, the applicant has proposed a new site-specific ITAAC in COLA Part 10, Appendix A.7, Item 1 which also requires the completion of an as-built pipe hazards analysis for the site-specific moderate-energy piping in accordance with the evaluation criteria described in DCD Section 3.6.1 and 3.6.2.

3.6.2.6 Conclusions

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to the determination of rupture locations and dynamic effects associated with the postulated rupture of piping, and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is currently reviewing the information in DCD Tier 2, Section 3.6.2 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to the determination of rupture locations and dynamic effects associated with the postulated rupture of piping incorporated by reference, in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's SER on the US-APWR DCD. The SER on the US-APWR DCD is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.6.2 of this SER to reflect the final disposition of the DC application.

In addition, the staff concludes that pending satisfactory verification of the confirmatory items, the applicant meets the requirements of GDC 4 and 10 CFR 52.80(a) as they relate to the determination of rupture locations and dynamic effects associated with the postulated rupture of piping.

The staff based its conclusion on the following:

- STD COL 3.6(4), as it relates to criteria used to define break and crack location and configuration for site-specific piping, is acceptable, pending the verification of the confirmatory item, because the applicant's proposed approach, along with the proposed license condition and ITAAC, will ensure that essential shutdown and safety-related SSCs will be protected from pipe breaks.

3.6.3 Leak-Before-Break Evaluation Procedures

3.6.3.1 Introduction

This section addresses the use of leak-before-break (LBB) evaluation methods to eliminate pipe breaks in certain high-energy piping systems.

3.6.3.2 Summary of Application

Section 3.6, "Protection Against Dynamic Effects Associated with Postulated Rupture of Piping," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, Section 3.6 of the US-APWR DCD, Revision 3. Section 3.6 of the DCD includes Section 3.6.3, "LBB Evaluation Procedures."

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.6.3, the applicant provided the following information:

US-APWR COL Information Items

- STD COL 3.6(10)

The applicant provided additional information in STD COL 3.6(10) to address COL Information Item 3.6(10) in the DCD, Revision 3 regarding operating and maintenance procedures for water hammer prevention. STD COL 3.6(10) applies to Section 3.6.3.3.1, "Water Hammer."

3.6.3.3 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 the Commission's regulations pertaining to wind loadings and the associated acceptance criteria are addressed in Section 3.6.3, "Leak-Before-Break Evaluation Procedures," Revision 1, issued March 2007, of NUREG-0800.

The applicable regulatory requirements for LBB evaluation procedures are as follows:

> GDC 4, as it relates to the exclusion of dynamic effects of the pipe ruptures that are postulated in SRP Section 3.6.2, "Determination of Rupture Locations and Dynamic Effects Associated with the Postulated Rupture of Piping." The design basis for the piping means those conditions specified in the safety analysis report, as amended, and, which may include regulations in 10 CFR Part 50, applicable sections of NUREG-0800, RGs, and industry standards such as the ASME Code.

3.6.3.4 Technical Evaluation

The staff reviewed Section 3.6.3 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference, addresses the required information relating to LBB evaluation procedures. Section 3.6.3 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff's technical evaluation of the information incorporated by

reference related to LBB evaluation procedures will be documented in the staff's FSER on the DC application for the US-APWR design.

The staff reviewed the information contained in Section 3.6.3 of the CPNPP, Units 3 and 4, COL FSAR:

US-APWR COL Information Items

- STD COL 3.6(10)

The staff reviewed STD COL 3.6(10) related to COL Information Item 3.6(10) included under Section 3.6.3.3.1 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the last sentence of the second paragraph in DCD Tier 2, Revision 3, Section 3.6.3.3.1, with the following:

> Generally, water hammer is not experienced in Reactor Coolant Loop (RCL) branch piping, and the piping is designed to preclude the voiding condition according to operation at a pressure greater than the saturation pressure of the coolant. No valve that requires immediate action, such as pressurizer safety valve or relief valve, is present in the piping. Operating and maintenance procedures regarding water hammer are included in system operating procedures in Subsection 13.5.2.1. A milestones schedule for implementation of the procedures is also included in Subsection 13.5.2.1. The procedures are to address plant operating and maintenance requirements to provide adequate measures to prevent water hammer due to a voided line condition.

The staff reviewed STD COL 3.6(10) and CPNPP, Units 3 and 4, COL FSAR Section 13.5.2.1, "Operating and Emergency Operating Procedures," and confirmed that a milestone schedule exists for preparing water hammer procedures as stated in the COL information item that was added to the US-APWR DCD. The staff considers this change to be an administrative commitment that has been documented in the CPNPP, Units 3 and 4, COL FSAR and the applicant's response to COL Information Item 3.6(10) is, thus, acceptable.

3.6.3.5 Post Combined Operating License Activities

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

3.6.3.6 Conclusion

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to LBB evaluation procedures, and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is currently reviewing the information in DCD Tier 2, Section 3.6.3 under Docket Number 52-021. The results of the staff's technical evaluation of the information relating to LBB evaluation procedures incorporated by reference, in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's SER on the US-APWR DCD. The SE on the US-APWR DCD is not complete to date, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.6.3 of the SER to reflect the final disposition of the DC application.

In addition, the staff has compared the additional COL information within the application to the relevant NRC regulations, acceptance criteria defined in SRP Section 3.6.3, and other NRC RGs and concludes that the relevant information presented within the CPNPP, Units 3 and 4, COL FSAR is acceptable and meets the requirements of GDC 4 as it relates to the LBB evaluation procedures since it conforms to the guidelines of SRP Section 3.5.1.1. The staff based its conclusion on the following:

- STD COL 3.6(10), as it relates to operating and maintenance procedures for water hammer prevention, is acceptable because a milestone schedule exists for preparing water hammer procedures.

3.7 Seismic Design

3.7.1 Seismic Design Parameters

[This section is still under review and the SE will be provided at a later time]

3.7.1.1 Introduction

3.7.1.2 Summary of Application

3.7.1.3 Regulatory Basis

3.7.1.4 Technical Evaluation

3.7.1.5 Post-Combined License Activities

3.7.1.6 Conclusions

3.7.2 Seismic Design Analysis

[This section is still under review and the SE will be provided at a later time]

3.7.2.1 Introduction

3.7.2.2 Summary of Application

3.7.2.3 Regulatory Basis

3.7.2.4 Technical Evaluation

3.7.2.5 Post-Combined License Activities

3.7.2.6 Conclusions

3.7.3 Seismic Subsystem Analysis

[This section is still under review and the SE will be provided at a later time]

3.7.3.1 Introduction

3.7.3.2 Summary of Application

3.7.3.3 Regulatory Basis

3.7.3.4 Technical Evaluation

3.7.3.5 Post-Combined License Activities

3.7.3.6 Conclusions

3.7.4 Seismic Instrumentation

[This section is still under review and the SE will be provided at a later time]

3.7.4.1 Introduction

3.7.4.2 Summary of Application

3.7.4.3 Regulatory Basis

3.7.4.4 Technical Evaluation

3.7.4.5 Post-Combined License Activities

3.7.4.6 Conclusions

3.8 Design of Category 1 Structures

3.8.1 Concrete Containment

[This section is still under review and the SE will be provided at a later time]

3.8.1.1 Introduction

3.8.1.2 Summary of Application

3.8.1.3 Regulatory Basis

3.8.1.4 Technical Evaluation

3.8.1.5 Post-Combined License Activities

3.8.1.6 Conclusions

3.8.2 Steel Containment

The US-APWR, and likewise, CPNPP, Units 3 and 4, do not utilize a steel containment. Portions of the US-APWR design which fall under Division 1 of the ASME Code, Section III

(Reference 3.8-2), which are pressure-retaining but not backed by concrete, are discussed in Section 3.8.1 above.

3.8.3 Concrete and Steel Internal Structures of Concrete Containment

[This section is still under review and the SE will be provided at a later time]

3.8.3.1 Introduction

3.8.3.2 Summary of Application

3.8.3.3 Regulatory Basis

3.8.3.4 Technical Evaluation

3.8.3.5 Post-Combined License Activities

3.8.3.6 Conclusions

3.8.4 Other Category 1 Structures

[This section is still under review and the SE will be provided at a later time]

3.8.4.1 Introduction

3.8.4.2 Summary of Application

3.8.4.3 Regulatory Basis

3.8.4.4 Technical Evaluation

3.8.4.5 Post-Combined License Activities

3.8.4.6 Conclusions

3.8.5 Foundations

[This section is still under review and the SE will be provided at a later time]

3.8.5.1 Introduction

3.8.5.2 Summary of Application

3.8.5.3 Regulatory Basis

3.8.5.4 Technical Evaluation

3.8.5.5 Post-Combined License Activities

3.8.5.6 Conclusions

3.9 Mechanical Systems and Components

3.9.1 Special Topics for Mechanical Components

This section of the CPNPP, Units 3 and 4, COL FSAR provides information on methods of analysis for Seismic Category I components and supports, including both those designed as ASME Boiler and Pressure Vessel (B&PV) Code, Section III, Division 1, Class 1, 2, 3, or core support (CS) and those not covered by the Code.

Design transients and methods of analysis are described for all seismic Category I components, component supports, CS structures, and reactor internals designated as Class 1, 2, 3 and CS under ASME Code, Section III, and those not covered by the Code. Also included are the assumptions and procedures used for the inclusion of transients in the design and fatigue evaluation of ASME Code Class 1 and CS components and the computer programs used in the design and analysis of seismic Category I components and their supports, as well as experimental and inelastic analytical techniques.

Specific topics of the staff's review include the following:

- Design transients
- Computer program used in analyses
- Experimental stress analysis
- Considerations for the evaluation of the faulted conditions
- Module interaction, coupling and other issues

Section 3.9, "Mechanical Systems and Components," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, with no departures or supplements, Section 3.9.1, "Special Topics for Mechanical Components," of the US-APWR DCD, Revision 3. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review. The NRC staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in US-APWR DCD Section 3.9.1 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to special topics for mechanical components incorporated by reference, in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's FSER of the DC application for the US-APWR. The SE for the US-APWR DC application is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.9.1, "Special Topics for Mechanical Components," of this SE to reflect the final disposition of the DC application design.

3.9.2 Dynamic Testing and Analysis of Systems, Structures and Components

3.9.2.1 Introduction

This section is reviewed to determine whether the criteria, testing procedures, and dynamic analyses employed by the applicant will ensure the structural and functional integrity of piping systems, mechanical equipment, reactor internals, and their supports (including supports for conduit and cable trays, and ventilation ducts) under vibratory loadings, including those due to

fluid flow (especially loading caused by adverse flow conditions, such as instabilities over standoff pipes and branch lines in the steam system) and postulated seismic events.

3.9.2.2 Summary of Application

Section 3.9, "Mechanical Systems and Components," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, Section 3.9 of the US-APWR DCD, Revision 3. Section 3.3 of the DCD includes Section 3.9.2, "Dynamic Testing and Analysis of Systems, Components, and Equipment."

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.9.2, the applicant provided the following:

US-APWR COL Information Items

- CP COL 3.9(2)

The applicant provided additional information in CP COL 3.9(2) to address COL Information Item 3.9(2) in DCD Revision 3 regarding the classification of CPNPP, Unit 3, reactor internals as prototype. CP COL 3.9(2) applies to Subsection 3.9.2.4.1, "Background."

3.9.2.3 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 the Commission regulations pertaining to the dynamic testing and analysis of SSCs and the associated acceptance criteria are given in Section 3.9.2, "Dynamic Testing and Analysis of Systems, Structures, and Components," Revision 3, March 2007, of NUREG-0800.

The applicable regulatory requirements for dynamic testing and analysis of systems, components, and equipment are as follows:

1. 10 CFR 50.55a and GDC 1, as they relate to the design, fabrication, erection, and testing of SSCs in accordance with quality standards commensurate with the importance of the safety function to be performed.

2. GDC 2 and 10 CFR Part 50, Appendix S, as they relate to the ability of SSCs without loss of capability to perform their safety function, to withstand the effects of natural phenomena, such as earthquakes, tornadoes, floods, and the appropriate combination of all loads.

3. GDC 4, as it relates to the protection of SSCs against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit.

4. GDC 14, "Reactor Coolant Pressure Boundary," as it relates to designing SSCs of the reactor coolant pressure boundary (RCPB) to have an extremely low probability of rapidly propagating failure and of gross rupture.

5. GDC 15, “Reactor Coolant System Design,” as it relates to designing the reactor coolant system with sufficient margin to assure that the RCPB is not exceeded during normal operating conditions, including anticipated operational occurrences.

6. 10 CFR Part 50, Appendix B, as it relates to the quality assurance criteria for nuclear power plants.

7. 10 CFR 52.80(a), which requires that a COL application address the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act and the NRC’s regulations.

3.9.2.4 Technical Evaluation

The staff reviewed Section 3.9.2 of the CPNPP Units 3 and 4 COL FSAR and checked the referenced DCD. The staff’s review confirmed that the information contained in the application and incorporated by reference addresses the required information related to the dynamic testing and analysis of SSCs. Section 3.9.2 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff’s technical evaluation of the information incorporated by reference related to the dynamic testing and analysis of SSCs will be documented in the staff’s FSER on the DC application for the US-APWR design.

The staff reviewed the information contained in Section 3.9.2 of the CPNPP Units 3 and 4 COL FSAR:

US-APWR COL Information Items

- CP COL 3.9(2)

The staff reviewed CP COL 3.9(2) related to COL Information Item 3.9(2) included under Section 3.9.2.4.1 of the CPNPP Units 3 and 4 COL FSAR, Revision 3. The applicant replaced the first, second, and third paragraphs in DCD Tier 2, Revision 3, Section 3.9.2.4.1, with the following:

> The CPNPP Unit 3 reactor internals are classified as a prototype in accordance with RG 1.20 (Reference 3.9-21). Upon qualification of the CPNPP Unit 3 as a valid prototype, the CPNPP Unit 4 reactor internals will be classified as non-prototype category I based on the designation of RG 1.20 (Reference 3.9-21).
>
> Following the recommendation of RG 1.20 (Reference 3.9-21), a pre-operational vibration measurement program is developed for the CPNPP Unit 3 as the first operational US-APWR reactor internals. Data will be acquired only during the hot functional test, before core loading. This is in accordance with RG 1.20. Analysis (Subsection 3.9.2.3) shows that the responses under normal operating conditions with fuel assemblies in the core are almost the same or slightly smaller than those under hot

functional test conditions without the core. The final report of the results of the vibration assessment program is submitted to the NRC within 180 days following completion of vibration testing.

Subsequent to the completion of the vibration assessment program for the CPNPP Unit 3 reactor internals, the vibration analysis program will be used to qualify the CPNPP Unit 4 under the criteria for non-prototype category I.

The staff finds CP COL 3.9(2) acceptable since it conforms to the guidelines of Regulatory Guide (RG) 1.20, "Comprehensive Vibration Assessment Program for Reactor Internals During Preoperational and Initial Startup Testing," Revision 3, March 2007, as follows. Subsequent to the completion of the vibration assessment program for the CPNPP Unit 3 reactor internals, the vibration analysis program will be used to qualify the CPNPP Unit 4 under the criteria for non-prototype category I. CPNNP Unit 3 is committed to implementing a pre-operational vibration assessment program and to prepare the final report consistent with guidance of RG 1.20 for a prototype. Subsequent COL Applicants need only provide information in accordance with the applicable portion of position C.3 of RG 1.20 for non-prototype internals. The applicant is committed to providing the final report of the results of the vibration assessment program to the NRC within 180 days following completion of vibration testing according to Regulatory Position C.2.5 of RG 1.20.

Based on the above, the staff finds that the information related to reactor internals classification and testing is adequate in meeting the NRC regulatory requirements, and thus is acceptable.

3.9.2.5 Post Combined License Activities

- The first COL Applicant is to complete the vibration assessment program, including the vibration test results, consistent with guidance of RG 1.20. Subsequent COL Applicant need only provide information in accordance with the applicable portion of position C.3 of RG 1.20 for non-prototype internals.

3.9.2.6 Conclusion

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to the dynamic testing and analysis of SSCs, and there is no outstanding information expected to be addressed in the CPNPP Units 3 and 4 COL FSAR related to this section.

The staff is currently reviewing the information on DCD Tier 2, Section 3.9.2 on Docket Numbers 52-021. The results of the staff's technical evaluation of the information relating to the dynamic testing and analysis of SSCs incorporated by reference in the CPNPP Units 3 and 4 COL FSAR will be documented in the NRC staff's SER on the US-APWR DCD. The SER on the US-APWR DCD is not complete to date, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.9.2 of this SER 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 COL FSAR is acceptable and meets the requirements of GDC 1 and 4. The staff based its conclusion on the applicant's meeting the relevant requirements of GDC 1 and 4 with regard to the internals of a prototype reactor being tested to quality standards commensurate with the importance of the safety functions being performed and being appropriately protected against

dynamic effects (a) by meeting the guidelines of a prototype test as specified in RG 1.20 and (b) by having a preoperational vibration measurement program planned to confirm that unexpected, abnormal vibrations do not occur, and to ensure that the vibration responses of the reactor internals are sufficiently small compared to an acceptance criterion based on the design fatigue curves in the ASME Code, Section III. The combination of preoperational testing program, analysis of test results, and post-test inspection program and acceptance criteria provides adequate assurance that the reactor internals will, during their service life, withstand the flow-induced vibrations of the reactor without loss of structural integrity. The staff based its conclusion on the following:

- CP COL 3.9(2), as it relates to classification of CPNPP Unit 3 reactor internals as prototype, is acceptable because it conforms to the guidelines of RG 1.20

3.9.3 ASME Code Class 1, 2, and 3 Components, Component Supports, and Core Support Structures

3.9.3.1 Introduction

This section discusses the staff evaluation of the structural integrity and functional capability of pressure-retaining components, their supports, and CS structures are ensured by designing them in accordance with ASME Code, Section III, or earlier industrial standards. The loading combinations and their respective stress limits, the design and installation of pressure-relief devices, and the design and structural integrity of ASME Code, Class 1, 2, and 3 components and component supports are included.

The acceptance criteria for the SSC design include the following considerations:

- Loading combinations, design transients, and stress limits
- Pump and valve operability assurance
- Design and installation criteria of ASME Code Class 1, 2, and 3 pressure-relieving devices
- Component and piping supports

3.9.3.2 Summary of Application

Section 3.9, “Mechanical Systems and Components,” of the CPNPP Units 3 and 4 COL FSAR, Revision 3, incorporates by reference Section 3.9 of the US-APWR DCD, Revision 3. Section 3.9 of the DCD includes Section 3.9.3, “ASME Code Class 1, 2, and 3 Components, Component Supports, and Core Support Structures.”

In addition, in CPNPP Units 3 and 4 COL FSAR Section 3.9.3, the applicant provided the following:

US-APWR COL Information Items

- CP COL 3.9(10) and STD CP COL 3.9(10)

The applicant provided additional information in Comanche Peak (CP) COL 3.9(10) and in Standard (STD) COL 3.9(10) to address COL Information Item 3.9(10) regarding site-specific

active pumps. STD COL 3.9(10) applies to Subsection 3.9.3.3.1, “Pump Operability.” CP COL 3.9(10) applies to Table 3.9-201, “List of Site-Specific Active Pumps.”

- STD COL 3.9(1)

The applicant provided additional information in STD COL 3.9(1) to address COL Information Item 3.9(1) regarding snubber functionality. STD COL 3.9(1) applies to Subsection 3.9.3.4.2.5, “Design Specifications.”

3.9.3.3 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 the Commission’s regulations pertaining to ASME Code Class 1, 2, and 3 components, component supports, and CS structures, and the associated acceptance criteria, are given in Section 3.9.3, “ASME Code Class 1, 2, and 3 Components, and Component Supports, and Core Support Structures,” Revision 2, March 2007, of NUREG-0800.

The applicable regulatory requirements for ASME Code Class 1, 2, and 3 components, component supports, and CS structures are as follows:

1. 10 CFR 50.55a and GDC 1, as they relate to the design, fabrication, erection, and testing of SSCs in accordance with quality standards commensurate with the importance of the safety function to be performed.

2. GDC 2 and 10 CFR Part 50, Appendix S, as they relate to the ability of SSCs without loss of capability to perform their safety function, to withstand the effects of natural phenomena, such as earthquakes, tornadoes, floods, and the appropriate combination of all loads.

3. GDC 4, as it relates to the protection of SSCs against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit.

4. GDC 14, as it relates to designing SSCs of the reactor coolant pressure boundary (RCPB) to have an extremely low probability of rapidly propagating failure and of gross rupture.

5. GDC 15, as it relates to designing the reactor coolant system (RCS) with sufficient margin to assure that the RCPB is not exceeded during normal operating conditions, including anticipated operational occurrences (AOOs).

6. 10 CFR Part 50, Appendix B, as it relates to the quality assurance (QA) criteria for nuclear power plants.

7. 10 CFR Part 52 requires that the components and component supports, and CS.

8. 10 CFR 52.80(a), which requires that a COLA address the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act of 1954, and the NRC's regulations.

3.9.3.4 Technical Evaluation

The staff reviewed Section 3.9.3 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference, addresses the required information relating to ASME Code Class 1, 2, and 3 components, component supports, and CS structures. Section 3.9.3 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The NRC staff's technical evaluation of the information incorporated by reference, related to ASME Code Class 1, 2, and 3 components, component supports, and CS structures will be documented in the staff SER on the DC application for the US-APWR design.

The staff reviewed the information contained in the CPNPP, Units 3 and 4, COL FSAR:

US-APWR COL Information Items

- STD COL 3.9(10)

The staff reviewed STD COL 3.9(10) related to COL Information Item 3.9(10) included under Section 3.9.3.3.1 of the CPNPP, Units 3 and 4, COL FSAR, Revision 1. The applicant replaced the last sentence of the first paragraph in DCD Subsection 3.9.3.3.1 with the following:

> The site-specific list of active pumps is provided in Table 3.9-201.

- CP COL 3.9(10)

The staff reviewed CP COL 3.9(10) related to COL Information Item 3.9(10), included as Table 3.9-201 of the CPNPP, Units 3 and 4, COL FSAR.

The last sentence of the first paragraph of DCD Tier 2, Revision 0, Subsection 1, states, "Table 3.9-7 lists the active pumps." Replacing this sentence with "The site-specific list of active pumps is provided in Table 3.9-201" is not consistent with intent of DCD Tier 2, Table 3.9-7, "List of Active Pumps, ", since DCD Tier 2, Table 3.9-7 identified the active pumps in US-APWR standard plant. Active pumps are those whose operability is relied upon to perform a safety-related function during transients or events in the respective operating condition categories. The criterion included in this section is that the design of these pumps is in accordance with ASME Code Section III requirements as outlined in DCD Tier 2, Table 3.9-6, "Stress Criteria for ASME Code, Section III, Class 1, Components and Supports and Class CS Core Supports," for Class 1 and Table 3.9-8, "Stress Criteria for ASME Code, Section III Class

and Components and Supports," for Class 2/3 pumps. In **RAI 2736, Question 03.09.03-2**, the staff requested that the applicant address the following:

- Explain the safety-related function of Table 3.9-201 pumps during transients or events in the respective operating condition.

- Discuss Table 3.9-201 and the criterion that listed in DCD Table 3.9-8 for Class 2 and 3 components.

In its response to **RAI 2736, Question 03.09.03-2**, dated November 13, 2009, the applicant provided a markup to CPNPP, Units 3 and 4, COL FSAR, Table 3.9-201, and stated the following:

> As noted in the basis column of FSAR Table 3.9-201, the safety function of the UHS [ultimate heat sink] Transfer Pump is to transfer water between basins. The pumps are required to operate during a design basis event. The transfer pump (from the non-operating basin) is operated remotely when the water level in any of the operating basins decreases to the pre-determined level during an accident. The pumps do not operate during normal operation mode except during inservice testing.
>
> FSAR Table 3.9-201 lists site-specific active pumps including the criterion for determination of their active status and is consistent with DCD Tier 2, Table 3.9-7, which lists all standard active pumps. The criterion included in DCD Tier 2, Section 3.9.3 for the design of the active pumps is applicable to the pumps listed in the CPNPP Units 3 and 4 COL FSAR, Table 3.9-201. The pumps in CPNPP Units 3 and 4 COL FSAR Table 3.9-201 are Class 3 pumps and thus ASME Section III Criteria listed in DCD Tier 2, Table 3.9-8 are applicable.

The staff finds the RAI response is acceptable because the applicant addressed the list of pumps and added the information requested by the staff. In addition, DCD Tier 2, Revision 1 Subsection 3.9.3.3.1, added the COL Information Item 3.9(10), to the end of the first paragraph. The staff confirmed the applicant incorporated the proposed changes to Table 3.9-201 in CPNPP, Units 3 and 4, COL FSAR Revision 1. Accordingly, **RAI 2736, Question 03.09.03-2, is resolved and closed.**

Based on the above, the staff finds that STD COL 3.9(10) and CP COL 3.9(10) adequately address COL Information Item 3.9(10).

- STD COL 3.9(1)

The staff reviewed STD COL 3.9(1) related to COL Information Item 3.9(1) included under Section 3.9.3.4.2.5 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the second paragraph of DCD Tier 2, Revision 3, Section 3.9.3.4.2.5 with the following:

> The design specification for snubbers installed in harsh service conditions (e.g. high humidity, temperature, radiation levels) is evaluated for the projected life of the snubber to assure snubber functionality including snubber materials (e.g., lubricants, hydraulic fluids, seals).

The staff finds the STD COL 3.9(1) defines appropriate information to be included in snubber design specifications. In addition, DCD Tier 2, Section 3.9.6.4, "IST Program for Dynamic Restraints," describes an inservice testing program for snubbers, which is an operational program. These provide assurance that snubber functionality is evaluated and maintained. Therefore, the staff finds that STD COL 3.9(1) adequately addresses COL Information Item 3.9(1).

3.9.3.5 Post-Combined License Activities

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

3.9.3.6 Conclusions

The staff reviewed the CPNPP, Units 3 and 4, COLA and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information related to ASME Code Class 1, 2, and 3 components, component supports, and CS structures, and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is currently reviewing the information in DCD Tier 2, Section 3.9.3 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to ASME Code Class 1, 2, and 3 components, component supports, and CS structures incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff SER on the US-APWR DCD. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.9.3 of this SER 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, COL FSAR is acceptable and meets the requirements of 10 CFR 52. The staff based its conclusion on the following:

- STD COL 3.9(10) and CP COL 3.9(10), as they relate to site-specific active pumps, are acceptable because the FSAR, Table 3.9-201 revision lists site-specific active pumps including the criterion for determination of their active status and is consistent with DCD Tier 2, Table 3.9-7, fully addressing the information required by COL Information Item 3.9(10) as it relates to ASME Code Class 1, 2, and 3 components, component supports, and CS structures.

- STD COL 3.9(1), as it relates to snubber functionality, is acceptable because design specification include appropriate snubber information and inservice testing and examination requirements for snubbers are to be implemented as operational programs, fully addressing the information required by COL Information Item STD COL 3.9(1).

3.9.4 Control Rod Drive System

This section of the CPNPP, Units 3 and 4, COL FSAR provides information on the control rod drive system (CRDS), which provides one of the independent reactivity control systems used to adjust the core output.

Section 3.9, “Mechanical Systems and Components,” of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, with no departures or supplements, Section 3.9.4, “Control Rod Drive System,” of the US-APWR DCD, Revision 3. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review. The NRC staff’s review confirmed that there is no outstanding issue related to this section.

The CRDS consists of the control rods and the related mechanical components, which provide the means for mechanical movement. GDC 26, “Reactivity Control System Redundancy and Capability,” and GDC 27, “Combined Reactivity Control Systems Capability,” require that the CRDS provide one of the independent reactivity control systems. The rods and the drive mechanism shall be capable of reliably controlling reactivity changes under conditions of normal operation, including AOOs, and under postulated accident conditions. A positive means for inserting the rods shall always be maintained to ensure appropriate margin for malfunction, such as stuck rods. The applicant’s information regarding design criteria; testing programs; method of operation; applicable design codes and standards; design loads and combinations; and operability assurance program is reviewed. This information pertains to the CRDS, which is considered to extend to the coupling interface with the reactivity control elements in the reactor pressure vessel. The review in this section is limited to the control rod drive mechanism portion of the CRDS.

The staff is reviewing the information in US-APWR DCD Section 3.9.4 under Docket Number 52-021. The results of the staff’s technical evaluation of the information related to the CRDS incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff’s FSER of the DC application for the US-APWR. The SE for the US-APWR DC application is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.9.4, “Control Rod Drive System,” of this SE to reflect the final disposition of the DC application design.

3.9.5 Reactor Pressure Vessel Internals

This section of the CPNPP, Units 3 and 4, COL FSAR provides information on the design of the reactor pressure vessel internals, including preservice and inservice inspection plans.

Section 3.9.5 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, with no departures or supplements, Section 3.9.5, “Reactor Pressure Vessel Internals,” of the US-APWR DCD, Revision 3. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review. The NRC staff’s review confirmed that there is no outstanding issue related to this section.

The reactor internals consist of two major assemblies - the lower internals and the upper internals. The reactor internals provide the protection, alignment and support for the core, control rods, and gray rods to provide safe and reliable reactor operation. In addition, the reactor internals help to accomplish the following: direct the main coolant flow to and from the fuel assemblies; absorb control rod dynamic loads, fuel assembly loads, and other loads and transmit these loads to the reactor vessel; support instrumentation within the reactor vessel; provide protection for the reactor vessel against excessive radiation exposure from the core; and position and support reactor vessel radiation surveillance specimens.

The criteria for the reactor vessel internals design include the following:

- Design arrangements.
- Design loading conditions.
- Design bases.

The staff is reviewing the information in US-APWR DCD Section 3.9.5 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to reactor pressure vessel internals incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's FSER of the DC application for the US-APWR. The SE for the US-APWR DC application is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.9.5, "Reactor Pressure Vessel Internals," of this SE to reflect the final disposition of the DC application design.

3.9.6 Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints

3.9.6.1 Introduction

This section discusses the review of the description of the functional design, qualification, and inservice testing (IST) and motor-operated valve (MOV) testing operational programs for pumps, valves, and dynamic restraints in the CPNPP, Units 3 and 4, COL FSAR. RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," issued June 2007, discusses the Commission's position provided in SECY-05-0197, "Review of Operational Programs in a Combined License Application and General Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria [ITAAC]," issued October 28, 2005, that operational programs should be fully described in COLAs to avoid the need to specify ITAAC for those programs. The applicant relies on the CPNPP, Units 3 and 4, COL FSAR with its incorporation by reference, of the US-APWR DCD and supplemental information to fully describe the IST and MOV testing operational programs.

3.9.6.2 Summary of Application

Section 3.9, "Mechanical Systems and Components," of the CCNPP, Units 3 and 4, FSAR, Revision 3, incorporates by reference, Section 3.9 of the US-APWR DCD, Revision 3. Section 3.9 of the DCD, includes Section 3.9.6, "Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints."

In CPNPP Units 3 and 4 COL FSAR Section 3.9.9, "Combined License Information," the applicant provides a response to the US-APWR COL Information Items related to pumps, valves, and dynamic restraints as follows:

COL Information Item 3.9(1) *Snubber functionality*

This COL information item is addressed in Section 3.9.3.4.2.5, "Design Specifications."

COL Information Item 3.9(6) *Program for IST of dynamic restraints in accordance with the ASME OM Code*

This COL information item is addressed in Sections 3.9.6, "Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints," and 3.9.6.4, "IST Program for Dynamic Restraints."

COL Information Item 3.9(8) *Administrative control of the edition and addenda to be used for the IST program and to provide a full description of their IST program for pumps, valves, and dynamic restraints*

This COL information item is addressed in Section 3.9.6.

COL Information Item 3.9(10) *Site-specific active pumps*

This COL item is addressed in Section 3.9.3.3.1, "Pump Operability," and Table 3.9-201, "List of Site-Specific Active Pumps."

COL Information Item 3.9(11) *Site-specific, safety-related pump IST parameters and frequency*

This COL information item is addressed in Section 3.9.6.2, "IST Program for Pumps," and Table 3.9-202, "Site-Specific Pump IST Requirements."

COL Information Item 3.9(12) *Testing and frequency of site-specific valves subject to IST*

This COL information item is addressed in Section 3.9.6.3, "IST Program for Valves," and Table 3.9-203, "Site-Specific Valve IST Requirements."

DCD Tier 2, Section 3.9.3.3.1, "Pump Operability," states that the COL applicant is to identify the site-specific active pumps. In response to STD COL 3.9(10), CPNPP Units 3 and 4 COL FSAR Section 3.9.3.3.1 states that site-specific active pumps are listed in Table 3.9-201, which is identified as CP COL 3.9(10). In particular, Table 3.9-201 specifies four ultimate heat sink (UHS) transfer pumps that are required for transferring water between the UHS basins.

DCD Tier 2, Section 3.9.3.4.2, "Snubbers," includes provisions for the assurance of snubber functionality, and inspection, testing, repair, and/or replacement of snubbers. DCD Tier 2, Section 3.9.3.4.2.5, "Design Specifications," indicates that the COL applicant is to assure snubber functionality in harsh service conditions, including snubber materials (e.g., lubricants, hydraulic fluids, and seals). In response to STD COL 3.9(1), CPNPP Units 3 and 4 COL FSAR Section 3.9.3.4.2.5 of the same title states that the "design specification for snubbers installed in harsh service conditions (e.g., high humidity, temperature, radiation levels) is evaluated for the projected life of the snubber to assure that snubber functionality, including snubber materials (e.g., lubricants, hydraulic fluids, seals)."

In response to STD COL 3.9(6) and (8), CPNPP Units 3 and 4 COL FSAR Section 3.9.6 modifies DCD Tier 2, Section 3.9.6, to state that the US-APWR utilizes the ASME *Code for Operation and Maintenance of Nuclear Power Plants* (OM Code), 2004 Edition through the 2006 Addenda (or the optional ASME Code Cases listed in RG 1.192, "Operation and Maintenance Code Case Acceptability, ASME OM Code," that is incorporated by reference in 10 CFR 50.55a, subject to the applicable limitations and modifications) for developing the IST program for ASME *Boiler & Pressure Vessel Code* (B&PV Code), Section III, Class 1, 2 and 3 safety-related pumps, valves and dynamic restraints in DCD Tier 2, Section 3.9.6.

CPNPP Units 3 and 4 COL FSAR Section 3.9.6 also states that the IST program for pumps, valves, and dynamic restraints is administratively controlled to ensure that the equipment will be capable of performing its safety function throughout the life of the plant. CPNPP Units 3 and 4 COL FSAR Section 3.9.6 also states that the CPNPP Units 3 and 4 IST program incorporates the IST program described in DCD Tier 2, Section 3.9.6 and its subsections as expanded in the CPNPP Units 3 and 4 COL FSAR. The IST program is developed in accordance with the requirements delineated in ASME B&PV Code, Section XI, "Rules for Inservice Inspection for Nuclear Power Plant Components;" the ASME OM Code; the plant Technical Specifications; and good engineering practices. The IST program is said to rely on baseline information obtained during plant construction and startup testing. The program will be implemented in general conformance with NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants." CPNPP Units 3 and 4 COL FSAR Section 3.9.6 lists several aspects of the IST program and information that will be incorporated in project documents. The IST program will be developed and implemented per the milestone schedule provided in CPNPP Units 3 and 4 COL FSAR, Table 13.4-201, "Operational Programs Required by NRC Regulations."

In response to STD COL 3.9(11) and (12), CPNPP Units 3 and 4 COL FSAR Section 3.9.6.2 and Section 3.9.6.3, indicate that site-specific safety-related pump and valve IST parameters and frequencies are provided in Table 3.9-202 and Table 3.9-203 respectively. These tables are identified as CP COL 3.9(11) and CP COL 3.9(12), respectively.

In response to STD COL 3.9(6), CPNPP Units 3 and 4 FSAR Section 3.9.6.4 modifies US-APWR DCD Section 3.9.6.4 to specify that the IST program for dynamic restraints is implemented in accordance with the ASME OM Code.

3.9.6.3 Regulatory Basis

The regulatory basis for the staff review of design-related information in the US-APWR DCD is documented in the FSER on the US-APWR standard plant.

The regulatory basis for staff review of the Section 3.9.6 operational programs in a COLA FSAR is provided by 10 CFR Parts 50 and 52. Specifically, the NRC regulations in 10 CFR 52.79(a) require that the COL application include information at a level sufficient to enable the Commission to reach a final conclusion on all safety matters that must be resolved by the Commission before COL issuance. For example, paragraph (4) in 10 CFR 52.79(a) requires that a COL application include the design of the facility with specific reference to the general design criteria (GDC) in Appendix A to 10 CFR Part 50, which establish the necessary design, fabrication, construction, testing, and performance requirements for structures, systems and components (SSCs) that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. Paragraph (11) in 10 CFR 52.79(a) requires that a COL application provide a description of the programs and their implementation necessary to ensure that the systems and components meet the requirements of the ASME B&PV Code and the ASME OM Code in accordance with 10 CFR 50.55a. Paragraph (29)(i) in 10 CFR 52.79(a) requires that a COL application provide plans for conduct of normal operations, including maintenance, surveillance, and periodic testing of SSCs. Paragraph (37) in 10 CFR 52.79(a) requires that a COL application provide the information necessary to demonstrate how operating experience insights have been incorporated into the plant design.

In RG 1.206, the staff provides guidance for a COL applicant in preparing and submitting its COLA in accordance with the NRC regulations. For example, Section C.IV.4 in RG 1.206 discusses the requirement in 10 CFR 52.79(a) for descriptions of operational programs that

need to be included in the FSAR for a COLA to allow a reasonable assurance finding of acceptability. In particular, a COL applicant should fully describe the IST, MOV Testing, and other operational programs as defined in Commission Paper SECY-05-0197 to avoid the need for ITAAC for the implementation of those programs. The term "fully described" for an operational program should be understood to mean that the program is clearly and sufficiently described in terms for scope and level of detail to allow a reasonable assurance finding of acceptability. Further, operational programs should be described at a functional level and an increasing level of detail where implementation choices could materially and negatively affect the program effectiveness and acceptability. The Commission approved the use of a license condition for operational program implementation milestones that are fully described or referenced in the FSAR as discussed in the staff requirements memorandum (SRM) for SECY-05-0197, dated February 22, 2006.

The staff followed SRP Section 3.9.6, "Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints," Revision 3, issued March 2007, in its review of the CPNPP COLA. CPNPP Units 3 and 4 COL FSAR in Table 1.9-206, "Comanche Peak Nuclear Power Plant Units 3 & 4 Conformance with Standard Review Plan Chapter 3 Design of Structures, Systems, Components & Equipment," indicates that the COLA conforms to SRP Section 3.9.6.

The staff compared the CPNPP Units 3 and 4 COL FSAR information with the guidance provided in RG 1.206. CPNPP Units 3 and 4 COL FSAR in Table 1.9-201, "Comanche Peak Nuclear Power Plant Units 3 & 4 Conformance with Division 1 Regulatory Guides," indicates that the COLA conforms to RG 1.206 with exceptions.

3.9.6.4 Technical Evaluation

The staff reviewed the CPNPP Units 3 and 4 COLA, and the applicable sections in the DCD incorporated by reference in the CPNPP Units 3 and 4 COL FSAR, for the functional design, qualification, and IST programs for safety-related pumps, valves, and dynamic restraints to determine whether the CPNPP COLA meets the regulatory requirements to provide reasonable assurance that the applicable safety-related components at CPNPP Units 3 and 4 will be capable of performing their safety functions. In its review, the staff evaluated whether the CPNPP COLA with the incorporation by reference of the DCD contains an acceptable description of the functional design, qualification, and IST programs, including the MOV Testing program, for CPNPP Units 3 and 4 that provides reasonable assurance that the safety-related components within the scope of the CPNPP Units 3 and 4 IST program will be capable of performing their safety functions in accordance with the NRC regulations.

3.9.6.4.1 Evaluation of Operational Program Description

<u>STD and CP COL Information Items</u>

As described in this technical evaluation, the staff reviewed the provisions in the CPNPP Units 3 and 4 COL FSAR to address each of the following US-APWR COL Information Items related to pumps, valves, and dynamic restraints listed in CPNPP Units 3 and 4 COL FSAR Section 3.9.9:

COL Information Item 3.9(1) *Snubber functionality*

COL Information Item 3.9(6) *Program for IST of dynamic restraints in accordance with the ASME OM Code*

COL Information Item 3.9(8) *Administrative control of the edition and addenda to be used for the IST program and to provide a full description of their IST program for pumps, valves, and dynamic restraints*

COL Information Item 3.9(10) *Site-specific active pumps*

COL Information Item 3.9(11) *Site-specific, safety-related pump IST parameters and frequency*

COL Information Item 3.9(12) *Testing and frequency of site-specific valves subject to IST*

CPNPP Units 3 and 4 COL FSAR Section 3.9 incorporates by reference Section 3.9 in the US-APWR DCD Tier 2 with departures and supplemental information. In **RAI 2772, Question 03.09.06-1**, the staff requested that the applicant describe the implementation of the functional design and qualification process specified in the US-APWR DCD for pumps, valves, and dynamic restraints to be used at CPNPP, Units 3 and 4. For example, the staff requested that the applicant discuss the application of ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment used in Nuclear Power Plants," for the functional design and qualification of pumps, valves, and dynamic restraints. Further, the staff requested that the applicant discuss the availability of design and procurement specifications for NRC on-site review to demonstrate the implementation of the US-APWR functional design and qualification process for pumps, valves, and dynamic restraints to be used at CPNPP, Units 3 and 4.

In its response to **RAI 2772, Question 03.09.06-1**, dated October 26, 2009, the applicant stated that DCD applicant's Technical Report MUAP-08015, "US-APWR Equipment Environmental Qualification Program," Revision 1, issued November 2009, would provide the implementation milestones for the equipment qualification process for the US-APWR and for site-specific components through its incorporation by reference.

In follow-up **RAI 6027, Question 03.09.06-13**, the staff requested that the applicant discuss the implementation of the provisions in the US-APWR DCD for the functional design and qualification of pumps, valves, and dynamic restraints. For example, the staff requested that the applicant address its application of ASME QME-1-2007 as accepted in Revision 3 to RG 1.100, "Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants," consistent with the US-APWR DCD. The staff also requested that the applicant provide a schedule for the availability of a sample of design and procurement specifications for pumps, valves, and dynamic restraints for audit by the NRC staff.

In its response to **RAI 6027, Question 03.09.06-13**, dated November 7, 2011, the applicant stated that the US-APWR DCD was being revised to specify that the functional design and qualification of pumps, valves, and dynamic restraints will be performed in accordance with ASME QME-1-2007 as accepted in Revision 3 to RG 1.100. In that the CPNPP, Units 3 and 4, COL FSAR incorporates the DCD by reference, the applicant stated that it will apply ASME QME-1-2007 for the design and qualification of pumps, valves, and dynamic restraints for CPNPP, Units 3 and 4. The staff considers the planned revision to the US-APWR DCD to specify the use of ASME QME-1-2007 as accepted in Revision 3 to RG 1.100 for the functional design and qualification of pumps, valves, and dynamic restraints to be acceptable for reference

in the CPNPP, Units 3 and 4, COL FSAR. The staff will confirm this planned revision to the US-APWR DCD as part of the review of the US-APWR DCD.

In its response to **RAI 6027, Question 03.09.06-13**, the applicant stated that the design and procurement specifications for pumps, valves, and dynamic restraints for the site-specific design were not currently available. The NRC regulations in 10 CFR 52.79(a)(11) require COL applicants to provide a description of the programs and their implementation necessary to ensure that systems and components meet the requirements of the ASME B&PV Code and OM Code in accordance with 10 CFR 50.55a. In follow-up **RAI 6222, Question 03.09.06-21**, the staff requested that the applicant provide information (either in sample design and procurement specifications or in the CPNPP, Units 3 and 4, COL FSAR) that specifies the implementation of the IST program sufficient for the staff to make a finding regarding compliance with 10 CFR 52.79(a)(11).

In its response to **RAI 6222, Question 03.09.06-21**, dated February 27, 2012, the applicant provided a planned revision to CPNPP, Units 3 and 4, COL FSAR Section 3.9.6 stating that the US-APWR utilizes the ASME OM Code, 2004, Edition through the 2006, Addenda (or optional ASME Code Case listing in RG 1.192 that is incorporated by reference in 10 CFR 50.55a, subject to the applicable limitations and modifications) for developing the IST program for ASME B&PV Code, Section III, Class 1, 2 and 3 safety-related pumps, valves and dynamic restraints in US-APWR DCD Tier 2, Section 3.9.6. The applicant also indicated that the FSAR would be revised to include the items specified in **RAI 6222, Question 03.09.06-21,** for incorporation in project documents such as the System Design Packages, System Descriptions, Procurement Specifications, and System Requirement Documents. Subsequently, the staff confirmed that Revision 3 to the CPNPP, Units 3 and 4, COL FSAR includes the provision for use of the ASME OM Code, 2004, Edition through the 2006, Addenda (or optional ASME Code Case listing in RG 1.192 that is incorporated by reference, in 10 CFR 50.55a, subject to the applicable limitations and modifications) for developing the IST program for ASME B&PV Code, Section III, Class 1, 2 and 3 safety-related pumps, valves and dynamic restraints in US-APWR DCD Tier 2, Section 3.9.6. Revision 3 to the CPNPP, Units 3 and 4, COL FSAR also includes the list of information to be incorporated in project documents such as System Design Packages, System Descriptions, Procurement Specifications, and System Requirement Documents.

The staff determined that the aspects listed in the CPNPP, Units 3 and 4, COL FSAR to be addressed in the procurement specifications did not provide the level of detail necessary for the staff to reach a safety finding on the implementation of the functional design, qualification, and IST programs for pumps, valves, and dynamic restraints for CPNPP, Units 3 and 4. During follow-up discussions, the US-APWR DCD applicant has indicated that a sample of design and procurement specifications will be prepared for staff audit. The staff will perform an audit of the US-APWR design and procurement specifications to evaluate the implementation of the functional design, qualification, and IST programs in accordance with the requirements of 10 CFR 52.79(a)(11). Therefore, pending the completion of the audit, **RAI 6222, Question 03.09.06-21, is being tracked as an Open Item**.

CPNPP, Units 3 and 4, COL FSAR Section 3.9.6 incorporates by reference, the provisions in the US-APWR DCD in describing the operational programs for IST of pumps, valves, and dynamic restraints, and MOV testing at CPNPP Units 3 and 4. COL Information Item 13.4(1) listed in CPNPP Units 3 and 4 FSAR Table 1.8-201, indicates, among other actions, that the COL applicant is to “fully describe” the operational programs as defined in SECY-05-0197.

In **RAI 2772, Question 03.09.06-2**, the staff requested that the applicant describe the IST and MOV testing operational programs as discussed in Commission paper SECY-05-0197 through a combination of the US-APWR DCD and CPNPP, Units 3 and 4, COL FSAR.

In its response to **RAI 2772, Question 03.09.06-2**, dated October 26, 2009, the applicant stated that the IST programs for pumps, valves, and dynamic restraints are described through a combination of the US-APWR DCD and the CPNPP, Units 3 and 4, COL FSAR. In follow-up **RAI 6027, Question 03.09.06-14**, the staff requested that the applicant confirm that the CPNPP, Units 3 and 4, COL FSAR combined with the US-APWR DCD provides a full description of the IST program for pumps, valves, and dynamic restraints for CPNPP, Units 3 and 4. The staff requested that the applicant submit any planned modifications to the CPNPP, Units 3 and 4, COL FSAR to fully describe the IST program where the US-APWR DCD provisions need to be supplemented. The staff also requested that the applicant clarify a reference to Nonmandatory Appendix A, "Preparation of Testing Plans," of the ASME OM Code in Revision 2 to the CPNPP, Units 3 and 4, COL FSAR.

In its response to **RAI 6027, Question 03.09.06-14**, dated November 7, 2011, the applicant stated that the US-APWR DCD was intended to provide a full description of the IST program for CPNPP, Units 3 and 4. The applicant also stated that the CPNPP, Units 3 and 4, COL FSAR would be revised to delete the reference to the ASME OM Code, Appendix A. In follow-up **RAI 6222, Question 03.09.06-22,** the staff requested that the applicant revise the CPNPP, Units 3 and 4, COL FSAR to respond to COL Information Item 3.9(8) by referencing the provisions in the US-APWR DCD and specifying any plant-specific information in the CPNPP, Units 3 and 4, COL FSAR to provide a full description of the IST program for pumps, valves, and dynamic restraints to be used at CPNPP, Units 3 and 4.

In its response to **RAI 6222, Question 03.09.06-22**, dated March 9, 2012, the applicant stated that the CPNPP, Units 3 and 4, COL FSAR, Section 3.9.6 would be revised to state that the CPNPP, Units 3 and 4, IST program incorporates the IST program described in the US-APWR DCD Tier 2, Section 3.9.6 and its subsections as expanded in the CPNPP, Units 3 and 4, COL FSAR. The planned revision to the CPNPP, Units 3 and 4, COL FSAR also would specify that the IST program will be developed in accordance with the requirements delineated in ASME B&PV Code, Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," the ASME OM Code, the plant TS, and good engineering practices. The applicant stated that the CPNPP, Units 3 and 4, COL FSAR revision would indicate that the IST program will rely on baseline information obtained during plant construction and startup testing, and would provide information on the use of NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants." The planned CPNPP, Units 3 and 4, COL FSAR revision would list several aspects of the IST program and state that the IST program will be developed and implemented per the milestone schedule provided in Table 13.4-201 for the IST program. The applicant provided a supplemental response to **RAI 6222, Question 03.09.06-22**, dated June 13, 2012, that modified the planned FSAR revision to remove the detailed discussion of NUREG-1482. The staff found the planned changes to the CPNPP Units 3 and 4 FSAR to be acceptable in clarifying the incorporation of the IST program description in the US-APWR DCD with the additional provisions specified in the CPNPP, Units 3 and 4, COL FSAR.

The staff confirmed that Revision 3 to the CPNPP, Units 3 and 4, COL FSAR includes the planned changes provided in the applicant's response to **RAI 6222, Question 03.09.06-22**, dated March 9, 2012. However, the CPNPP, Units 3 and 4, COL FSAR changes specified in the applicant's supplemental response to **RAI 6222, Question 03.09.06-22**, dated June 13, 2012, are not included in Revision 3 to the CPNPP, Units 3 and 4, FSAR. Therefore,

implementation of **RAI 2772, Question 03.09.06-2**, **RAI 6027, Question 03.09.06-14**, and **RAI 6222, Question 03.09.06-22, are being tracked as Confirmatory Items** until the CPNPP, Units 3 and 4, FSAR is revised to include the modifications provided in the applicant's supplemental RAI response dated June 13, 2012.

The NRC regulations in 10 CFR 50.55a(f)(4)(i) and (g)(4)(i) require that the IST and inservice inspection programs during the initial 120-month interval comply with the requirements in the latest edition and addenda of the Code incorporated by reference in the regulations on the date 12 months before the date scheduled for initial loading of fuel for a COL under 10 CFR Part 52 (or the optional ASME Code cases listed in the applicable RGs), subject to the limitations and modifications listed in 10 CFR 50.55a of the NRC regulations. In **RAI 2772, Question 03.09.06-3**, the staff requested that the applicant specify the most recent edition and addenda of the ASME OM Code incorporated by reference, in 10 CFR 50.55a that will be used as the basis for the IST program description to provide support for staff review of the COLA for CPNPP Units 3 and 4. In addition, the staff requested that the applicant discuss the planned use of any code cases and their implementation consistent with RG 1.192, and any requests for relief from or alternatives to the OM Code, and their justification.

In its response to **RAI 2772, Question 03.09.06-3**, dated October 26, 2009, the applicant provided an initial edition and addenda of the ASME OM Code to be used as the basis for the IST program description for CPNPP, Units 3 and 4. The applicant stated that the ASME OM Code Cases listed in RG 1.192 will be applied to the IST program as necessary. The applicant indicated that the application of any relief or alternatives to the OM Code and their justification would be provided in the response to **RAI 2772, Question 03.09.06-10**. In follow-up **RAI 6027, Question 03.09.06-15**, the staff requested that the applicant specify in the CPNPP, Units 3 and 4, COL FSAR the specific edition and addenda to the ASME OM Code that will be used as the basis for the full description of the IST program for pumps, valves, and dynamic restraints to support the COL application for CPNPP, Units 3 and 4. The staff also requested that the applicant specify in the CPNPP, Units 3 and 4, COL FSAR any ASME OM Code Cases included as part of the full description of the IST program to be implemented at CPNPP, Units 3 and 4.

In its response to **RAI 6027, Question 03.09.06-15**, dated November 7, 2011, the applicant stated that the 2004 Edition through the 2006 Addenda of the ASME OM Code would be used for the IST program for pumps, valves, and dynamic restraints at CPNPP, Units 3 and 4. The applicant provided a planned modification of the CPNPP, Units 3 and 4, COL FSAR to incorporate its RAI response. The staff found the planned changes to the CPNPP, Units 3 and 4, FSAR to be acceptable as they specify the ASME OM Code edition and addenda as incorporated by reference in 10 CFR 50.55a that provide the basis for the description of the IST program for pumps, valves, and dynamic restraints to be used at CPNPP, Units 3 and 4, in support of the COLA. The staff confirmed that Revision 3 to the CPNPP, Units 3 and 4, COL FSAR specifies the ASME OM Code edition and addenda noted in the applicant's response and clarifies COL Information Item 3.9(8) for a full description of the IST program for pumps, valves, and dynamic restraints at CPNPP, Units 3 and 4. Therefore, **RAI 2772, Question 03.09.06-3 and RAI 6027, Question 03.09.06-15, are resolved and closed.**

In **RAI 2772, Question 03.09.06-4**, the staff requested that the applicant clarify the CPNPP, Units 3 and 4, COL FSAR to ensure that the IST program (as compared to a program plan) will be available to the NRC staff for review and inspection in a timely manner to allow evaluation of compliance with the NRC regulations applicable to the IST programs for pumps, valves, and dynamic restraints prior to plant operation. In its response to **RAI 2772, Question 03.09.06-4**, dated October 26, 2009, the applicant stated that it would submit a schedule that supports the

planning and conduct of NRC inspections of operational programs, including the IST program, no later than 12 months after issuance of the COL or at the start of construction as defined in 10 CFR 50.10a, whichever is later. As discussed under **RAI 6222, Question 03.09.06-23,** below, the applicant has included a proposed license condition in Part 10, "ITAAC and Proposed License Conditions," of Revision 3 to the COLA that specifies the submittal of a schedule that supports the planning and conduct of NRC inspections of operational programs.

In follow-up **RAI 6027, Question 03.09.06-16**, the staff requested that the applicant clarify the CPNPP, Units 3 and 4, COL FSAR to specify that the IST program (rather than a program plan) for CPNPP, Units 3 and 4, will be available for NRC inspection consistent with the operational program schedule. In its response to **RAI 6027, Question 03.09.06-16**, dated November 7, 2011, the applicant stated that the CPNPP, Units 3 and 4, COL FSAR would be revised to refer to the IST program (rather than the program plan) consistent with the US-APWR DCD. The staff confirmed that Revision 3 to the CPNPP, Units 3 and 4, FSAR has incorporated those planned changes. The staff finds that the changes to the CPNPP, Units 3 and 4, FSAR to reference the IST program rather than a program plan are acceptable. Therefore, **RAI 2772, Question 03.09.06-4 and RAI 6027, Question 03.09.06-16, are resolved and closed.**

CPNPP, Units 3 and 4, COL FSAR Section 3.9.6 provides plant-specific supplemental information in addition to incorporating by reference, the US-APWR DCD for the functional design, qualification, and IST programs for pumps, valves, and dynamic restraints. In **RAI 2772, Question 03.09.06-5**, the staff requested that the applicant confirm that the provisions in the US-APWR DCD for functional design and qualification, and IST and MOV testing operational programs, as supplemented by the information in the CPNPP, Units 3 and 4, COL FSAR, will be applied to the specified pumps, valves, and dynamic restraints, or describe plant-specific provisions in these technical areas for the pumps, valves, and dynamic restraints. In its response to **RAI 2772, Question 03.09.06-5**, dated October 26, 2009, the applicant confirmed that the provisions in the US-APWR DCD for the functional design and qualification, and IST and MOV testing operational programs, as supplemented by the information in the CPNPP, Units 3 and 4, COL FSAR, will be applied to the specified pumps, valves, and dynamic restraints. The staff finds the response acceptable in that the applicant has clarified that the US-APWR DCD provisions for the functional design and qualification, and IST and MOV testing operational programs, as supplemented by the information in the CPNPP, Units 3 and 4, COL FSAR, will be applied to the specified pumps, valves, and dynamic restraints at CPNPP, Units 3 and 4. Therefore, **RAI 2772, Question 03.09.06-5, is resolved and closed.**

CPNPP, Units 3 and 4, COL FSAR, Table 3.9-203 provides information on testing of valves in addition to those identified in the US-APWR DCD. In **RAI 2772, Question 03.09.06-6**, the staff requested that the applicant provide (1) actuator type; (2) Code Class; (3) normal, safety, and fail safe position; (4) containment isolation function; and (5) test parameters and frequency, for the listed plant-specific valves. The staff also requested the applicant to provide this information for valves listed in US-APWR DCD Tier 2, Table 3.9-14, "Valve Inservice Test Requirements."

In its response to **RAI 2772, Question 03.09.06-6**, dated October 26, 2009, the applicant provided a planned revision to CPNPP, Units 3 and 4, COL FSAR, Table 3.9-203 to include valve and actuator type, safety-related missions, safety functions, ASME IST Category, IST type and frequency, and applicable notes. The applicant stated that the ASME Code Class of the valves listed in CPNPP, Units 3 and 4, COL FSAR Table 3.9-203 is provided in CPNPP, Units 3 and 4, COL FSAR Table 3.2-201, "Classification of Site-Specific Mechanical and Fluid Systems, Components, and Equipment," and applicable figures identified in Revision 2 to CPNPP, Units 3 and 4, COL FSAR as Figure 9.2.1-1R, "Essential Service Water System Piping and

Instrumentation Diagram," and Figure 9.2.5-1R, "Ultimate Heat Sink System Piping and Instrumentation Diagram." The applicant indicated that these figures provide the normal and fail safe position of the valves within the IST program in the system piping and instrumentation diagram. The applicant noted that CPNPP, Units 3 and 4, COL FSAR, Table 3.9-203 would specify any containment isolation function for the listed valves. The staff confirmed that Revision 2 (and 3) to CPNPP, Units 3 and 4, COL FSAR Table 3.9-203 includes changes specified in the RAI response.

In follow-up **RAI 6027, Question 03.09.06-17**, the staff requested that the applicant clarify the specified IST type and frequency for power-operated valves listed in CPNPP, Units 3 and 4, COL FSAR, Table 3.9-203 to be consistent with the regulatory requirement in 10 CFR 50.55a to implement the ASME OM Code IST provisions. In its response to **RAI 6027, Question 03.09.06-17**, dated November 7, 2011, the applicant provided planned changes to CPNPP, Units 3 and 4, COL FSAR Table 3.9-203 to include additional safety functions for specific valves and additional notes for remote position indication requirements. The staff confirmed that Revision 3 to the CPNPP, Units 3 and 4, COL FSAR includes the changes specified in the applicant's RAI response. The staff finds that the changes to the CPNPP, Units 3 and 4, FSAR are acceptable in that they clarify that the IST program table satisfies the regulatory requirements in 10 CFR 50.55a. Therefore, **RAI 2772, Question 03.09.06-6 and RAI 6027, Question 03.09.06-17, are resolved and closed.**

Footnote 6 in Revision 0 to CPNPP, Units 3 and 4, COL FSAR Table 3.9-203 stated that exercise testing for the specified valves would be performed at cold shutdown to avoid impact on power operation. In **RAI 2772, Question 03.09.06-7**, the staff requested that the applicant discuss the basis for the deferral of exercise testing without a partial stroke test at a quarterly interval for the specific identified valves. In its response to **RAI 2772, Question 03.09.06-7**, the applicant provided a planned revision to CPNPP, Units 3 and 4, COL FSAR Table 3.9-203 to specify that a full stroke exercise test will be performed quarterly for power-operated valves listed in CPNPP, Units 3 and 4, COL FSAR Table 3.9-203 in addition to the other required inservice tests and their frequency. The applicant also planned to delete Footnote 6 from CPNPP, Units 3 and 4, COL FSAR Table 3.9-203. The staff confirmed that Revision 2 (and 3) to CPNPP, Units 3 and 4, COL FSAR Table 3.9-203 reflects the planned changes specified in the RAI response. The staff finds CPNPP, Units 3 and 4, COL FSAR Table 3.9-203 to be acceptable in clarifying the performance of full stroke exercise tests on a quarterly frequency that satisfies the regulatory requirements for IST programs specified in the ASME OM Code. Therefore, **RAI 2772, Question 03.09.06-7, is resolved and closed.**

Revision 0 to CPNPP, Units 3 and 4, COL FSAR Section 3.9.6.3 stated that any alternate method for verification of valve position indicator operation, and its justification, will be described in the IST program plan outlined 12 months prior to fuel load. In **RAI 2772, Question 03.09.06-8**, the staff requested that the confirm that any alternate method for verification of valve position indicator operation, and its justification, will be made available consistent with the implementation schedule for the IST program to provide for timely review during NRC inspection of the IST program prior to plant operation. In its response to **RAI 2772, Question 03.09.06-8**, dated October 26, 2009, the applicant confirmed that alternate methods for valve position verification will be made available consistent with the implementation schedule for the IST program to provide timely review during NRC inspection of the IST program prior to plant operation. The applicant stated that alternate methods for valve position verification, if necessary, will meet the requirements of the ASME OM Code. Later revisions to the CPNPP Units 3 and 4 FSAR removed the supplemental provision regarding alternate methods for valve position verification. Therefore, **RAI 2772, Question 03.09.06-8 is resolved** in that the ASME

OM Code provisions for valve position verification as incorporated by reference in 10 CFR 50.55a will be implemented.

US-APWR DCD Tier 2, Section 3.9.6.3.1, "IST Program for MOVs," states that the IST program will identify MOVs that require non-intrusive diagnostic testing techniques. In **RAI 2772, Question 03.09.06-9**, the staff requested that the applicant discuss plans for non-intrusive testing of safety-related MOVs in fully describing the MOV Testing operational program in support of the NRC review of the COLA for CPNPP, Units 3 and 4. In its response to **RAI 2772, Question 03.09.06-9**, dated October 26, 2009, the applicant noted that the US-APWR DCD describes the MOV testing program and that CPNPP, Units 3 and 4, COL FSAR Section 3.9.6 had been revised to delete a supplemental provision regarding MOV non-intrusive diagnostic testing techniques. The NRC staff finds the RAI response acceptable in that the description in the US-APWR DCD is sufficient to describe the MOV testing program as incorporated by reference, in the CPNPP, Units 3 and 4, COL FSAR. Therefore, **RAI 2772, Question 03.09.06-9, is resolved and closed.**

In **RAI 2772, Question 03.09.06-10**, the staff requested that the applicant provide justification for requests for relief from, or alternatives to, the ASME OM Code edition and addenda used as the basis for the IST program description in the COLA following the guidance in RG 1.206, or an application-specific approach in justifying relief or alternative requests. In its response to **RAI 2772, Question 03.09.06-10**, dated October 26, 2009, the applicant stated that there are no Code relief requests specified in the CPNPP, Units 3 and 4, COL FSAR. The applicant noted that relief requests might become necessary in the course of developing the IST program. In follow-up **RAI 6027, Question 03.09.06-18**, the staff requested that the applicant clarify whether any alternatives to the ASME OM Code are currently planned for the development and implementation of the CPNPP Units 3 and 4 IST program. In its response to **RAI 6027, Question 03.09.06-18,** dated November 7, 2011, the applicant stated that it had not identified any alternatives to the ASME OM Code to be applied at CPNPP Units 3 and 4. The staff notes that the US-APWR DCD applicant is planning to revise the US-APWR DCD to specify the use of ASME OM Code Case OMN-1 (Revision 0, 1999), "Alternative Rules for Preservice and Inservice Testing of Certain Motor-Operated Valve Assemblies in Light-Water Reactor Power Plants," that is accepted for use with conditions in RG 1.192. The staff considers the RAI response acceptable in that the US-APWR DCD and CPNPP, Units 3 and 4, FSAR have clarified the current plans for relief from or alternatives to the ASME OM Code. Therefore, **RAI 2772, Question 03.09.06-10 and RAI 6027, Question 03.09.06-18, are resolved and closed.**

Nuclear power plant operating experience has revealed the potential for adverse flow effects from vibration caused by hydrodynamic loads and acoustic resonance on reactor coolant, steam, and feedwater systems. DCD Tier 2, Section 3.9.3, "ASME Code Class 1, 2, and 3 Components, Component Supports, and Core Support Structures," specifies provisions for evaluating the load combinations on safety-related components including fluid effects due to various system operational characteristics. DCD Tier 2, Section 14.2, "Initial Plant Test Program," includes Subsection 14.2.12.1.51, "Steady-State Vibration Monitoring of Safety-Related and High-Energy Piping," to demonstrate that steady state vibrations of safety-related and high-energy piping are within acceptable limits. In **RAI 2772, Question 03.09.06-11**, the staff requested that the applicant discuss the planned implementation of the program indicated in the DCD to address potential adverse flow effects on safety-related components within the IST program in the reactor coolant, steam, and feedwater systems at CPNPP, Units 3 and 4, from hydraulic loading and acoustic resonance during plant operation.

In its response **to RAI 2772, Question 03.09.06-11**, dated October 26, 2009, the applicant stated that the CPNPP, Units 3 and 4, COL FSAR incorporates by reference, the planned implementation of the DCD operational program to address potential adverse flow effects on safety-related components within the IST program in the reactor coolant, steam, and feedwater systems. In follow-up **RAI 6027, Question 3.9.6-19**, the staff requested that the applicant discuss its plans to implement the provisions in the US-APWR DCD to provide reasonable assurance that potential adverse flow effects will be addressed at CPNPP, Units 3 and 4.

In its response to **RAI 6027, Question 03.09.06-19**, dated November 7, 2011, the applicant stated that steady state vibration monitoring of safety-related and high-energy piping will be performed as described in DCD Tier 2, Subsection 14.2.12.1.51 as part of the Initial Plant Test Program. The applicant states that the test method identifies safety-related and high-energy piping runs that are screened qualitatively for perceptible vibration by visual inspection. Also, all piping observed to be vibrating will be monitored with portable instrumentation. The results will then be assessed using quantitative screening criteria or, if necessary, using standard stress evaluation techniques. Finally, the applicant states that steady state vibrations of safety-related and high-energy piping will be verified to be within the allowable stress limits defined in DCD Tier 2, Section 3.9.2, "Dynamic Testing and Analysis of Systems, Components, and Equipment." The staff finds the RAI response acceptable in that it clarifies the applicant's plans to implement the provisions in the US-APWR DCD to provide reasonable assurance that potential adverse flow effects will be addressed at CPNPP, Units 3 and 4. Therefore, **RAI 2772, Question 03.09.06-11 and RAI 6027, Question 03.09.06-19, is resolved and closed.**

3.9.6.4.2 COL Information Items

The applicant addresses the COL information items as listed in CPNPP Units 3 and 4 FSAR Section 3.9.9 as follows:

COL 3.9(1) *Snubber functionality*

> CPNPP Units 3 and 4 FSAR Section 3.9.3.4.2.5 states that the "design specification for snubbers installed in harsh service conditions (e.g., high humidity, temperature, radiation levels) is evaluated for the projected life of the snubber to assure that snubber functionality, including snubber materials (e.g., lubricants, hydraulic fluids, seals)." As discussed above, the staff will address the functional design and qualification of dynamic restraints as part of the planned audit of design and procurement specifications for pumps, valves, and dynamic restraints. The completion of the audit is associated with **RAI 6222, Question 03.09.06-21, which is being tracked as an Open Item**.

COL 3.9(6) *Program for IST of dynamic restraints in accordance with the ASME OM Code*

> The DC applicant has indicated that COL 3.9(6) will be revised to state that the COL applicant is to provide the program for IST of dynamic restraints in accordance with the ASME OM Code. In anticipation of this DCD change, Revision 3 to the CPNPP Units 3 and 4 FSAR in Section 3.9.6.4 states that the IST program for dynamic restraints is implemented in accordance with the ASME OM Code. The staff will verify that the US-APWR DCD modification is implemented as part of its review of the US-APWR design certification application.

COL 3.9(8) *Administrative control of the edition and addenda to be used for the IST program and to provide a full description of their IST program for pumps, valves, and dynamic restraints*

The DC applicant has indicated that COL 3.9(8) will be revised to state that the COL applicant is to administratively control the edition and addenda to be used for the IST program and to provide a full description of their IST program for pumps, valves, and dynamic restraints. In anticipation of this change, Revision 3 to the CPNPP Units 3 and 4 FSAR states that this COL item is addressed in Section 3.9.6. As discussed above for **RAI 6222, Question 03.09.06-22**, the staff will confirm the modifications to the CPNPP Units 3 and 4 FSAR Section 3.9.6 to provide a full description of the IST program for pumps, valves, and dynamic restraints. Accordingly, **RAI 6222, Question 03.09.06-22 is being tracked as a Confirmatory Item**.

COL 3.9(10) *Site-specific active pumps*

CPNPP Units 3 and 4 FSAR Section 3.9.3.3.1 and Table 3.9-201 address site-specific active pumps for CPNPP Units 3 and 4. The staff found that the applicant has identified the site-specific active pumps for CPNPP Units 3 and 4 that will be addressed in accordance with the functional design, qualification, and IST programs described in the CPNPP Units 3 and 4 FSAR together with the US-APWR DCD. Therefore, the applicant has satisfied COL 3.9(10) as it relates to the functional design, qualification, and inservice testing programs for pumps, valves, and dynamic restraints.

COL 3.9(11) *Site-specific, safety-related pump IST parameters and frequency*

CPNPP Units 3 and 4 FSAR Section 3.9.6.2 provides site-specific safety-related pump IST parameters and frequencies in Table 3.9-202. The staff found that the applicant has specified the IST parameters and frequency for the site-specific safety-related pumps at CPNPP Units 3 and 4 in accordance with the specified ASME OM Code as incorporated by reference in 10 CFR 50.55a. Therefore, the applicant has satisfied COL 3.9(11).

COL 3.9(12) *Testing and frequency of site-specific valves subject to IST*

CPNPP Units 3 and 4 FSAR Section 3.9.6.2 provides site-specific safety-related valve IST parameters and frequencies in Table 3.9-203. Based on the changes made to Table 3.9-203 by the applicant in response to RAIs, the staff found that the applicant has specified the IST testing and frequency for site-specific valves at CPNPP Units 3 and 4 in accordance with the specified ASME OM Code as incorporated by reference in 10 CFR 50.55a. Therefore, the applicant has satisfied COL 3.9(12).

3.9.6.4.3 Evaluation of License Conditions

As stated in COLA Revision 3, Part 2 FSAR, Table 13.4-201, item 18, the applicant has proposed to implement the following license condition that the staff accepts as **License Condition 3-2**.

- **License Condition (3-2)** – Prior to initial fuel load, the licensee shall implement the motor-operated valve testing program.

The applicant provided a license condition that addressed the implementation of the motor operated valve testing program. This condition is consistent with SECY-05-0197, “Review of

Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria, dated October 28, 2005, which discusses license conditions for operational programs. Since the MOV testing program is an operational program, the staff finds the applicant's proposed license condition to be acceptable.

Furthermore, in COLA Revision 3, Part 2 FSAR, Table 13.4-201, item 6, the applicant proposed the implementation of a license condition for the Preservice Testing Program. By letter dated April 28, 2011, the staff evaluated this license condition as part of the Chapter 5, "Reactor Coolant and Connecting Systems," safety evaluation (ADAMS No. ML111050504). The staff found the following license condition to be acceptable:

- **License Condition (5-2)** – The licensee shall implement the preservice testing program prior to initial fuel load.

COLA Part 10, "Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) and Proposed License Conditions," Section 2.3, "Operational Programs," states that the implementation of operational programs identified in CPNPP, Units 3 and 4, FSAR Table 13.4-201 by the milestones indicated in the table is a potential license condition. The applicant states that some of these programs may be adequately controlled by other methods such as the regulations, the TS, or a commitment, and will not need to be addressed in a license condition.

In **RAI 2772, Question 03.09.06-12**, the staff requested that the applicant discuss the plans to develop license conditions for implementation of the CPNPP, Units 3 and 4, operational programs consistent with the guidance in RG 1.206 and Commission paper SECY-05-0197. In its response to **RAI 2772, Question 03.09.06-12**, dated October 29 2009, the applicant stated that COLA Part 10, Section 2.3, had been revised to state in a proposed license condition that the licensee shall implement the programs or portions of programs identified in CPNPP, Units 3 and 4, FSAR Table 13.4-201 on or before the associated milestones in Table 13.4-201. The applicant provided Regulatory Commitment 6591 that specified submittal of a schedule to the NRC that supports the planning and conduct of NRC inspections of operational programs no later than 12 months after issuance of the COL or at the start of construction as defined in 10 CFR 50.10a, whichever is later.

In follow-up **RAI 6027, Question 03.09.06-20**, the staff requested that the applicant clarify its plans regarding license conditions for operational programs and their milestones with planned changes to the COLA in support of its response to **RAI 2772, Question 03.09.06-12**. In addition, the staff requested that the applicant include a note in FSAR Table 13.4-201 for the milestone of full implementation of the IST program after generator on-line on nuclear heat specifying that appropriate portions of the IST program will be implemented as necessary to support the system operability requirements of the TS.

In its response to **RAI 6027, Question 03.09.06-20**, dated November 7, 2011, the applicant provided in COLA Part 10, proposed License Condition 2.D(11), "Operational Program Implementation," that stated the following:

> The licensee shall implement the programs or portions of programs identified in FSAR Table 13.4-201 with the "Implementation" of "License Condition" on or before the associated milestones in FSAR Table 13.4-201.

The applicant also stated that Regulatory Commitment 6591 would provide for submittal of a schedule to the NRC that supports the planning and conduct of NRC inspections of operational

programs no later than 12 months after issuance of the COL or at the start of construction as defined in 10 CFR 50.10a, whichever is later. In addition, the applicant provided a planned revision to CPNPP, Units 3 and 4, FSAR Table 13.4-201 to clarify the IST implementation milestone.

In follow-up **RAI 6222, Question 03.09.06-23**, the staff requested that the applicant clarify its response to **RAI 6027, Question 03.09.06-20,** to be consistent with responses to RAIs for other FSAR sections with operational programs. The staff also requested that the applicant clarify the planned revision to FSAR Table 13.4-201 for an acceptable milestone for implementation of the IST program to specify "appropriate" portions rather than "acceptance" portions of the program.

In its response to **RAI 6222, Question 03.09.06-23**, dated February 27, 2012, the applicant stated that the following License Condition 2.D(12), "Operational Program Implementation Schedules," would be included in COLA Part 10:

> The Licensee shall submit to the Director of NRO, a schedule, no later than 12 months after issuance of the COL or at the start of construction as defined in 10 CFR 50.10(a), whichever is later, that supports planning for and conduct of NRC inspections of operational programs listed in FSAR Table 13.4-201 with the exception of the Fitness for Duty program. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter for each applicable operational program until either the operational program has been fully implemented or the plant has been placed in commercial service, whichever comes first.
>
> The Licensee shall submit to the Director of NRO, a schedule, no later than 12 months after issuance of the COL, that supports planning for and conduct of NRC inspections of the Fitness for Duty program listed in FSAR Table 13.4-201. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the Fitness for Duty program has been fully implemented or the plant has been placed in commercial service, whichever comes first.

The applicant also provided a planned revision to Note 1 in CPNPP, Units 3 and 4, COL FSAR Table 13.4-201 as requested in **RAI 6222, Question 03.09.06-23**.

The staff confirmed that Revision 3 to the COLA Part 10 includes License Condition 2.D(12) with the two specific conditions provided in the applicant's response to **RAI 6222, Question 03.09.06-23**, in addition to License Condition 2.D(11) discussed in the response to **RAI 6027, Question 03.09.06-20**. The staff also confirmed that Revision 3 to the CPNPP, Units 3 and 4, FSAR in Table 13.4-201 includes the corrected Note 1 as specified in the response to **RAI 6222, Question 03.09.06-23**. The staff has decided to apply the standard license condition for operational program schedule specified in SECY-05-0197. Therefore, **RAI 2772, Question 03.09.06-12; RAI 6027, Question 03.09.06-20; and RAI 6222, Question 03.09.06-23, are resolved and closed.**

As discussed in SECY-05-0197, the staff has developed standard license conditions for the applicable operational programs, including those described above. The staff plans to impose the following license condition to support its plans to inspect operational programs and their implementation to ensure these programs are being implemented consistent with the COLA FSAR.

- **License Condition (3-3)** – No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO a schedule that supports planning for, and the conducting of, NRC inspections of the inservice testing program (including the preservice and MOV testing). The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until the inservice testing program (including the preservice and MOV testing) has been fully implemented.

3.9.6.5 Post-Combined License Activities

The NRC regulations in 10 CFR 50.55a(f)(4)(i) state that inservice tests to verify operational readiness of pumps and valves, whose function is required for safety conducted during the initial 120-month interval must comply with the requirements in the latest edition and addenda of the ASME Code incorporated by reference in 10 CFR 50.55a(b) on the date 12 months before the date scheduled for initial fuel loading under a COL issued per 10 CFR Part 52 (or the optional ASME Code cases listed in RG 1.192), subject to the limitations and modifications listed in Section 50.55a. A similar requirement is stated in 10 CFR 50.55a(g)(4)(i) for dynamic restraints. NRC inspection of the licensee's IST and MOV Testing operational programs will be conducted when these programs are available.

In addition, the applicant has proposed two license conditions related to this section.

- **License Condition (3-2)** – Prior to initial fuel load, the licensee shall implement the motor-operated valve testing program.

- **License Condition (5-2)** – The licensee shall implement the preservice testing program prior to initial fuel load.

Finally, for the reasons discussed in the technical evaluation section, the staff plans to impose the following license condition below:

- **License Condition (3-3)** – No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO a schedule that supports planning for, and the conducting of, NRC inspections of the inservice testing program (including the preservice and MOV testing). The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until the inservice testing program (including the preservice and MOV testing) has been fully implemented.

3.9.6.6 Conclusions

The staff is currently reviewing the information in DCD Tier 2, Section 3.9.6 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to functional design, qualification, and IST programs for pumps, valves, and dynamic restraints incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's SER on the US-APWR DCD. The SE on the US-APWR DCD is not yet complete and is being tracked as part of Open Item [1-1]. The staff will update Section 3.9.6 of this SER to reflect the final disposition of the DC application.

The staff reviewed the CPNPP COL application together with its incorporation by reference of the US-APWR DCD to determine whether it demonstrates that the functional design, qualification, and IST programs for safety-related pumps, valves, and dynamic restraints will satisfy the applicable NRC regulations, and provides reasonable assurance that those components will be capable of performing their safety functions at CPNPP Units 3 and 4. The staff is unable to complete its evaluation of whether the applicant has provided a full description of the functional design, qualification, and IST programs for safety-related pumps, valves, and dynamic restraints at CPNPP, Units 3 and 4, through incorporation by reference, of the US-APWR DCD with supplemental information in the CPNPP, Units 3 and 4, FSAR until the open and confirmatory items specified in this SER section are resolved and closed.

The remaining open and confirmatory items for the NRC staff review of the functional design, qualification, and IST programs for pumps, valves, and dynamic restraints for CPNPP, Units 3 and 4, are **RAI 6222, Question 03.09.06-21, which is being tracked as an Open Item** (audit of pump, valve, and dynamic constraint procurement specifications) and **RAI 6222, Question 03.09.06-22 is being tracked as a Confirmatory Item** (completion of IST program description).

The applicant made changes to its FSAR in anticipation of planned changes to the US-APWR DCD. The staff will confirm that those planned DCD changes are implemented as part of the US-APWR DC review. The staff will make any changes necessary to this CPNPP COLA SER upon completion of the US-APWR DC review.

The staff based its conclusion in part on the following:

- STD COL 3.9(1), is under review pending the staff performing an audit of the US-APWR design and procurement specifications for pumps, valves, and dynamic restraints. Therefore, pending the completion of the audit, **RAI 6222, Question 03.09.06-21 is being tracked as an Open Item**.

- STD COL 3.9(6), regarding the program for IST of dynamic restraints in accordance with the ASME OM Code, is acceptable pending the revision of COL Information Item 3.9(6) in the DCD.

- STD COL 3.9(8), regarding the administrative control of the edition and addenda to be used for the IST program and to provide a full description of their IST program for pumps, valves, and dynamic restraints, is acceptable pending the verification of **RAI 6222, Question 03.09.06-22, which is being tracked as a Confirmatory Item**.

- STD COL 3.9(10) and CP COL 3.9(10), STD COL 3.9(11) and CP COL 3.9(11), STD COL 3.9(12) and CP COL 3.9(12), are acceptable as they address the site-specific active pumps, site-specific safety-related pump IST parameters and frequency, and the testing and frequency of site-specific valves subject to IST, respectively.

3.10 Seismic and Dynamic Qualification of Mechanical and Electrical Equipment

3.10.1 Introduction

The purpose of this section is to review the information provided by the applicant that is employed to ensure the functionality of mechanical and electrical equipment under the full range of normal and accident loadings (including seismically induced loadings). The review addresses mechanical and electrical equipment associated with systems that are essential to emergency reactor shutdown, reactor core cooling, containment isolation, and containment and reactor heat removal or are otherwise essential in preventing significant release of radioactive material to the environment. It also addresses instrumentation that is needed to assess plant and environmental conditions during and after an accident.

3.10.2 Summary of Application

Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference Section 3.10 of the US-APWR DCD, Revision 3.

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.10, the applicant provided the following information:

US-APWR COL Information Items

- STD COL 3.10(1)

The applicant provided additional information in STD COL 3.10(1) to address COL Information Item 3.10(1) in the DCD, Revision 3 regarding the equipment seismic qualification program. STD COL 3.10(1) applies to Section 3.10.4.1, "Implementation Program and Milestones."

- STD COL 3.10(3)

The applicant provided additional information in STD COL 3.10(3) to address COL Information Item 3.10(3) in the DCD, Revision 3 regarding maintenance of equipment qualification files, including equipment qualification summary data sheets (EQSDSs). STD COL 3.10(3) applies to Section 3.10.

- CP COL 3.10(5)

The applicant provided additional information in CP COL 3.10(5) to address COL Information Item 3.10(5) in the DCD, Revision 3 regarding previously tested components. CP COL 3.10(5) applies to Section 3.10.2, "Methods and Procedures for Qualifying Mechanical and Electrical Equipment and Instrumentation."

- CP COL 3.10(8)

The applicant provided additional information in CP COL 3.10(8) to address COL Information Item 3.10(8) in the DCD, Revision 3 regarding the site-specific operating basis earthquake (OBE). CP COL 3.10(8) applies to Section 3.10.1, "Seismic Qualification Criteria."

- CP COL 3.10(9)

The applicant provided additional information in CP COL 3.10(9) to address COL Information Item 3.10(9) in the DCD, Revision 3 regarding the applicability of high-frequency excitation to vibration-sensitive components. CP COL 3.10(9) applies to Section 3.10.2.

3.10.3 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 the Commission's regulations for the seismic and dynamic qualification of mechanical and electrical equipment, and the associated acceptance criteria, are given in Section 3.10, "Seismic and Dynamic Qualification of Mechanical and Electrical Equipment," Revision 3, issued March 2007, of NUREG-0800.

The applicable regulatory requirements for the seismic and dynamic qualification of mechanical and electrical equipment are as follows:

1. GDC 1 and GDC 30, "Quality of Reactor Coolant Pressure Boundary," as they relate to qualifying equipment to appropriate quality standards commensurate with the importance of the safety functions to be performed.

2. GDC 2 and Appendix S to 10 CFR Part 50, as they relate to designing equipment to withstand the effects of natural phenomena such as earthquakes.

3. GDC 4 as it relates to qualifying equipment as capable of withstanding the dynamic effects associated with external missiles and internally-generated missiles, pipe whip, and jet impingement forces.

4. GDC 14, as it relates to qualifying equipment associated with the reactor coolant boundary so that there is an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.

5. 10 CFR Part 50, Appendix B, as it relates to qualifying equipment using the QA criteria provided. 10 CFR Part 50, Appendix B, Criterion III, as it relates to verifying and checking the adequacy of design, such as by the performance of a suitable test program, among other things, and, which specifically requires that a test program used to verify the adequacy of a specific design feature shall include suitable qualifications testing of a prototype unit under the most adverse design conditions.

6. 10 CFR 52.80(a), which requires that a COLA include the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act of 1954, and the NRC's regulations.

The related acceptance criteria are as follows:

1. RG 1.61, "Damping Values for Seismic Design of Nuclear Power Plants," Revision 1, issued March 2007.

2. RG 1.89, “Environmental Qualification of Certain Electric Equipment Important to Safety for Nuclear Power Plants,” Revision 1, issued June 1984.

3. RG 1.92, “Combining Modal Responses and Spatial Components in Seismic Response Analysis,” Revision 2, issued July 2006.

4. RG 1.97, “Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident,” Revision 4, issued June 2006.

5. RG 1.100, “Seismic Qualification of Electric and Mechanical Equipment for Nuclear Power Plants,” Revision 3, issued September 2009.

6. IEEE Standard 344-2004, “IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Generating Stations,” and ASME QME-1-2007, “Qualification of Active Mechanical Equipment Used in Nuclear Power Plants,” as they relate to the seismic qualification of equipment used in nuclear power plants.

3.10.4 Technical Evaluation

The staff reviewed Section 3.10 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff’s review confirmed that the information contained in the application and incorporated by reference, addresses the required information relating to the seismic and dynamic qualification of mechanical and electrical equipment. Section 3.10 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff’s technical evaluation of the information incorporated by reference related to the seismic and dynamic qualification of mechanical and electrical equipment will be documented in the staff FSER on the DC application for the US-APWR design.

The staff reviewed the following information contained in Section 3.10 of the CPNPP, Units 3 and 4, COL FSAR:

US-APWR COL Information Items

- STD COL 3.10(1)

The staff reviewed STD COL 3.10(1) related to COL Information Item 3.10(1) included under Section 3.10.4.1 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the second sentence of the first paragraph in DCD Section 3.10.4.1 with the following:

> Technical Report MUAP-08015, "US-APWR Equipment Environmental Qualification Program" (DCD Reference 3.11-3) describes the EQ [environmental qualification] Program, as defined in DCD Tier 2 Section 3.11, for all COL

applicants using the US-APWR technology. The Technical Report was submitted to the NRC as part of the US-APWR Design Certification application. Figure 2.1 of MUAP-08015 established the overall framework for implementing the EQ Program including seismic qualification. The seismic qualification program implementation schedule is part of the EQ Program implementation milestone schedule provided in FSAR Section 3.11. The seismic qualification program is implemented during the design, procurement, construction and preoperational testing phases of the project as described in MUAP-08015. The project-specific implementation milestone for the seismic qualification program is consistent with the EQ Program implementation milestone identified in FSAR Table 13.4-201. Project-specific implementation of the US-APWR EQ Program provides for the turnover of all EQ Program records to the licensee. The EQ Program is the basis for the seismic qualification program applicable to replacement parts and components during plant operation.

In CPNPP, Units 3 and 4, COL FSAR, Revision 0, the applicant addressed COL Information Item 3.10(1) by indicating that the plan for the documentation and implementation of the seismic qualification program, including milestones and completion dates with appropriate information submitted with sufficient time for staff review and approval before installation of the equipment, would be established later. However, according to Section C.I.3.10.4 of RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," issued June 2007, aforementioned information should be provided by the COL applicant at the time of COLA. Therefore, in **RAI 2370, Question 03.10-1**, the staff requested the applicant to provide the implementation plan for the seismic qualification program.

In its response to **RAI 2370, Question 03.10-1**, dated September 22, 2009, the applicant stated that the plan for the CPNPP, Units 3 and 4, seismic qualification program is provided in the DCD applicant's Technical Report MUAP-08015, "US-APWR Equipment Qualification Program." The implementation milestone schedule for the CPNPP, Units 3 and 4, Environmental Qualification (EQ) Program is provided in CPNPP, Units 3 and 4, COL FSAR, Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment." The applicant proposed to update CPNPP, Units 3 and 4, COL FSAR, Section 3.10.4.1 to specify that the seismic qualification program will be performed as part of the CPNPP, Units 3 and 4, EQ Program. The staff finds the response acceptable since the applicant provided an implementation plan for the seismic qualification program and updated the CPNPP, Units 3 and 4, COL FSAR accordingly. The staff confirmed that the proposed changes were incorporated into CPNPP, Units 3 and 4, COL FSAR, Revision 1. Accordingly, **RAI 2370, Question 03.10-1, is resolved and closed**, and the staff finds that the applicant has adequately addressed COL Information Item 3.10(1).

- CP COL 3.10(3)

The staff reviewed CP COL 3.10(3) related to COL Information Item 3.10(3) included under Section 3.10 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the second sentence of the fifth paragraph in DCD Section 3.10 with the following:

> The files generated by the environmental qualification (EQ) Program referenced in Subsection 3.10.4.1 include provisions for recording seismic qualification information including test results. The records that form the equipment qualification files include provisions for recording seismic qualification information and are sometimes referred to as equipment qualification summary data sheets (EQSDSs). The qualification records for each seismic Category I and II piece of

equipment are updated for individual components as new information becomes available. Information is recorded during the analysis, design, procurement (including testing information), construction, and preoperational testing phases of the project, and will be available for review throughout the duration of the project. The implementation of the Operational EQ Program prior to fuel load is a license condition in accordance with Table 13.4-201.

During the review of CPNPP, Units 3 and 4, COL FSAR, Revision 0, the staff determined that the applicant did not fully address COL Information Item 3.10(3). In **RAI 2370, Question 03.10-2**, the staff requested the applicant to: a) clarify whether test results will be included in the EQSDSs and b) to inform the staff when the EQSDSs file is complete and available for staff review and approval. If the file will be available prior to when the license is granted, the applicant should provide the staff with enough time to review the qualification file. Otherwise, if the file will be available after the license is granted, then pursuant to 10 CFR 52.79(d)(3), the applicant is requested to provide a license condition.

In its response to **RAI 2370, Question 03.10-2**, dated September 22, 2009, the applicant stated that the files generated by the EQ Program referenced in CPNPP, Units 3 and 4, COL FSAR, Section 3.10.4.1 contain provisions for recording seismic qualification information, including test results where applicable. These records will be available for review during the procurement, construction and preoperational testing phases of the project. These records are the qualification records for safety-related and important-to-safety equipment. The applicant proposed to revise CPNPP, Units 3 and 4, COL FSAR, Section 3.10 to recognize that seismic qualification testing is part of the equipment qualification file, and to state the implementation of the EQ Program prior to fuel load is a license condition in accordance with Table 13.4-201. The staff finds that the response acceptable since the applicant clarified the documentation of the test results and that the implementation of the EQ Program prior to fuel load is a license condition. The staff confirmed that the proposed changes were incorporated into CPNPP, Units 3 and 4, COL FSAR, Revision 1. Accordingly, **RAI 2370, Question 03.10-2, is resolved and closed**, and the staff finds that the applicant has adequately addressed COL Information Item 3.10(3).

- CP COL 3.10(5)

The staff reviewed CP COL 3.10(5) related to COL Information Item 3.10(5) included under Section 3.10.2 of the CPNPP, Units 3 and 4, COL FSAR. The applicant replaced the twenty-sixth paragraph (starts with “Components that have been previously tested ….”) in DCD Tier 2, Section 3.10.2 with the following:

> Components that have been previously tested to IEEE Std 344-1971 prior to submittal of the DCD will be reevaluated six months prior to procurement of equipment to justify the appropriateness of the input motion and requalify the equipment using biaxial test input motion, except when a single-axis test input motion is justified. Results of the reevaluation and requalification of the above described components are incorporated into the equipment environmental qualification program.

The staff finds that the applicant’s actions adequately addressed the COL Information Item 3.10(5) since the applicant committed to the actions in COL Information Item 3.10(5) and indicated that the results will be incorporated into the equipment EQ program.

- CP COL 3.10(8)

The staff reviewed CP COL 3.10(8) related to COL Information Item 3.10(8) included under Subsection 3.10.1 of the CPNPP, Units 3 and 4, COL FSAR. The applicant replaced the last sentence of third paragraph in DCD Tier 2, Section 3.10.1 with the following:

> For design of seismic Category I and seismic Category II SSCs that are site-specific (not part of the standard plant), the OBE is set at 1/3 of the site-specific SSE, as discussed in Subsection 3.7.1.1, and is therefore eliminated from explicit design analysis, except for fatigue effects as explained below.

The staff finds that the applicant's actions adequately addressed the COL Information Item 3.10(8) since it conforms to the requirements of 10 CFR Part 50, Appendix S regarding the OBE.

- CP COL 3.10(9)

The staff reviewed CP COL 3.10(9) related to COL Information Item 3.10(9) included under Section 3.10.2 of the CPNPP, Units 3 and 4, COL FSAR. The applicant replaced the last two sentences of the fourth paragraph in DCD Section 3.10.2 with the following:

> However, the site-specific GMRS [ground motion response spectra] and FIRS [foundation input response spectra] as reported in Section 3.7 do not exceed the CSDRS [certified seismic design response spectra]. Therefore, high frequency exceedances of in-structure response spectra and subsequent potential effects on the functional performance of vibration-sensitive components, such as relays and other instrument and control devices, whose output could be affected by high frequency excitation, are not applicable.

The staff finds that the applicant's above statements acceptable since the applicant has verified that the site-specific response spectra do not exceed the CSDRS, and therefore COL Information Item 3.10(9) is adequately addressed.

3.10.5 Post-Combined License Activities

The implementation of the Operational EQ Program (including seismic qualification of equipment) prior to fuel load is a license condition in accordance with CPNPP Units 3 and 4 COL FSAR Table 13.4-201, "Operational Programs Required by NRC Regulation and Program Implementation." A COL applicant/holder that references the US-APWR DCD will maintain, on file with the EQ Program, a list of systems, equipment, and equipment supports, and EQSDSs for the seismic qualification of each piece of safety-related seismic Category I equipment, for both standard plant equipment and site-specific equipment. The data sheets will be populated during the analysis, design, procurement, construction, and preoperational testing phases of the CPNPP Units 3 and 4 project.

3.10.6 Conclusions

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to the seismic and dynamic qualification of mechanical and electrical equipment, and there is no outstanding

information expected to be addressed in the CPNPP Units 3 and 4 COL FSAR related to this section.

The staff is reviewing the information in DCD Tier 2, Section 3.10 on Docket Number 52-021. The results of the staff's technical evaluation of the information related to the seismic and dynamic qualification of mechanical and electrical equipment incorporated by reference in the CPNPP Units 3 and 4 COL FSAR will be documented in the staff SER on the US-APWR DCD. The SER on the US-APWR is not complete to date, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.10 of the SER to reflect the final disposition of the DC application.

The staff concludes that the relevant information presented within the CPNPP Units 3 and 4 COL FSAR, Section 3.10, meets the regulatory requirements and acceptance criteria summarized in Section 3.10.3 of this SER. The staff based its conclusion on the following:

- STD COL 3.10(1), as it relates to the equipment seismic qualification program, is acceptable because it provided an implementation plan for the seismic qualification program.

- STD COL 3.10(3), as it relates to the maintenance of equipment qualification files, including equipment qualification summary data sheets (EQSDSs), is acceptable because it described the documentation of qualification records and identified the license condition for the EQ program.

- CP) COL 3.10(5), as it relates to previously tested components, is acceptable because the applicant committed to the actions in COL Information Item 3.10(5) and indicated that the results will be incorporated into the equipment EQ program.

- CP COL 3.10(8), as it relates to the site-specific (OBE), is acceptable because it conforms to the requirements of 10 CFR Part 50, Appendix S regarding the OBE.

- CP COL 3.10(9), as it relates to the applicability of high-frequency excitation to vibration-sensitive component, is acceptable because the applicant has verified that the site-specific response spectra do not exceed the CSDRS.

3.11 Environmental Qualification of Mechanical and Electrical Equipment

3.11.1 Introduction

This section addresses the EQ of important to safety mechanical and electrical equipment for CPNPP Units 3 and 4. The objective of the EQ program is to demonstrate that the important to safety mechanical and electrical equipment is capable of performing its intended design safety function under all normal environmental conditions, AOOs, and accident and post-accident environmental conditions.

3.11.2 Summary of Application

Section 3.11, “Environmental Qualification of Mechanical and Electrical Equipment,” of CPNPP, Units 3 and 4, COL FSAR, Revision 3 incorporates by reference, Section 3.11 of the US-APWR DCD, Revision 3, with supplemental information. In addition, Appendix 3D, “Equipment Qualification List Safety and Important to Safety Electrical and Mechanical Equipment,” of CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, Appendix 3D, of the US-APWR DCD, Revision 3.

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.11 and Appendix 3D, the applicant provided the following information:

US-APWR COL Information Items

- CP COL 3.11(1)

The applicant provided additional information in CP COL 3.11(1) to address COL Information Item 3.11(1) regarding the EQ document assembly and maintenance. CP COL 3.11(1) applies to Section 3.11.

- STD COL 3.11(2)

The applicant provided additional information in CP COL 3.11(2) to address COL Information Item 3.11(2) regarding the qualification tests results recorded. CP COL 3.11(2) applies to Section 3.11.3, “Qualification Test Results.”

- CP COL 3.11(3)

The applicant provided additional information in CP COL 3.11(3) to address COL Information Item 3.11(3) regarding the schedule for EQ program implementation milestones. CP COL 3.11(3) applies to Section 3.11.

- CP COL 3.11(4)

The applicant provided additional information in CP COL 3.11(4) to address COL Information Item 3.11(4) regarding periodic tests, calibrations, and inspections. CP COL 3.11(4) applies to Section 3.11.

- STD COL 3.11(5) and CP COL 3.11(5)

The applicant provided additional information in STD COL 3.11(5) and CP COL 3.11(5) to address COL Information Item 3.11(5) regarding site-specific equipment addressed in EQ program. STD COL 3.11(5) applies to Section 3.11.1.1, “Equipment Identification,” and Section 3D.1.6, “Determination of Seismic Requirements.” CP COL 3.11(5) applies to Section Table 3D-201, “Site-Specific Environmental Qualification Equipment List.”

- STD COL 3.11(6)

The applicant provided additional information in STD COL 3.11(6) to address COL Information Item 3.11(6) regarding the site-specific EQ process. STD COL 3.11(6) applies to Section 3.11.4, “Loss of Ventilation.”

- STD COL 3.11(7)

The applicant provided additional information in STD COL 3.11(7) to address COL Information Item 3.11(7) regarding the site-specific chemical and radiation environmental requirements. STD COL 3.11(7) applies to Section 3.11.5, "Estimated Chemical and Radiation Environment."

- STD COL 3.11(8) and CP COL 3.11(8)

The applicant provided additional information in STD COL 3.11(8) and CP COL 3.11(8) to address COL Information Item 3.11(8) regarding site-specific mechanical equipment requirements. STD COL 3.11(8) applies to Section 3.11.6, "Qualification of Mechanical Equipment," and Section 3D.1.6. CP COL 3.11(8) applies to Section Table 3D-201.

- STD COL 3.11(9)

The applicant provided additional information in STD COL 3.11(9) to address COL Information Item 3.11(9) regarding the parameters based on site-specific considerations. STD COL 3.11(9) applies to Section 3.11.1.2, "Definition of Environmental Conditions."

3.11.3 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 the Commission's regulations for the EQ of mechanical and electrical equipment, and the associated acceptance criteria are given in Section 3.11, "Environmental Qualification of Mechanical and Electrical Equipment," Revision 3, issued March 2007, of NUREG-0800.

The applicable regulatory requirements for the EQ of mechanical and electrical equipment are as follows:

1. 10 CFR 50.49 requires that the applicant establish a program for qualifying electrical equipment important to safety located in a harsh environment.

2. GDC 1 requires that components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed.

3. GDC 2 requires that components important to safety be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety function.

4. GDC 4 requires that components important to safety be designed to accommodate the effects of, and be compatible with, the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents (LOCAs).

5. GDC 23 requires that protection systems be designed to fail in a safe state, or in a state demonstrated to be acceptable on some other defined basis, if conditions such as postulated adverse environments (e.g., extreme heat or cold, pressure, steam, water, or radiation) are experienced.

6. 10 CFR Part 50, Appendix B, Criterion III, requires that measures be established to ensure that applicable regulatory requirements and the associated design bases are correctly translated into specifications, drawings, procedures and instructions. Criterion III also requires measures for verifying and checking the adequacy of design, such as by the performance of a suitable test program. The measures specifically requiring that a test program used to verify the adequacy of a specific design feature shall include suitable qualifications testing of a prototype unit under the most adverse design conditions.

7. 10 CFR Part 50, Appendix B, Section XI, requires that a test control plan be established to ensure that all tests needed to demonstrate a component's capability to perform satisfactorily in service be identified and performed in accordance with written procedures that incorporate the requirements and acceptance limits contained in applicable design documents.

8. 10 CFR Part 50, Appendix B, Section XVII, requires that sufficient records be maintained to furnish evidence of activities affecting quality.

Regulatory guidance provided for the above requirements includes:

1. RG 1.89, “Environmental Qualification of Certain Electrical Equipment Important to Safety for Nuclear Power Plants,” Revision 1, issued June 1984, provides the principal guidance for implementing the requirements and criteria of 10 CFR 50.49 for EQ of electrical equipment that is important to safety and located in a harsh environment.

2. NUREG-0588, “Interim Staff Position on Environmental Qualification of Safety-Related Electrical Equipment,” Category I guidance may be used if relevant guidance is not provided in RG 1.89.

3. RG 1.40, “Qualification Tests of Continuous-Duty Motors Installed inside the Containment of Water-Cooled Nuclear Power Plants,” endorses Institute of Electrical and Electronics Engineers (IEEE) Standard 334, "IEEE Standard for Qualifying Continuous Duty Class 1E Motors for Nuclear Power Generating Stations," Revision 0, issued March 1973.

4. RG 1.63, “Electrical Penetration Assemblies in Containment Structures for Nuclear Power Plants,” endorses IEEE Standard 317, "IEEE Standard for Electric Penetration Assemblies in Containment Structures for Nuclear Power Generating Stations," Revision 3, issued February 1987.

5. RG 1.73, “Qualification Tests of Electric Valve Operators Installed Inside the Containment of Nuclear Power Plants,” endorses IEEE Standard 382, "IEEE Trial Use Guide for Type Test of Class 1E Electric Valve Operators for Nuclear Power Generating Stations," issued January 1974.

6. RG 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," Revision 4, issued June 2006, provides guidance acceptable to the staff for the EQ of the post-accident monitoring equipment described in subsection I, Item 1(f), of this SRP section, as well as instruments and controls for the equipment.

7. Draft RG 1.131, “Qualification Tests of Electric Cables and Field Splices for Light-Water-Cooled Nuclear Power Plants,” endorses IEEE Standard 383-1974, "Standard for Type Test of Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations," issued April 2009. Since then RG 1.131 was replaced by RG 1.211, “Qualification of Safety-Related Cables and Field Splices for Nuclear Power Plants,” issued April 2009, endorses IEEE Standard 383-2003, "Standard for Qualifying Class 1E Electric Cables and Field Splices for Nuclear Power Generating Stations."

8. RG 1.156, “Environmental Qualification of Connection Assemblies for Nuclear Power Plants,” issued November 1987, endorses IEEE Standard 572, "IEEE Standard for Qualification of Class 1E Connection Assemblies for Nuclear Power Generating Stations."

9. RG 1.158, "Qualification of Safety-Related Lead Storage Batteries for Nuclear Power Plants," issued February 1989, endorses IEEE Standard 535, "IEEE Standard for Qualification of Class 1E Lead Storage Batteries for Nuclear Power Generating Stations."

10. RG 1.180, "Guidelines for Evaluating Electromagnetic and Radio- Frequency Interference in Safety-Related Instrumentation and Control Systems," Revision 1, issued October 2003, provides guidance acceptable to the staff for determining electromagnetic compatibility for instrumentation and control (I&C) equipment during service.

11. RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," issued July 2000, provides guidance acceptable to the staff for determining the radiation dose and dose rate for equipment during postulated accident conditions. These criteria, as supplemented by those of RG 1.89, should be used to evaluate the accident source term used in the environmental design and qualification of equipment important to safety.

12. RG 1.206, “Combined License Applications for Nuclear Power Plants,” the staff provides guidance for a COL applicant in preparing and submitting its COLA in accordance with the NRC regulations. For example, Section C.IV.4 in RG 1.206 discusses the requirement in 10 CFR 52.79(a) for descriptions of operational programs that need to be included in the FSAR for a COLA to allow a reasonable assurance finding of acceptability. In particular, a COL applicant should fully describe the EQ operational program as defined in SECY-05-0197, “Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria,” dated October 28, 2005, to avoid the need for ITAAC for the implementation of those programs. The term “fully described” for an operational program should be understood to mean that the program is clearly and sufficiently described in

terms for scope and level of detail to allow a reasonable assurance finding of acceptability. Further, operational programs should be described at a functional level and an increasing level of detail where implementation choices could materially and negatively affect the program effectiveness and acceptability. The Commission approved the use of a license condition for operational program implementation milestones that are fully described or referenced in the FSAR as discussed in the staff requirements memorandum (SRM) for SECY-05-0197, dated February 22, 2006.

13. RG 1.209, "Guidelines for Environmental Qualification of Safety-Related Computer-Based Instrumentation and Control Systems in Nuclear Power Plants," issued March 2007, provides guidance acceptable to the staff for determining the environmental qualification procedures for safety-related computer-based I&C systems for service within nuclear power plants.

3.11.4 Technical Evaluation

The staff reviewed Section 3.11 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference, addresses the relevant information related to the EQ of mechanical and electrical equipment. Section 3.11 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The NRC staff's technical evaluation of the information incorporated by reference, related to the EQ of mechanical and electrical equipment will be documented in the staff's FSER on the DC application for the US-APWR design.

US-APWR COL Information Items

- CP COL 3.11(1)

The staff reviewed CP COL 3.11(1) related to COL Information Item 3.11(1) included under Section 3.11 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the first sentence of the sixth paragraph in DCD Tier 2, Revision 3, Section 3.11, with the following:

> Prior to unit fuel load, the Licensee establishes and implements an Operational EQ program and assembles and maintains the electrical and mechanical EQ records for the life of the plant to fulfill the records retention requirements delineated in 10 CFR 50.49 (Reference 3.11-2) and in compliance with the quality assurance program (QAP) described in Chapter 17.

- STD COL 3.11(2)

The staff reviewed STD COL 3.11(2) related to COL Information Item 3.11(2) included under Section 3.11.3 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the fifth paragraph in DCD Tier 2, Revision 3, Section 3.11.3, with the following:

> Test results for electrical and mechanical equipment are maintained with the project records as auditable files. Such records are maintained from the time of

initial receipt through the entire period during which the subject equipment remains installed in the plant or is stored for future use. Documentation for the qualification of safety-related equipment and nonsafety-related equipment, which is important to safety, is ultimately the responsibility of the COL Applicant who, later as the licensee, maintains a complete set of EQ records. The EQ records are maintained for the life of plant to fulfill the records retention requirements delineated in 10 CFR 50.49 (Reference 3.11-2) and in compliance with the QAP described in Chapter 17.

- CP COL 3.11(3)

The staff reviewed CP COL 3.11(3) related to COL Information Item 3.11(3) included under Section 3.11 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the last sentence of the fifth paragraph in DCD Tier 2, Revision 3, Section 3.11, with the following:

The CPNPP Units 3 and 4 EQ Program implementation milestones are as follows:

Activity	Milestone
Formulate Units 3 and 4 EQ Program	COLA Submittal
Assist with Reactor Vendor/Architect-Engineer/Constructor Combined License EQ Program	
Operational EQ Program established	Unit 3 Fuel Load
Operational EQ Program established	Unit 4 Fuel Load

As stated in COLA Part 2, FSAR Table 13.4-201, item 3, the applicant has proposed to include the following license condition for the Environmental Qualification Program:

- **License Condition (3-4)** – Prior to initial fuel load, the licensee shall implement the Environmental Qualification Program.

Operational programs are specific programs required by regulations. The Environmental Qualification program is a fully described program as discussed in SECY-05-0197, "Review of Operational Programs in a Combined License Application and Generic Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria," dated October 28, 2005. As such, the applicant's proposed license condition above is acceptable.

Due to the scope of this operational program, submittal of this program development is necessary to plan for and conduct NRC inspections during construction for conformance to the regulations. Therefore, the staff plans to impose the following license condition below:

- **License Condition (3-5)** – No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO a schedule that supports planning for, and the conducting of, NRC inspections of the Environmental Qualification Program. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until the Environmental Qualification Program has been fully implemented.

- CP COL 3.11(4)

The staff reviewed CP COL 3.11(4) related to COL Information Item 3.11(4) included under Section 3.11 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the eighth paragraph in DCD Tier 2, Revision 3, Section 3.11, with the following:

> This subsection addresses EQ implementation in conjunction with the initial design, procurement, construction, startup and testing up to the point of turnover. Implementation of the operational EQ program is included in Table 13.4-201. Periodic tests, calibrations, and inspections which verify that the identified equipment remains capable of fulfilling its intended function are described in the operational EQ program. The features of the US-APWR Equipment Qualification Program Technical Report MUAP-08015 (Reference 3.11-3) are included in the CPNPP Units 3 and 4 EQ Program.

- STD COL 3.11(5)

The staff reviewed STD COL 3.11(5) related to COL Information Item 3.11(5) included under Section 3.11.1.1 and Section 3D.1.6 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the last sentence of the first paragraph in DCD Tier 2, Revision 3, Section 3.11.1.1, with the following:

> Table 3D-201 identifies site-specific electrical and mechanical equipment locations and environmental conditions (both normal and accident) to be addressed in the EQ program. This table lists information on site-specific safety-related equipment and nonsafety-related equipment which is important to safety. The provisions in the US-APWR DCD for the environmental qualification of mechanical equipment are applied to the plant-specific systems. This list forms the basis for the operational Equipment Qualification Master Equipment List (EQMEL), which will be prepared in conjunction with work activities authorized by an engineering/procurement/construction (EPC) contract.

The applicant also replaced the third and fourth sentences in DCD Tier 2, Revision 3, Appendix 3D, Subsection 3D.1.6, with the following:

> The seismic class of safety-related mechanical, electrical, and Instrumentation and Control are shown in Table 3D-201 and DCD Table 3D-2 [US-APWR Environmental Qualification Equipment List]. 10 CFR 50, Appendix B requirements will be applied to seismic category I electrical, instrumentation and control (I&C), and mechanical equipment contained in Table 3D-201 and DCD Table 3D-2, as discussed in DCD Subsections 3.2.1.1.1 [Seismic Category I] and 3.2.1.1.2 [Seismic Category II].

This replacement also applies to STD COL 3.11(8).

- CP COL 3.11(5)

The staff reviewed CP COL 3.11(5) related to COL Information Item 3.11(5) included under Table 3D-201 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant added Table 3D-201 in Appendix 3D.

This addition also applies to STD COL 3.11(8).

- STD COL 3.11(6)

The staff reviewed STD COL 3.11(6) related to COL Information Item 3.11(6) included under Section 3.11.4 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the second paragraph in DCD Tier 2, Revision 3, Section 3.11.4, with the following:

> Site-specific electrical and mechanical equipment (including instrumentation and control and certain accident monitoring equipment), subject to environmental stress associated with loss of ventilation or other environmental control systems including heat tracing, heating, and air conditioning, is qualified using the process described in MUAP-08015 (Reference 3.11-3).

- STD COL 3.11(7)

The staff reviewed STD COL 3.11(7) related to COL Information Item 3.11(7) included under Section 3.11.5 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the paragraph in DCD Tier 2, Revision 3, Section 3.11.5, with the following:

> Chemical and radiation environmental requirements for site-specific electrical and mechanical equipment (including instrumentation and control and certain accident monitoring equipment) are included in MUAP-08015 (Reference 3.11-3). This equipment is qualified using the process described in MUAP-08015 (Reference 3.11-3).

- STD COL 3.11(8)

The staff reviewed STD COL 3.11(8) related to COL Information Item 3.11(8) included under Section 3.11.6 and Section 3D.1.6 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the second paragraph in DCD Tier 2, Revision 3, Section 3.11.5, with the following:

> Site-specific mechanical equipment requirements are to be included in Table 3D-201 by completion of detailed design. This equipment is qualified using the process described in MUAP-08015 (Reference 3.11-3).

The applicant also replaced the third and fourth sentences in DCD Tier 2, Revision 3, Appendix 3D, Subsection 3D.1.6, as described with STD COL 3.11(5).

- CP COL 3.11(8)

The staff reviewed CP COL 3.11(5) related to COL Information Item 3.11(8) included under Table 3D-201 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant added Table 3D-201 in Appendix 3D.

This replacement also applies to STD COL 3.11(5).

- STD COL 3.11(9)

The staff reviewed STD COL 3.11(9) related to COL Information Item 3.11(9) included under Section 3.11.1.2 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the fourth sentence of the first paragraph in DCD Tier 2, Revision 3, Section 3.11.1.2, with the following:

> Plant-specific EQ parameters are documented in the corresponding equipment specifications, drawings, procedures, instructions, and qualification packages. When procurement specifications are developed they will contain, as applicable, the following items:
>
> - Applicable EQ parameters for harsh or mild environments (see MUAP-08015, Chapter 4 for a list of parameters and allowable/required margins). This includes attributes such as operating and accident temperature ranges and radiation levels, qualification testing requirements typical of an equipment supplier, qualified life requirements, expectations for equipment suppliers to provide a list of components that need to be replaced periodically in order to maintain qualification, records and documentation requirements for the equipment vendor, etc.
> - Applicable seismic parameters.
> - Applicable operating time for certain SSCs subject to harsh environment operability limitations.
> - Acceptable methods of qualification (test, analysis, commercial grade dedication, etc.) for each listed attribute or parameter and appropriate QA requirements.
> - Acceptable types of documentation to be supplied to document qualification.
> - Other issues pertinent to the preparation of these specifications address shipping, storage, installation and spare parts requirements.

3.11.4.1 Environmental Qualification of Electrical and Instrumentation and Control Equipment

The staff reviewed CP COL 3.11(1) with regard to the EQ of electrical and I&C equipment. The EQ list for CPNPP, Units 3 and 4, comprises of equipment that is required to be qualified by DCD Tier 2, Table 3D-2, and site-specific equipment list in CPNPP, Units 3 and 4, COL FSAR Table 3D-201. The identified plant-specific equipment important to safety is the UHS and its support equipment (e.g., cooling towers). Since they are not exposed in a design basis accident (DBA) harsh environment, they are not required to be environmentally qualified for more than normal, operational test, and AOO environments. The information presented for each item of equipment listed in Table 3D-201 includes the designated functional requirements, definition of the applicable environmental parameters, and a description of the qualification process employed in accordance with DCD applicant's Technical Report MUAP-08015, "US-APWR Equipment Qualification Program," Revision 1, issued October 2009.

According to CP COL 3.11(1), the applicant is responsible for assembling and maintaining the EQ document only. CP COL 3.11(1) appears shifting its full responsibility for the EQ program

and maintaining the EQ record keeping to the licensee (or the plant operator). The staff determined that responsibility between the applicant and the licensee needed clarification.

In **RAI 3705, Question 03.11-12**, the staff requested the applicant to explain what is required of the applicant under the COL 3.11(1). In its response to **RAI 3705, Question 03.11-12**, dated November 11, 2009, the applicant stated that "the documentation of the qualification of important to safety and safety-related equipment is ultimately the responsibility of the COL applicant (i.e., operating license holder-licensee)." This response seems to indicate that the COL applicant becomes the licensee (plant operator) once the unit loads fuel and the EQ record turnover process is completed for CPNPP, Units 3 and 4. In a supplemental response to **RAI 3705, Question 03.11-12**, dated March 5, 2010, the applicant revised above CP COL 3.11(1) further as follows:

> Prior to unit fuel load, the licensee establishes and implements an operational EQ program, and assembles, and maintains the electrical and mechanical EQ records for the life of the plant to fulfill the records retention requirements delineated in 10 CFR 50.49 (Reference 3.11-2) and in compliance with the quality assurance program (QAP) described in Chapter 17.

Per the supplemental response, the applicant will be assembling, and maintaining the EQ records as well as establishing and implementing an operational EQ program for the life of the plant as indicated in the revised CP COL 3.11(1). Since the applicant becomes the licensee upon issuance of COL, there is no need to distinguish between the applicant and licensee for CPNPP, Units 3 and 4, and therefore the supplemental response is acceptable. The staff confirmed that CPNPP, Units 3 and 4, COL FSAR, Revision 2 incorporates the changes identified in the supplemental response to **RAI 3705, Question 03.11-12**. Accordingly, **RAI 3705, Question 03.11-12, is resolved and closed**. With the revision of CP COL 3.11(1) and the resolution of **RAI 3705, Question 03.11-12**, the staff finds CP COL 3.11(1) acceptable regarding the EQ of electrical and I&C equipment, since the applicant identifies the responsibility for assembling and maintaining the EQ document.

The staff reviewed STD COL 3.11(2) with regard to the EQ of electrical and I&C equipment, which requires the applicant to describe how the results of qualification tests are to be recorded.

In **RAI 3705, Question 03.11-13**, the staff requested the applicant to elaborate on the responsibility of the applicant versus the licensee (COL holder) in meeting the requirements of 10 CFR 50.49. In its response to **RAI 3705, Question 03.11-13**, dated November 11, 2009, the applicant clarified that the applicant has a responsibility to maintain the EQ project records until the COL issuance and proposed changes to STD COL 3.11(2). In its supplemental response to **RAI 3705, Question 03.11-13**, dated March 5, 2010, the applicant further revised the STD COL 3.11(2) as follows:

> Test results for electrical and mechanical equipment are maintained with the project records as auditable files. Such records are maintained from the time of initial receipt through the entire period during which the subject equipment remains installed in the plant or is stored for future use. Documentation for the qualification of safety-related equipment and nonsafety-related equipment which is important to safety is ultimately the responsibility of the COL applicant who, later as the licensee, maintains a complete set of EQ records. The EQ records are maintained for the life of plant to fulfill the records retention requirements

delineated in 10 CFR 50.49 (Reference 3.11-2) and in compliance with the QAP described in Chapter 17.

The changes for STD COL 3.11(2) outline the responsibility between the COL applicant and the licensee (i.e., the COL applicant documents and the licensee maintains). In addition, it clearly states how its meet the requirements under 10 CFR 50.49. The staff finds the supplemental RAI response and the revised STD COL 3.11(2) acceptable, with regard to the EQ of electrical and I&C equipment, since the applicant described how the results of the qualification tests are to be recorded in an auditable file in accordance with requirements of 10 CFR 50.49. The staff confirmed that CPNPP, Units 3 and 4, COL FSAR, Revision 2, incorporates the changes identified in the supplemental response to **RAI 3705, Question 03.11-13**. Accordingly, **RAI 3705, Question 03.11-13, is resolved and closed**.

The staff reviewed CP COL 3.11(3) with regard to the EQ of electrical and I&C equipment, which requires the applicant to provide a schedule showing the EQ Program proposed implementation milestones. In **RAI 3705, Question 03.11-14**, the staff requested the applicant to clarify whether the EQ program implementation schedule for CPNPP, Units 3 and 4, was up to date and also asked to explain how this will work with the operational program identified in CPNPP, Units 3 and 4, FSAR in Table 13.4-201. In its response to **RAI 3705, Question 03.11-14**, dated November 11, 2009, the applicant provided the implementation schedule detail, but failed to include operational EQ programs. In its supplemental response to **RAI 3705, Question 03.11-14**, dated March 5, 2010, the applicant referenced Figure 9.1, "US-APWR Project Specific EQ Program Milestone Schedule," in MUAP-08015, Revision 1, as the project-specific EQ program milestone schedule. The applicant also referred to the EQ program implementation schedule provided with the supplement response to **RAI 3705, Question 03.11-12,** which was revised to include operational EQ programs for CPNPP, Units 3 and 4, with the following information:

Activity	**Milestone**
Formulate Units 3 and 4 EQ Program	COLA Submittal
Assist with Reactor Vendor/Architect-Engineer/ Constructor EQ Program	Combined License
Operational EQ Program established	Unit 3 Fuel Load
Operational EQ Program established	Unit 4 Fuel Load

The staff finds the supplemental RAI response and the revised CP COL 3.11(3) acceptable, with regard to the EQ of electrical and I&C equipment, since the applicant provided necessary schedule information for the EQ Program implementation milestones.

The staff confirmed that CPNPP, Units 3 and 4, COL FSAR, Revision 2, incorporates the changes identified in the supplemental response to **RAI 3705, Question 03.11-14**. Accordingly, **RAI 3705, Question 03.11-14, is resolved and closed**.

The staff reviewed CP COL 3.11(4) with regard to the EQ of electrical and I&C equipment, which requires the applicant to describe periodic tests, calibrations, and inspections to be performed during the life of the plant.

In **RAI 3705, Question 03.11-15**, the staff requested the applicant to explain how the applicant intends to implement the requirements described in MUAP-08015 and the operational EQ program identified in Table 13.4-201 of the CPNPP, Units 3 and 4, COL FSAR.

In its response to **RAI 3705, Question 03.11-15**, dated November 11, 2009, the applicant stated the equipment qualification program, which is used to design, procure, construct, and test for CPNPP, Units 3 and 4, is described in MUAP-08015, Revision 1. The equipment qualification program is used for furnishing all documentation for testing, installation, maintenance of all EQ records for the life of the facility. The operational EQ program is for addressing EQ program for replacement parts, inspections, testing, and renovations. The applicant also proposed to revise CP COL 3.11(4) as follows:

> This subsection addresses EQ implementation in conjunction with the initial design, procurement, construction, startup and testing up to the point of turnover and initial license issuance. Implementation of the operational EQ program is included in Table 13.4-201. Periodic tests, calibrations, and inspections which verify that the identified equipment remains capable of fulfilling its intended function are described in the operational EQ program. The features of the US-APWR Equipment Qualification Program Technical Report MUAP-08015 (Reference 3.11-3) are included in the CPNPP units 3 and 4 EQ Program.

The applicant identified the equipment qualification program in MUAP-08015, Revision 1 for design, procurement, construction, and testing, and for providing all documentation as well as maintaining all equipment qualification program records. Also, the operational program implementation will address EQ for replacement parts, inspections, testing, and renovation for CPNPP Units 3 and 4. The staff finds the RAI response and the revised CP COL 3.11(4) acceptable, with regard to the EQ of electrical and I&C equipment, since the applicant clarified the use of the equipment qualification program in MUAP-08015, Revision 1 for design, procurement, construction, and testing, and for providing all documentation. The staff confirmed that CPNPP, Units 3 and 4, COL FSAR, Revision 2, incorporates the changes identified in the response to **RAI 3705, Question 03.11-15**. Accordingly, **RAI 3705, Question 03.11-15, is resolved and closed**.

The staff reviewed STD COL 3.11(5) and CP COL 3.11(5) with regard to the EQ of electrical and I&C equipment, which requires the applicant to identify the site-specific equipment to be addressed in the EQ program, including locations and environmental conditions.

Since the “important to safety” equipment includes “safety-related and nonsafety-related” equipment, the staff noted that the statement in CPNPP, Units 3 and 4, COL FSAR, Section 3.11.1.1 on “safety-related or important to safety equipment” should be corrected.

In **RAI 3705, Question 03.11-16**, the staff requested the applicant to correct the above statement “safety-related or important-to-safety” equipment to “safety-related and nonsafety-related equipment,” and also requested the applicant to explain what “Other” means under the “Purpose” column of the CPNPP, Units 3 and 4, COL FSAR, Table 3D-201. In its response to **RAI 3705, Question 03.11-16**, dated November 11, 2009, the applicant revised “safety-related or important-to-safety equipment” to “safety-related and important-to-safety equipment.” The applicant also added a sentence, “The provision in the US-APWR DCD for the environmental qualification (EQ) of mechanical equipment will be applied to the plant-specific systems” to indicate the table includes mechanical equipment.

In its supplemental response to **RAI 3705, Question 03.11-16**, March 5, 2010, the applicant further revised the STD 3.11(5) as follows:

> Table 3D-201 identifies CPNPP Units 3 and 4 site-specific electrical and mechanical equipment locations and environmental conditions (both normal and accident) to be addressed in the EQ program. This table lists information on site-specific safety-related and nonsafety-related equipment which is important to safety. The provisions in the US-APWR DCD for the environmental qualification of mechanical equipment are applied to the plant-specific systems.

In addition, the applicant explained that "Other" is used in "Purpose" column of CPNPP, Units 3 and 4, COL FSAR, Table 3D-201, where it means "Instruments used for safe shutdown" or "Instrument used for operation of safety-related heating and ventilation equipment."

The staff finds the supplement RAI response and the revised STD COL 3.11(5) acceptable, with regard to the EQ of electrical and I&C equipment, since the applicant's revision clarified "important to safety" equipment as "safety-related equipment and nonsafety-related" equipment that is important to safety and added a sentence regarding the EQ of mechanical equipment. The staff confirmed that CPNPP, Units 3 and 4, COL FSAR, Revision 2, incorporates the changes identified in the supplemental response to **RAI 3705, Question 03.11-16**. Accordingly, **RAI 3705, Question 03.11-16, is resolved and closed**. The staff finds CP COL 3.11(5) acceptable, with regard to the EQ of electrical and I&C equipment, since CPNPP, Units 3 and 4, COL FSAR, Table 3D-201 identifies site-specific electrical and I&C equipment to be addressed in the EQ Program.

The staff reviewed STD COL 3.11(6) with regard to the equivalent qualification process for the EQ of site-specific electrical and I&C equipment.

In **RAI 3705, Question 03.11-17**, the staff requested the applicant to identify where the equivalent qualification process described in STD COL 3.11(6) has been defined or elaborated, and provide details of parameters that will be considered for evaluating the equivalency.

In its response to **RAI 3705, Question 03.11-17**, dated November 11, 2009, the applicant stated that the equivalent qualification process means that the site-specific electrical and mechanical equipment will be qualified following the guidance provided in MUAP-08015, Revision 1. The applicant indicated that in DCD Tier 2, Revision 3, COL Information Item 3.11(6) will be revised to state:

> "The COL Applicant is to qualify site-specific electrical and mechanical equipment (including instrumentation and control, and certain accident monitoring equipment) using a qualification process that is equivalent to that delineated for the US-APWR standard plant, as described in Technical Report MUAP-08015(R1)."

In the supplemental response to **RAI 3705, Question 03.11-17**, dated March 5, 2010, the applicant removed the word "equivalent qualification process" from STD COL 3.11(6) and revised it further as below:

> Site-specific electrical and mechanical equipment (including instrumentation and control and certain accident monitoring equipment), subject to environmental stress associated with loss of ventilation or other environmental control systems including heat tracing, heating, and air conditioning, is qualified using the process described in MUAP-08015 (Reference 3.11-3).

The staff finds the supplement RAI response and the revised STD COL 3.11(6) acceptable, with regard to the EQ of electrical and I&C equipment, since the deletion of the term "equivalent qualification process" from COL Information Items 3.11(6) is acceptable since the "equivalent" qualification denotes the qualification process described in MUAP-08015, Revision 1.

Subsequently, the staff confirmed that the DCD applicant revised COL Information Item 3.11(6) in DCD Tier 2, Revision 3 as stated in the response to **RAI 3705, Question 03.11-17**. The staff confirmed that CPNPP, Units 3 and 4, COL FSAR, Revision 2, incorporated the changes identified in the supplemental response to **RAI 3705, Question 03.11-17**. Accordingly, **RAI 3705, Question 03.11-17, is resolved** with regard to STD COL 3.11(6)**.**

The staff reviewed STD COL 3.11(7) with regard to the EQ of site-specific electrical and I&C equipment, which requires the COL applicant to identify chemical and radiation environmental requirements for site-specific qualification of electrical and mechanical equipment.

As described in the supplemental response to **RAI 3705, Question 03.11-17,** the applicant deleted "equivalent qualification process," from STD COL 3.11(6). The applicant made a similar change to STD COL 3.11(7) as follows:

> Chemical and radiation environmental requirements for site-specific electrical and mechanical equipment (including instrumentation and control and certain accident monitoring equipment) are included in MUAP-08015 (Reference 3.11-3). This equipment is qualified using the process described in MUAP-08015 (Reference 3.11-3).

With deletion of the phrase, "equivalent qualification process," the staff finds that the qualification process for site-specific chemical and radiation requirements for CPNPP, Units 3 and 4, will use the process described in MUAP-08015, Revision 1. Therefore, the staff finds the staff finds the supplement RAI response and the revised STD COL 3.11(7) acceptable, with regard to the EQ of electrical and I&C equipment, since the applicant resolved the issue with the phrase "equivalent qualification process."

The staff confirmed that CPNPP, Units 3 and 4, COL FSAR, Revision 2, incorporated the changes identified in the supplemental response to **RAI 3705, Question 03.11-17**. Accordingly, **RAI 3705, Question 03.11-17, is resolved** with regard to STD COL 3.11(7)**.**

STD COL 3.11(8) is associated with site-specific mechanical equipment requirements.

As described in the supplemental response to **RAI 3705, Question 03.11-17**, the applicant deleted the phrase "equivalent qualification process," from STD COL 3.11(6). The applicant made a similar change to STD COL 3.11(8) as follows:

> Site-specific mechanical equipment requirements are to be included in Table 3D-201 by completion of detailed design. This equipment is qualified using the process described in MUAP-08015 (Reference 3.11-3).

With deletion of the phrase, "equivalent qualification process" the staff finds that the qualification process for site-specific mechanical equipment requirements the applicant will use the process described in MUAP-08015, Revision 1. Therefore, the staff finds the staff finds the supplement RAI response acceptable, since the applicant resolved the issue with the phrase "equivalent qualification process."

The staff confirmed that CPNPP, Units 3 and 4, COL FSAR, Revision 2, incorporated the changes identified in the supplemental response to **RAI 3705, Question 03.11-17**. Accordingly, **RAI 3705, Question 03.11-17, is resolved** with regard to STD COL 3.11(8)**.** The acceptability of STD COL 3.11(8) and CP COL 3.11(8) is further discussed below in Section 3.11.4.2 of this report. Since the applicant has resolved the concerns related to STD COL 3.11(6), STD COL 3.11(7), and STD COL 3.11(8), **RAI 3705, Question 03.11-17, is resolved and closed.**

The staff reviewed STD COL 3.11(9) with regard to the EQ of site-specific electrical and I&C equipment, which states that the COL applicant may revise the parameters based on site-specific considerations.

In the supplemental response to **RAI 3705, Question 03.11-12**, the COL applicant revised its previous STD COL 3.11(9) with the following:

> Plant-specific EQ parameters are documented in the corresponding equipment specifications, drawings, procedures, instructions, and qualification packages.

The staff finds the staff finds the supplement RAI response and the revised STD COL 3.11(9) acceptable, with regard to the EQ of electrical and I&C equipment, since the applicant has provided more specific requirements for EQ documentation (e.g., equipment specifications, drawings, procedures, instructions, and qualification packages). The staff confirmed that CPNPP, Units 3 and 4, COL FSAR, Revision 2, incorporated the changes identified in the supplemental response to **RAI 3705, Question 03.11-12**. Accordingly, **RAI 3705, Question 03.11-12, is resolved** with regard to STD COL 3.11(9)**.**

3.11.4.2 Environmental Qualification of Mechanical Equipment

The staff reviewed the CPNPP Units 3 and 4 COLA, and the applicable sections in the DCD incorporated by reference in the CPNPP Units 3 and 4 FSAR, for the EQ of mechanical equipment to determine whether the COLA meets the regulatory requirements to provide reasonable assurance that the applicable components at CPNPP Units 3 and 4 will be capable of performing their safety functions. In its review, the staff evaluated whether the CPNPP Units 3 and 4 COLA with the incorporation by reference of the DCD contains an acceptable description of the EQ program for CPNPP Units 3 and 4 that provides reasonable assurance that mechanical equipment within the scope of the CPNPP Units 3 and 4 EQ program will be capable of performing the safety functions with respect to environmental qualification in accordance with the NRC regulations.

CPNPP, Units 3 and 4, COL FSAR Section 3.11 incorporates by reference, the provisions in the DCD for the design process for the EQ of mechanical equipment at CPNPP, Units 3 and 4. In **RAI 2765, Question 03.11-1**, the staff requested that the applicant describe the implementation of the design process specified in the DCD. For example, the staff requested that the applicant discuss the application of ASME Standard QME-1-2007, “Qualification of Active Mechanical Equipment Used in Nuclear Power Plants,” specified in MUAP-08015, Revision 1, referenced in the DCD. The staff also requested that the applicant discuss the availability of design and procurement specifications for NRC on-site review to demonstrate the implementation of the US-APWR EQ process for mechanical equipment to be used at CPNPP, Units 3 and 4.

In its response to **RAI 2765, Question 03.11-1**, dated November 11, 2009, the applicant stated that the implementation of the US-APWR design process for the EQ of mechanical equipment,

including the application of ASME Standard QME-1, is described in MUAP-08015. The applicant stated that the design and procurement specifications, including the EQ requirements for mechanical equipment, would be developed and available on-site during the detailed design and procurement stages prior to equipment procurement.

In follow-up **RAI 6159, Question 03.11-18**, the staff requested that the applicant provide a schedule for the availability of a sample of EQ specifications for mechanical equipment to be used at CPNPP, Units 3 and 4, for audit by the NRC staff in support of its review of the COLA. In its response to **RAI 6159, Question 03.11-18**, dated February 27, 2012, the applicant indicated that the date for the availability of project-specific design and procurement specifications was unknown. The applicant provided a planned revision to STD COL 3.11(9) in CPNPP, Units 3 and 4, COL FSAR Section 3.11.1.2 that listed applicable items to be addressed in the procurement specifications when developed. The staff found that the items listed in the proposed change to the CPNPP, Units 3 and 4, COL FSAR did not provide the level of detail necessary for the staff to reach a safety finding on the implementation of the EQ of mechanical equipment. As discussed in Section 3.9.6 of this report, the DCD applicant has indicated that a sample of design and procurement specifications will be prepared for staff audit. The staff will perform an audit of the design and procurement specifications to evaluate the implementation of the EQ of mechanical equipment in accordance with the requirements of 10 CFR 52.79(a)(11). Therefore, pending the completion of the audit, **RAI 6159, Question 03.11-18, is being tracked as an Open Item**.

CPNPP, Units 3 and 4, COL FSAR Section 3.11 incorporates by reference, the provisions in the DCD in describing the operational program for EQ of mechanical equipment at CPNPP, Units 3 and 4. In **RAI 2765, Question 03.11-2**, the staff requested that the applicant fully describe the operational program for EQ of mechanical equipment per the guidance in Commission paper SECY-05-0197 and RG 1.206 through a combination of the DCD and CPNPP, Units 3 and 4, COL FSAR. In the RAI, the staff requested that the applicant address specific information related to the EQ operational program for mechanical equipment at CPNPP, Units 3 and 4.

In its response to **RAI 2765, Question 03.11-2**, dated November 11, 2009, the applicant stated that the US-APWR EQ program and its interface with the Operational Equipment Qualification Program are described in MUAP-08015. The applicant stated that the environmental parameters to be considered in the design process, such as pressure, temperature, and seismic factors, are identified and specified for the normal, abnormal, and DBA conditions in MUAP-08015. In follow-up **RAI 6159, Question 03.11-19**, the staff requested that the applicant describe the transition from the initial EQ program to the EQ program to be implemented during plant operation. In the RAI, the staff provided specific examples of the aspects of an acceptable description of the EQ operational program that should be addressed in the CPNPP, Units 3 and 4 COL FSAR. In its response to **RAI 6159, Question 03.11-19**, dated February 27, 2012, the applicant specified operational aspects of the EQ program that were addressed in MUAP-08015, and also provided a modification to STD COL 3.11(5) in CPNPP, Units 3 and 4 COL FSAR, Section 3.11.1.1 to note the preparation of the equipment qualification master equipment list. The staff is continuing its review of MUAP-08015 for the description of the DCD equipment qualification program and is unable to complete its evaluation of whether the applicant has provided a full description of the CPNPP, Units 3 and 4, EQ operational program. Pending the completion of the review of MUAP-08015, **RAI 6159, Question 03.11-19, is being tracked as an Open Item**.

CPNPP, Units 3 and 4, COL FSAR, Section 3.11 provides plant-specific information in addition to incorporating by reference, the DCD. In **RAI 2765, Question 03.11-3**, the staff requested

that the applicant confirm that the provisions in the DCD for EQ of mechanical equipment will be applied to the plant-specific systems identified in the CPNPP, Units 3 and 4, COL FSAR, or describe plant-specific EQ provisions for these systems at CPNPP, Units 3 and 4.

In its response to **RAI 2765, Question 03.11-3**, dated November 11, 2009, the applicant confirmed that the provisions in the DCD for EQ of mechanical equipment will be applied to the plant-specific systems identified in the CPNPP, Units 3 and 4, COL FSAR. Further, the applicant provided a planned modification to STD COL 3.11(5) in CPNPP, Units 3 and 4, COL FSAR, Section 3.11.1.1 that reflected its RAI response. The staff has confirmed that Revision 2 (and 3) to CPNPP, Units 3 and 4, COL FSAR Section 3.11.1.1 specifies that the provisions in the US-APWR DCD for EQ of mechanical equipment will be applied to the plant-specific systems. The staff finds that the applicant through its RAI response and the CPNPP, Units 3 and 4, COL FSAR has clarified that the provisions in the DCD for EQ of mechanical equipment will be applied to the plant-specific systems identified in the CPNPP Units 3 and 4 COL FSAR. Accordingly, **RAI 2765, Question 03.11-3, is resolved and closed**.

COL Information Item 3.11(1) in DCD Tier 2, Section 3.11.7 states that the COL applicant is responsible for assembling and maintaining the EQ document, which summarizes the qualification results for all equipment identified in US-APWR DCD Tier 2, Appendix 3D, for the life of the plant. CP COL 3.11(1) in CPNPP, Units 3 and 4, COL FSAR, Section 3.11 provides supplemental information on responsibility for the EQ program. In that the CPNPP, Units 3 and 4, COL FSAR appeared to focus on the EQ program for electrical equipment, in **RAI 2765, Question 03.11-4,** the staff requested that the applicant discuss the EQ record retention plans for mechanical equipment at CPNPP, Units 3 and 4.

In its response to **RAI 2765, Question 03.11-4**, dated November 11, 2009, the applicant stated that there is no difference in EQ record retention as it pertains to electrical or mechanical SSCs. The applicant stated that all records are treated equally. The applicant provided a planned modification to CP COL 3.11(1) in CPNPP, Units 3 and 4, COL FSAR, Section 3.11 to clarify this provision. The staff confirmed that Revision 2 (and 3) to CPNPP, Units 3 and 4, COL FSAR Section 3.11 specifies that prior to unit fuel load the licensee establishes and implements an Operational EQ program; and assembles and maintains the electrical and mechanical EQ records for the life of the plant to fulfill the records retention requirements delineated in 10 CFR 50.49 and in compliance with the QA program (QAP) described in Chapter 17, “Quality Assurance and Reliability Assurance.” Further, STD COL 3.11(2) in Revision 2 to CPNPP, Units 3 and 4, COL FSAR Section 3.11.3 specifies that documentation for the qualification of safety-related equipment and nonsafety-related equipment, which is important to safety, is ultimately the responsibility of the COL applicant who, later as the licensee, maintains a complete set of EQ records. The staff finds that CPNPP, Units 3 and 4, COL FSAR, Section 3.11 is acceptable in that it specifies the record retention requirements for mechanical equipment to be used at CPNPP, Units 3 and 4. Accordingly, **RAI 2765, Question 03.11-4, is resolved and closed**.

COL Information Item 3.11(4) in DCD Tier 2, Section 3.11.7 states that the COL applicant is to describe periodic tests, calibrations, and inspections, to be performed during the life of the plant, which verify the identified equipment remains capable of fulfilling its intended function. DCD Tier 2, Section 3.11 also states that the procedures and results of qualification by tests, analyses, or other methods for the safety-related equipment are documented and maintained as part of the unit’s EQ document. CP COL 3.11(4) in CPNPP, Units 3 and 4, COL FSAR, Section 3.11 provides supplemental information regarding COL Information Item 3.11(4). In **RAI 2765, Question 03.11-5**, the staff requested that the applicant clarify that the DCD applicant’s

responses to the staff's RAIs on MUAP-08015, and any modifications to the report, will be met as part of the EQ program for CPNPP, Units 3 and 4.

In its response to **RAI 2765, Question 03.11-5**, dated November 11, 2009, the applicant confirmed that the DCD applicant's responses to the staff's RAIs on MUAP-08015, and any modifications to the report will be met as part of the EQ program for CPNPP, Units 3 and 4. The applicant provided a planned modification to CPNPP, Units 3 and 4, COL FSAR to clarify this provision. The staff confirmed that Revision 2 (and 3) to CPNPP, Units 3 and 4, COL FSAR Section 3.11 specifies that the features of the US-APWR EQ Program Technical Report MUAP-08015 are included in the CPNPP, Units 3 and 4, EQ program. The staff finds the applicant's RAI response and the CPNPP, Units 3 and 4, COL FSAR are acceptable in that they clarify that the CPNPP, Units 3 and 4, EQ program will apply US-APWR Equipment Qualification Program Technical Report MUAP-08015 for CPNPP, Units 3 and 4. Accordingly, **RAI 2765, Question 03.11-5, is resolved and closed**.

COL Information Item 3.11(9) in DCD Tier 2, Section 3.11.7 states that the COL applicant may revise the [environmental] parameters [indicated in the DCD] based on site-specific considerations. STD COL 3.11(9) in CPNPP, Units 3 and 4, COL FSAR Section 3.11.1.2 provides supplemental information regarding site-specific considerations. In **RAI 2765, Question 03.11-6**, the staff requested that the applicant specify any site-specific environmental parameters to be used for the CPNPP, Units 3 and 4, EQ program that differ from the DCD EQ program description.

In its response to **RAI 2765, Question 03.11-6**, dated November 11, 2009, the applicant stated that site-specific environmental conditions for CPNPP, Units 3 and 4, will be identified during the detailed design for the project. The applicant stated that parameters based on site-specific considerations are documented in the corresponding equipment specifications, drawings, procedures, instructions, and qualification packages. The applicant provided a planned modification to STD COL 3.11(9) in CPNPP, Units 3 and 4, COL FSAR, Section 3.11.1.2 to clarify this provision. The staff confirmed that Revision 2 (and 3) to CPNPP, Units 3 and 4, COL FSAR Section 3.11.1.2 requires that plant-specific EQ parameters are documented in the corresponding equipment specifications, drawings, procedures, instructions, and qualification packages. The staff finds that the applicant's RAI response and the CPNPP, Units 3 and 4, COL FSAR are acceptable in that they clarify that site-specific environmental parameters will be documented in applicable equipment specifications and related records as part of the EQ program for CPNPP, Units 3 and 4. Accordingly, **RAI 2765, Question 03.11-6, is resolved and closed.**

COL Information Item 3.11(2) in DCD Tier 2, Section 3.11.7 states that the COL applicant is to describe how the results of the qualification tests are to be recorded in an auditable file in accordance with requirements of 10 CFR 50.49(j). DCD Tier 2, Section 3.11.3 specifies that such a record is maintained for the entire period during which the related equipment remains installed in the plant, stored for future use, or is held for permit verification. STD COL 3.11(2) in CPNPP, Units 3 and 4, COL FSAR, Section 3.11.3 provides supplemental information regarding EQ recordkeeping. In **RAI 2765, Question 03.11-7**, the staff requested that the applicant clarify that the CPNPP, Units 3 and 4, COL FSAR provisions for EQ record retention apply to all electrical and mechanical equipment within the scope of the EQ program for CPNPP, Units 3 and 4, and indicate any differences in record retention for electrical and mechanical equipment.

In its response to **RAI 2765, Question 03.11-7**, dated November 11, 2009, the applicant stated that MUAP-08015 contains information and clarifications on the US-APWR environmental and

seismic qualification programs applicable to the construction of CPNPP, Units 3 and 4, as well as the Operational Equipment Qualification Program (OEQP). The applicant stated that the electrical and mechanical EQ records generated by the project EQ program become the basis of the OEQP. The applicant stated that both the electrical and mechanical records of SSCs that are important to safety are retained for the life of the plant. The applicant clarified that there is no difference in EQ record retention as it pertains to electrical or mechanical SSCs, and that all records are treated equally. The applicant referred to the modification to the CPNPP, Units 3 and 4, COL FSAR made in response to **RAI 2765, Question 03.11-4**. The staff finds the applicant's response to **RAI 2765, Question 03.11-7** and the CPNPP, Units 3 and 4, COL FSAR are acceptable in that they clarify the record retention requirements for electrical and mechanical equipment to be used at CPNPP, Units 3 and 4. Accordingly, **RAI 2765, Question 03.11-7, is resolved and closed**.

COL Information Item 3.11(6) in DCD Tier 2, Section 3.11.7 states that the COL applicant is to qualify site-specific electrical and mechanical equipment (including instrumentation and control, certain accident monitoring equipment) using a qualification process that is equivalent to that delineated for the US-APWR standard plant, as described in MUAP-08015. DCD Tier 2, Section 3.11.4 also states that this includes equipment that is subject to environmental control systems including heat tracing and air conditioning. STD COL 3.11(6) in CPNPP, Units 3 and 4, COL FSAR Section 3.11.4 provides supplemental information regarding EQ of site-specific electrical and mechanical equipment, subject to environmental stress associated with loss of ventilation or other environmental control systems. In **RAI 2765, Question 03.11-8**, the staff requested that the applicant describe the equivalent qualification process to be used to qualify site-specific electrical and mechanical equipment, subject to environmental stress associated with loss of ventilation or other environmental control systems including heat tracing, heating, and air conditioning, for staff review in support of the COLA.

In its response to **RAI 2765, Question 03.11-8**, dated November 11, 2009, the applicant stated that the phrase "equivalent qualification process" means that the site-specific electrical and mechanical equipment will be qualified following the guidance provided in MUAP-08015. Subsequently, in STD COL 3.11(6) in Revision 2 (and 3) to CPNPP, Units 3 and 4, COL FSAR, Section 3.11.4, the applicant replaced the provision regarding an equivalent qualification process specified in DCD Tier 2, Section 3.11.4 with supplemental information. In particular, STD COL 3.11(6) in CPNPP, Units 3 and 4, COL FSAR, Section 3.11.4 specifies that site-specific electrical and mechanical equipment, subject to environmental stress associated with loss of ventilation or other environmental control systems including heat tracing, heating, and air conditioning, is qualified using the process described in MUAP-08015. The staff is reviewing the acceptability of MUAP-08015 as part of its review of the DCD. The staff finds the reference to MUAP-08015 for the qualification of site-specific electrical and mechanical equipment to be acceptable in the CPNPP, Units 3 and 4, COL FSAR in accordance with any limitations on the use of MUAP-08015 specified in the SER on the DCD. Therefore, the staff finds acceptable the RAI response with the additional modifications to STD COL 3.11(6) in Revision 2 to CPNPP Units 3 and 4 COL FSAR, Section 3.11.4. Accordingly, **RAI 2765, Question 03.11-8, is resolved and closed**.

COL Information Item 3.11(7) in DCD Tier 2, Section 3.11.7 states that the COL applicant is to identify chemical and radiation environmental requirements for site-specific qualification of electrical and mechanical equipment (including instrumentation and control, and certain accident monitoring equipment). DCD Tier 2, Section 3.11.5 indicates that this equipment is to be qualified using a qualification process that is equivalent to that delineated for the US-APWR standard plant, as described in MUAP-08015. STD COL 3.11(7) in CPNPP, Units 3 and 4, COL

FSAR, Section 3.11.5 provides supplemental information regarding chemical and radiation environmental requirements for site-specific electrical and mechanical equipment. In **RAI 2765, Question 03.11-9**, the staff requested that the applicant describe the equivalent qualification process to be used to qualify the referenced site-specific electrical and mechanical equipment for staff review in support of the COLA.

In its response to **RAI 2765, Question 03.11-9**, dated November 11, 2009, the applicant stated that the phrase "equivalent qualification process" means that the site-specific electrical and mechanical equipment will be qualified following the guidance provided in MUAP-08015. Subsequently, in STD COL 3.11(7) in Revision 2 (and 3) to CPNPP, Units 3 and 4, COL FSAR, Section 3.11.5, the applicant replaced the provision regarding an equivalent qualification process specified in DCD Tier 2, Section 3.11.5 with supplemental information. In particular, STD COL 3.11(7) in CPNPP, Units 3 and 4, COL FSAR, Section 3.11.5 specifies that the chemical and radiation environmental requirements for site-specific electrical and mechanical equipment are included in MUAP-08015, and that this equipment is qualified using the process described in MUAP-08015. As noted above, the staff is reviewing the acceptability of MUAP-08015 as part of its review of the DCD. The staff finds the reference to MUAP-08015 for the qualification of site-specific electrical and mechanical equipment to be acceptable in the CPNPP, Units 3 and 4, COL FSAR in accordance with any limitations on the use of MUAP-08015 specified in the SER on the DCD. Therefore, the staff finds acceptable the RAI response with the additional modifications to STD COL 3.11(7) in to CPNPP, Units 3 and 4, COL FSAR, Section 3.11.5. Accordingly, **RAI 2765, Question 03.11-9, is resolved and closed**.

COL Information Item 3.11(8) in DCD Tier 2, Section 3.11.7 states that the COL applicant is to provide the site-specific mechanical equipment requirements. DCD Tier 2, Section 3.11.6 further states that this equipment is to be qualified using a qualification process that is equivalent to that delineated for the US-APWR standard plant, as described in MUAP-08015. STD COL 3.11(8) in CPNPP, Units 3 and 4, COL FSAR, Section 3.11.6 provides supplemental information regarding site-specific mechanical equipment requirements. In **RAI 2765, Question 03.11-10**, the staff requested that the applicant describe the equivalent qualification process to be used to qualify the mechanical equipment for staff review in support of the COLA.

In its response to **RAI 2765, Question 03.11-10**, dated November 11, 2009, the applicant stated that the phrase "equivalent qualification process" means that the site-specific electrical and mechanical equipment will be qualified following the guidance provided in MUAP-08015. Subsequently, in STD COL 3.11(8) in Revision 2 (and 3) to CPNPP, Units 3 and 4, COL FSAR Section 3.11.6 the applicant replaced the provision regarding an equivalent qualification process specified in DCD Tier 2, Section 3.11.6 with supplemental information. In particular, STD COL 3.11(8) in CPNPP, Units 3 and 4, COL FSAR, Section 3.11.6 specifies that site-specific mechanical equipment is qualified using the process described in MUAP-08015. As noted above, the staff is reviewing the acceptability of MUAP-08015 as part of its review of the DCD. The staff finds the reference to MUAP-08015 for the qualification of site-specific mechanical equipment to be acceptable in the CPNPP, Units 3 and 4, COL FSAR in accordance with any limitations on the use of MUAP-08015 specified in the SER on the DCD. Therefore, the staff finds acceptable the RAI response with the additional modifications to STD COL 3.11(8) in Revision 2 CPNPP, Units 3 and 4, COL FSAR, Section 3.11.6. Accordingly, **RAI 2765, Question 03.11-10, is resolved and closed**.

Evaluation of COL Information Items with Regard to the EQ of Mechanical Equipment

The COL applicant addresses the COL Information Items listed in US-APWR DCD Tier 2, Section 3.11.7, “Combined License Information,” as follows:

COL Information Item 3.11(1) The COL Applicant is responsible for assembling and maintaining the environmental qualification document, which summarizes the qualification results for all equipment identified in Appendix 3D, for the life of the plant.

> CPNPP Units 3 and 4 COL FSAR Section 3.11 specifies that prior to unit fuel load the licensee establishes and implements an Operational EQ program. CPNPP Units 3 and 4 COL FSAR Section 3.11 also specifies that the licensee assembles and maintains the electrical and mechanical EQ records for the life of the plant to fulfill the records retention requirements delineated in 10 CFR 50.49 and in compliance with the quality assurance program described in Chapter 17. CPNPP Units 3 and 4 COL FSAR Section 3.11.3 specifies that documentation for the qualification of safety-related equipment and nonsafety-related equipment, which is important to safety, is ultimately the responsibility of the COL applicant who, later as the licensee, maintains a complete set of EQ records. The staff finds that applicant has identified the responsibility for assembling and maintaining EQ records. Therefore, the applicant has satisfied COL Information Item 3.11(1).

COL Information Item 3.11(2) The COL Applicant is to describe how the results of the qualification tests are to be recorded in an auditable file in accordance with requirements of 10 CFR 50.49(j).

> CPNPP Units 3 and 4 COL FSAR Section 3.11.3 states that test results for electrical and mechanical equipment are maintained with the project records as auditable files. The FSAR states that such records are maintained from the time of initial receipt through the entire period during which the subject equipment remains installed in the plant or is stored for future use. The FSAR specifies that documentation for the qualification of safety-related equipment and nonsafety-related equipment, which is important to safety, is ultimately the responsibility of the COL applicant who, later as the licensee, maintains a complete set of EQ records. Finally, the FSAR specifies that the EQ records are maintained for the life of plant to fulfill the records retention requirements delineated in 10 CFR 50.49 and in compliance with the QA program described in Chapter 17. The staff finds that the applicant has described how the results of qualification tests are to be recorded in an auditable file in accordance with the requirements of 10 CFR 50.49(j). Therefore, the applicant has satisfied COL Information Item 3.11(2).

COL Information Item 3.11(3) The COL Applicant is to provide a schedule showing the EQ Program proposed implementation milestones.

> CPNPP Units 3 and 4 COL FSAR Section 3.11 provides implementation milestones applicable to formulating the CPNPP Units 3 and 4 EQ Program (COLA submittal), assisting with the Reactor Vendor/Architect-Engineer/Constructor EQ Program (Combined License), and establishing Operational EQ Program (CPNPP Unit 3 and Unit 4 Fuel Load, respectively). The staff finds that the applicant has provided a schedule showing the proposed implementation milestones for the CPNPP Units 3 and 4 EQ Program. Therefore, the applicant has satisfied in COL Information Item 3.11(3).

COL Information Item 3.11(4) The COL Applicant is to describe periodic tests, calibrations, and inspections to be performed during the life of the plant, which verify the identified equipment remains capable of fulfilling its intended function.

> CPNPP Units 3 and 4 COL FSAR Section 3.11 states that this subsection addresses EQ implementation in conjunction with the initial design, procurement, construction, startup and testing up to the point of turnover. The FSAR also states that implementation of the operational EQ program is included in Table 13.4-201. The FSAR specifies that periodic tests, calibrations, and inspections which verify that the identified equipment remains capable of fulfilling its intended function are described in the operational EQ program. The FSAR states that the features of the US-APWR Equipment Environmental Qualification Program, Technical Report MUAP-08015 are included in the CPNPP Units 3 and 4 EQ program. The staff finds that the applicant has described periodic tests, calibrations, and inspections to be performed during the life of the plant, which verify the identified equipment remains capable of fulfilling its intended function. Therefore, the applicant has satisfied COL Information Item 3.11(4).

COL Information Item 3.11(5) The COL Applicant is to identify the site-specific equipment to be addressed in the EQ Program, including locations and environmental conditions.

> CPNPP Units 3 and 4 COL FSAR Subsection 3.11.1.1 states that CPNPP Units 3 and 4 COL FSAR Table 3D-201 identifies CPNPP Units 3 and 4 site-specific electrical and mechanical equipment locations and environmental conditions (both normal and accident) to be addressed in the EQ program. The table lists information on site-specific safety-related equipment and nonsafety-related equipment which is important to safety. The FSAR states that the provisions in the DCD for the environmental qualification of mechanical equipment are applied to the plant-specific systems. The staff finds that the applicant has identified the site-specific equipment to be addressed in the EQ Program, including locations and environmental conditions. Therefore, the applicant has satisfied COL Information Item 3.11(5).

COL Information Item 3.11(6) The COL Applicant is to qualify site-specific electrical and mechanical equipment (including instrumentation and control, and certain accident monitoring equipment) using a qualification process that is equivalent to that delineated for the US-APWR Standard Plant, as described in Technical Report MUAP-08015.

> CPNPP Units 3 and 4 COL FSAR Section 3.11.4 states that site-specific electrical and mechanical equipment (including instrumentation and control and certain accident monitoring equipment), subject to environmental stress associated with loss of ventilation or other environmental control systems including heat tracing, heating, and air conditioning, is qualified using the process described in MUAP-08015. The staff is evaluating MUAP-08015 as part of the review of the DCD. Therefore, the completion of COL Information Item 3.11(6) will be determined as part of the resolution of **RAI 6159, Question 03.11-19, which is being tracked as an Open Item,** as discussed above.

COL Information Item 3.11(7) The COL Applicant is to identify chemical and radiation environmental requirements for site-specific qualification of electrical and mechanical equipment (including instrumentation and control, and certain accident monitoring equipment).

> CPNPP Units 3 and 4 COL FSAR Section 3.11.5 states that chemical and radiation environmental requirements for site-specific electrical and mechanical equipment

(including instrumentation and control and certain accident monitoring equipment) are included in MUAP-08015. The FSAR also states that this equipment is qualified using the process described in MUAP-08015. The staff is evaluating MUAP-08015 as part of the review of the DCD. Therefore, the completion of COL Information Item 3.11(7) will be determined as part of the resolution of **RAI 6159, Question 03.11-19, which is being tracked as an Open Item,** as discussed above.

COL Information Item 3.11(8) The COL Applicant is to provide the site-specific mechanical equipment requirements.

CPNPP Units 3 and 4 COL FSAR Section 3.11.6 states that site-specific mechanical equipment requirements are to be included in Table 3D-201 by completion of detailed design. The FSAR also states that this equipment is qualified using the process described in MUAP-08015. The staff is evaluating MUAP-08015 as part of the review of the DCD. Therefore, the completion of COL Information Item 3.11(8) will be determined as part of the resolution of **RAI 6159, Question 03.11-19, which is being tracked as an Open Item,** as discussed above.

COL Information Item 3.11(9) Optionally, the COL Applicant may revise the parameters based on site-specific considerations.

CPNPP Units 3 and 4 FSAR Subsection 3.11.1.2 states that plant-specific EQ parameters are documented in the corresponding equipment specifications, drawings, procedures, instructions, and qualification packages. The NRC staff is planning to conduct an audit of the design and procurement specifications as part of the review of the DCD and COLA. Therefore, completion of COL Information Item 3.11(9) will be determined as part of resolution of **RAI 6159, Question 03.11-18, is being tracked as an Open Item,** as discussed above.

License Conditions

COLA Part 10, "ITAAC and Proposed License Conditions," Section 2.3, "Operational Programs," states that the implementation of operational programs identified in CPNPP, Units 3 and 4, COL FSAR Table 13.4-201 by the milestones indicated in the table is a potential license condition. The applicant states that some of these programs may be adequately controlled by other methods such as the regulations, the TS, or a commitment tracking system, and will not need to be addressed in a license condition. RG 1.206, Section C.IV.4.3 states that the COL will contain a license condition that requires the licensee to submit to the NRC a schedule, 12 months after issuance of the COL that supports planning for and conduct of NRC inspections of operational programs. The schedule will be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the operational programs in FSAR Table 13.4-201 have been fully implemented or the plant has been placed in commercial service, whichever comes first. In **RAI 2765, Question 03.11-11**, the staff requested that the applicant discuss the plans to develop license conditions for operational program implementation.

In its response to **RAI 2765, Question 03.11-11**, dated November 11, 2009, the applicant stated that a proposed license condition to address operational programs is provided in COLA Part 10. The proposed license condition in the RAI response stated that the licensee shall implement the programs or portions of programs identified in the table in Part 10 of the CPNPP Units 3 and 4 FSAR (such as the EQ program) on or before the associated milestones (prior to

initial fuel load for the EQ program).

In follow-up **RAI 6159, Question 03.11-20**, the staff requested that the applicant describe its plans to address operational program implementation consistent with RG 1.206 and Commission paper SECY-05-0197. In its response to **RAI 6159, Question 03.11-20**, dated February 27, 2012, the applicant indicated that proposed license conditions on operational program implementation had been submitted in the response to **RAI 6123, Question 13.06.06-2**, dated December 12, 2011.

In its response to **RAI 6027, Question 03.09.06-20**, dated November 7, 2011, the applicant provided in COLA Part 10 proposed License Condition 2.D(11), "Operational Program Implementation," that stated the following:

> The licensee shall implement the programs or portions of programs identified in FSAR Table 13.4-201 with the "Implementation" of "License Condition" on or before the associated milestones in FSAR Table 13.4-201.

In its response to **RAI 6222, Question 03.09.06-23**, dated February 27, 2012, the applicant stated that the following License Condition 2.D(12), "Operational Program Implementation Schedules," would be included in Part 10 of the CPNPP COLA:

> The Licensee shall submit to the Director of NRO, a schedule, no later than 12 months after issuance of the COL or at the start of construction as defined in 10 CFR 50.10(a), whichever is later, that supports planning for and conduct of NRC inspections of operational programs listed in FSAR Table 13.4-201 with the exception of the Fitness for Duty program. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter for each applicable operational program until either the operational program has been fully implemented or the plant has been placed in commercial service, whichever comes first.
>
> The Licensee shall submit to the Director of NRO, a schedule, no later than 12 months after issuance of the COL, that supports planning for and conduct of NRC inspections of the Fitness for Duty program listed in FSAR Table 13.4-201. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until either the Fitness for Duty program has been fully implemented or the plant has been placed in commercial service, whichever comes first.

The staff confirmed that those proposed license conditions have been incorporated into Revision 3 to COLA Part 10 consistent with Commission guidance. As discussed in SER Section 3.9.6, the staff will apply the standard license condition for operational program schedule specified in SECY-05-0197. Therefore, **RAI 2765, Question 03.11-11 and RAI 6159, Question 03.11-20, are resolved**.

3.11.5 Post-Combined License Activities

The staff has identified a post-COL activity and two license conditions related to CPNPP, Units 3 and 4, COL FSAR, Revision 3, Section 3.11.

- A COL applicant that references the US-APWR DC will assemble and maintain the EQ document and the qualification test results and qualification status file

during the equipment selection, procurement phase and throughout the installed life in the plant.

As specified in CPNPP, Units 3 and 4, COL FSAR Section 3.11, test results for electrical and mechanical equipment are maintained with the project records as auditable files. Such records are maintained from the time of initial receipt through the entire period during which the subject equipment remains installed in the plant or is stored for future use. Documentation for the qualification of safety-related equipment and nonsafety-related equipment, which is important to safety, is ultimately the responsibility of the COL applicant who, later as the licensee, maintains a complete set of EQ records. The EQ records are maintained for the life of plant to fulfill the records retention requirements delineated in 10 CFR 50.49 and in compliance with the QA program (QAP) described in Chapter 17. The NRC inspection of the licensee's EQ program will be conducted when the program is available during plant construction and operation.

As stated in COLA Part 2, FSAR Table 13.4-201, item 3, the applicant has proposed to include the following license condition for the Environmental Qualification Program that the staff accepts as **License Condition 3-4**.

- **License Condition (3-4)** – Prior to initial fuel load, the licensee shall implement the Environmental Qualification Program.

Finally, for the reasons discussed in the technical evaluation section, the staff plans to impose the following license condition below:

- **License Condition (3-5)** – No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO a schedule that supports planning for, and the conducting of, NRC inspections of the Environmental Qualification Program. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until the Environmental Qualification Program has been fully implemented.

3.11.6 Conclusions

The staff is currently reviewing the information in DCD Tier 2, Section 3.11 on Docket Number 52-021. The results of the staff's technical evaluation of the information related to the EQ of mechanical and electrical equipment incorporated by reference, in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's SER on the US-APWR DCD. The SE on the US-APWR DCD is not yet complete and is being tracked as part of Open Item [1-1]. The staff will update Section 3.11 of this SER to reflect the final disposition of the DC application.

The staff reviewed the CPNPP COLA together with its incorporation by reference of the US-APWR DCD to determine whether it demonstrates that the EQ of mechanical equipment will satisfy the applicable NRC regulations, and provides reasonable assurance that those components will be capable of performing their safety functions at CPNPP Units 3 and 4. The staff will be unable to complete its evaluation of whether the applicant has provided sufficient information for satisfying 10 CFR Parts 50 and 52 for the EQ of mechanical equipment at CPNPP Units 3 and 4, until the open items specified in this SER section are resolved. The remaining open items for the staff review of the EQ of mechanical equipment for CPNPP Units 3 and 4 are **RAI 6159, Question 03.11-18** (audit of mechanical equipment qualification

specifications) **RAI 6159, Question 03.11-19** (completion of the staff review of MUAP-08015 as part of the US-APWR DCD review).

The staff based its conclusion in part on the following:

- CP COL 3.11(1), STD COL 3.11(2), CP COL 3.11(3), CP COL 3.11(4), STD COL 3.11(5), and CP COL 3.11(5), are acceptable as they address EQ documentation, EQ records, EQ Program implementation milestones, the use of MUAP-08015 for CPNPP, Units 3 and 4, and site-specific equipment in the EQ program, respectively.

- STD COL 3.11(6), STD COL 3.11(7), STD COL 3.11(8) and CP COL 3.11(8), are under review pending the resolution of **RAI 6159, Question 03.11-19, which is being tracked as an open item.**

- STD COL 3.11(9) is under review pending the resolution of **RAI 6159, Question 03.11-18, which is being tracked as an open item.**

3.12 Piping Design Review

3.12.1 Introduction

This section covers the design of the piping system and piping support for seismic Category I, Category II, and nonsafety systems. It also discusses the adequacy of the structural integrity, as well as the functional capability, of the safety-related piping system, piping components, and their associated supports. The design of piping systems should ensure that they perform their safety-related functions under all postulated combinations of normal operating conditions, system operating transients, postulated pipe breaks, and seismic events. This includes pressure-retaining piping components and their supports, buried piping, instrumentation lines, and the interaction of non-seismic Category I piping and associated supports with seismic Category I piping and associated supports. This section covers the design transients and resulting loads and load combinations with appropriate specified design and service limits for seismic Category I piping and piping support, including those designated as ASME Code Class 1, 2, 3, and those not covered by the ASME Code. The areas evaluated include piping analysis methods, piping modeling techniques, piping stress analyses criteria, and piping support design.

3.12.2 Summary of Application

Section 3.12, “Piping Design Review,” of the CCNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, Section 3.12 of the US-APWR DCD, Revision 3

Note that DCD Tier 2, Section 3.12, Revision 3, does not include COL Information Item 3.12(5). In the amended response to **DCD RAI 742-5703, Question 03.12-25**, dated October 26, 2011, the applicant addressed thermal stratification issues and created a new COL Information Item, COL 3.12(5). The applicant included the new COL Information Item in CPNPP, Units 3 and 4, COL FSAR, Revision 3.

In addition, in CPNPP, Units 3 and 4, COL FSAR Section 3.12, the applicant provided the following information:

US-APWR COL Information Items

- STD COL 3.12(2)

The applicant provided additional information in STD COL 3.12(2) to address COL Information Item 3.12(2) in the DCD, Revision 3 regarding site-specific seismic response spectra for design of piping. CP COL 3.12(2) applies to Section 3.12.5.1, "Seismic Input Envelope vs. Site-Specific Spectra."

- CP COL 3.12(3)

The applicant provided additional information in CP 3.12(3) to address COL Information Item 3.12(3) in the DCD, Revision 3 regarding Site-specific ASME Code, Section III, Class 2 or 3 piping, exposed to wind or tornado loads. CP COL 12(3) applies to Section 3.12.5.3.6, "Wind/Tornado Loads."

- CP COL 3.12(4)

The applicant provided additional information in CP 3.12(4) to address COL Information Item 3.12(4) in the DCD, Revision 3 regarding piping systems evaluation for sensitivity to high frequency modes. CP COL 12(4) applies to Section 3.12.5.6, "High-Frequency Modes."

- CP COL 3.12(5)

The applicant provided additional information in CP 3.12(5) to address COL Information Item 3.12(5) in the DCD, Revision 3 regarding the monitoring of thermal stratification at the pressurizer surge line. CP COL 12(5) applies to Section 3.12.5.10, "Thermal Stratification."

3.12.3 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 the Commission's regulations for ASME Code Class 1, 2 and 3 piping systems, components and associated supports and the associated acceptance criteria are given in Section 3.12, "ASME Code Class 1, 2, and 3 Piping Systems, Piping Components and their Associated Supports," issued March 2007, of NUREG-0800.

The applicable regulatory requirements for ASME Code Class 1, 2, and 3 piping systems, piping components and their associated supports are as follows:

1. 10 CFR 50.55a and GDC 1, as they relate to piping systems, pipe supports, and components being designed, fabricated, erected, constructed, tested, and inspected to quality standards commensurate with the importance of the safety function to be performed.

2. GDC 2 and 10 CFR Part 50, Appendix S with regard to design transients and resulting load combinations for piping and pipe supports necessary to withstand

the effects of earthquakes combined with the effects of normal or accident conditions.

3. GDC 4, with regard to piping systems and pipe supports important to safety, being designed to accommodate the effects of, and to be compatible with, the environmental conditions of normal as well as postulated events, such as LOCA and dynamic effects.

4. GDC 14, with regard to the RCPB of the primary piping systems being designed, fabricated, constructed, and tested to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.

5. GDC 15, with regard to the RCSs and associated auxiliary, control, and protection systems shall be designed with sufficient margin to assure that the design conditions of the RCPB are not exceeded during any condition of normal operation, including AOOs.

6. 10 CFR 52.80(a), which requires that a COLA address the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the COL, the provisions of the Atomic Energy Act of 1954, and the NRC's regulations.

Acceptance criteria and guidelines adequate to meet the above requirements include:

1. SRP Acceptance Criteria in SRP Section 3.12, Section II, including criteria for (1) piping analysis methods, (2) piping modeling techniques, (3) piping stress analysis criteria, and (4) piping support design.

3.12.4 Technical Evaluation

The staff reviewed Section 3.12 of the CCNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference, addresses the relevant information related to the ASME Code Class 1, 2, and 3 piping systems, piping components and their associated supports. Section 3.12 of the US-APWR DCD is being reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff's technical evaluation of the information incorporated by reference, related to the ASME Code Class 1, 2, and 3 piping systems, piping components and their associated supports will be documented in the staff's FSER on the DC application for the US-APWR design.

The staff reviewed the information in Section 3.3.1 of the CCNPP, Units 3 and 4, COL FSAR:

US-APWR COL Information Items

- STD COL 3.12(2)

The staff reviewed STD COL 3.12(2) related to COL Information Item 3.12(2) included under Section 3.12.5.1 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the second paragraph in DCD Tier 2 Section 3.12.5.1 with the following:

> For piping located in the yard that is not part of the US-APWR standard design, site-specific response spectra described in Subsection 3.7.1 are used for piping analysis.

The supplemental information for STD COL 3.12(2) is being considered as an editorial change to clarify that for the piping located in the yard that is not part of the US-APWR standard design, site-specific response spectra described in Subsection 3.7.1 are used for piping analysis. The staff finds this acceptable.

- CP COL 3.12(3)

The staff reviewed CP COL 3.12(3) related to COL Information Item 3.12(3) included under Subsection 3.12.5.3.6 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the paragraph in DCD Tier 2 Section 3.12.5.3.6 with the following:

> There is no ASME Code, Section III (Reference 3.12-2) Class 2 or 3 piping exposed to wind or tornado loading. Non-ASME piping, such as B31.1 (Reference 3.12-1) exposed to wind or tornado loading, is evaluated to the wind and tornado loading identified in Section 3.3, in conjunction with the applicable piping code load combinations.

The supplemental information for CP COL 3.12(3) is being considered as an editorial change to clarify that there is no ASME Code, Section III Class 2 and 3 piping exposed to wind or tornado loading. The staff finds this acceptable.

- CP COL 3.12(4)

The staff reviewed CP COL 3.12(4) related to COL Information Item 3.12(4) included under Subsection 3.12.5.6 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the second paragraph in DCD Subsection 3.12.5.6 with the following:

> For the site-specific ground motion response spectra, there are no high frequency exceedances of the CSDRS. Therefore, high frequency screening of the piping system for high frequency sensitivity is not required.

The supplemental information for CP COL 3.12(4) identified that the COL Information Item has been addressed because there are no high frequency exceedances of the CSDRS for the CPNPP, Units 3 and 4, site-specific ground motion response spectra. The staff found this acceptable and documented the evaluation results of the site-specific in-structure response spectra in Section 3.7.2 of this report.

- CP COL 3.12(5)

The staff reviewed CP COL 3.12(5) related to COL Information Item 3.12(5) included under Subsection 3.12.5.10 of the CPNPP, Units 3 and 4, COL FSAR, Revision 3. The applicant replaced the last sentence of the last paragraph in DCD Subsection 3.12.5.10 with the following:

> The monitoring of the first cycle operation is performed when the CPNPP Unit 3 or 4 will be the first US-APWR Plant.

The staff notes that COL Information Item 3.12(5) was added in the amended response to **DCD RAI 742-5703, Question 03.12-25**, dated October 26, 2011. COL Information Item 3.12(5) addresses the need to monitor the pressurizer surge line thermal stratification during the first cycle operation of the first US-APWR plant. The measured thermal stratification temperatures will be compared with the values use in the DCD design analysis to confirm the design margins. The supplemental information for CP COL 3.12(5) identified that the applicant will implement the monitoring activity when the CPNPP, Unit 3 or 4, will be the first US-APWR Plant. On the basis that the applicant's commitment to monitoring allows the surge line design analysis to be verified with the data from actual operating conditions to ensure the surge line structural integrity, the staff finds this acceptable.

The applicant's piping design ITAAC closure schedule is evaluated and documented in Section 14.3.3 of this report.

3.12.5 Post-Combined License Activities

The following activity will be implemented by CPNPP, Units 3 and 4, following issuance of the COL:

- As-designed piping ITAAC ASME design report and as-built piping ITAAC ASME certified design report.

3.12.6 Conclusions

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to ASME Code Class 1, 2, and 3 piping systems, piping components and their associated supports, and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is currently reviewing the information in DCD Tier 2, Section 3.12 under Docket Number 52-021. The results of the staff's technical evaluation of the information relating to ASME Code Class 1, 2, and 3 piping systems, piping components and their associated supports incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR will be documented in the staff's SER on the US-APWR DCD. The SE on the US-APWR DCD is not complete to date, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.12 of the SE to reflect the final disposition of the DC application.

The staff concludes that the relevant information presented within the CPNPP, Units 3 and 4, COL FSAR is acceptable and meets the requirements of 10 CFR 50.55a and GDC 1, 2, 4, 14, and 15, 10 CFR Part 50, Appendix S, and 10 CFR 52.80(a).

The staff based its conclusion on the following:

- STD COL 3.12(2), as it relates to site-specific seismic response spectra for design of piping, is acceptable because it provided an editorial change to clarify that the piping located in the yard that is not part of the US-APWR standard design, site-specific response spectra described in Subsection 3.7.1 are used for piping analysis.

- CP COL 3.12(3), as it relates to site-specific ASME Code, Section III, Class 2 or 3 piping, exposed to wind or tornado loads is acceptable because it provided an editorial change to clarify that there is no ASME Code, Section III Class 2 and 3 piping exposed to wind or tornado loading.

- CP COL 3.12(4), as it relates to piping systems evaluation for sensitivity to high frequency modes, is acceptable because there are no high frequency exceedances of the CSDRS for the CPNPP, Units 3 and 4, site-specific ground motion response spectra.

- CP COL 3.12(5), as it relates to the monitoring of thermal stratification at pressurizer surge line, is acceptable because the applicant's commitment to monitoring allows the surge line design analysis to be verified with the data from actual operating conditions to ensure the surge line structural integrity.

3.13 Threaded Fasteners (ASME Code Classes 1, 2, and 3)

3.13.1 Introduction

The application describes the US-APWR standard plant and site-specific plant design criteria and testing for selection of threaded fastener materials for ASME B&PV Code (ASME Code), Section III, Class 1, 2, and 3 systems. Threaded fasteners used in US-APWR nuclear power plants comprise ASME Code Class 1, 2, and 3 fasteners (bolts, studs, nuts, washers, and screws). In this section the applicant addresses materials to fabricate threaded fasteners, as well as the criteria to fabricate, design, test, and inspect the threaded fasteners, both before initial service and during service.

3.13.2 Summary of Application

Section 3.13, "Threaded Fasteners (ASME Code Class 1, 2, and 3)," of the CPNPP, Units 3 and 4, COL FSAR, Revision 3, incorporates by reference, Section 3.13 of the US-APWR DCD, Revision 3. Section 3.13 of the DCD includes Section 3.13.1, "Design Considerations," and Section 3.13.2, "Inservice Inspection Requirements."

In addition, in the CPNPP, Units 3 and 4, COL FSAR, Section 3.13, the applicant provided the following information:

US-APWR COL Information Items

- STD COL 3.13(3)

The applicant provided additional information in STD COL 3.13(3) to address COL Information Item 3.13(3) in the DCD, Revision 3, regarding quality records including certified material test

reports for property test and analytical work on threaded fasteners. STD COL 3.13(3) applies to Section 3.13.1.5, “Certified Material Test Reports.”

- STD COL 3.13(4)

The applicant provided additional information in STD COL 3.13(4) to address COL Information Item 3.13(4) in the DCD, Revision 3, regarding compliance with ISI requirements. STD COL 3.13(4) applies to Section 3.13.2.

- STD COL 3.13(5)

The applicant provided additional information in STD COL 3.13(5) to address COL Information Item 3.13(5) in the DCD, Revision 3, regarding complying with the requirements of ASME Code, Section XI, and 10 CFR 50.55a. STD COL 3.13(5) applies to Section 3.13.2.

3.13.3 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 the Commission’s regulations pertaining to ASME Code Class 1, 2, and 3 threaded fasteners, and the associated acceptance criteria, are given in Section 3.13, “Threaded Fasteners - ASME Code Class 1, 2, and 3,” issued March 2007, of NUREG-0800.

The applicable regulatory requirements in the Commission’s regulations for ASME Code Class 1, 2, and 3 threaded fasteners are as follows:

1. GDC 1 and GDC 30, as they relate to the requirement that SSCs important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be performed.

2. GDC 4, as it relates to the compatibility of components with environmental conditions.

3. GDC 14, as it relates to the requirement that the RCPB be designed, fabricated, erected, and tested in a manner that provides assurance of an extremely low probability of abnormal leakage, rapidly propagating failure, or gross rupture.

4. GDC 31, “Fracture Prevention of Reactor Coolant Pressure Boundary,” as it relates to the requirement that the RCPB be designed with sufficient margin to ensure that when stressed under operating, maintenance, testing, and postulated accident conditions, the boundary behaves in a non-brittle manner and the probability of rapidly propagating fracture is minimized.

5. 10 CFR Part 50, Appendix B, as it relates to controlling the cleaning of material and equipment to prevent damage or deterioration.

6. 10 CFR Part 50, Appendix G, 'Fracture Toughness Requirements," as it relates to materials testing and acceptance criteria for fracture toughness of reactor pressure boundary components.

7. 10 CFR 50.55a incorporates by reference the design criteria of ASME Code, Section III, Class 1, 2, and 3 components. The selection of materials, design, testing, fabrication, installation and inspection of threaded fasteners and mechanical joints are acceptable if they meet the criteria of the ASME Code, Section III, Class 1, 2, and 3 components. However, 10 CFR 50.55a(b)(4) permits use of code cases that have been adopted by the staff in RG 1.84 in lieu of applicable criteria of ASME Code, Section III, Class 1, 2, and 3 components.

8. 10 CFR 52.80(a), which requires that a COLA contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act of 1954, and the NRC's regulations.

The related acceptance criteria are as follows:

1. RG 1.37, "Quality Assurance Requirements for Cleaning of Fluid Systems and Associated Components of Water-Cooled Nuclear Power Plants," Revision 1, issued March 2007.

2. RG 1.65, "Materials and Inspections for Reactor Vessel Closure Studs," issued October 1973.

3. RG 1.84, "Design, Fabrication, and Materials Code Case Acceptability, ASME Section III" Revision 35, issued October 2010.

4. NUREG-1339, "Resolution of Generic Safety Issue 29: Bolting Degradation or Failure in Nuclear Power Plants," issued June 1990.

3.13.4 Technical Evaluation

The staff reviewed Section 3.13 of the CPNPP, Units 3 and 4, COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the application and incorporated by reference, addresses the required information relating to ASME Code Class 1, 2, and 3 threaded fasteners. Section 3.13 of the US-APWR DCD was reviewed by the staff under Docket Number 52-021. The SER on the US-APWR is not yet complete, and this is being tracked as part of Open Item [1-1]. The staff's technical evaluation of the information incorporated by reference, related to ASME Code Class 1, 2, and 3 threaded fasteners will be documented in the staff's FSER on the DC application for the US-APWR design.

The staff reviewed the information contained in Section 3.13 of the CPNPP, Units 3 and 4, COL FSAR:

US-APWR COL Information Items

- STD COL 3.13(3)

The staff reviewed STD COL 3.13(3) related to COL Information Item 3.13(3) included under Section 3.13.1.5 of the CPNPP, Units 3 and 4, COL FSAR. The applicant replaced the first sentence in the first paragraph in DCD Tier 2, Revision 3, Section 3.13.1.5, with the following:

> Quality records, including certified material test reports for all property test and analytical work performed on nuclear threaded fasteners, are maintained for the life of plant as part of the QAP [quality assurance program] described in Chapter 17.

The staff reviewed the information provided in STD COL 3.13(3) for consistency with the requirements of 10 CFR 50, Appendix B as it relates to QA records. The applicant states that quality records, including certified material test reports for all property test and analytical work performed on nuclear threaded fasteners, are maintained for the life of plant as part of the QAP described in Chapter 17, "Quality Assurance and Reliability Assurance." The QAP as evaluated in Chapter 17 of this SER complies with 10 CFR 50, Appendix B. The staff determined that the applicant adequately addressed STD COL 3.13(3) by stating that quality records for threaded fasteners are maintained for the life of plant as part of the QAP. Therefore, the staff finds that STD COL 3.13(3) complies with 10 CFR 50, Appendix B for quality records and is acceptable.

- STD COL 3.13(4)

The staff reviewed STD COL 3.13(4) related to COL Information Item 3.13(4) included under Section 3.13.2 of the CPNPP, Units 3 and 4, COL FSAR. The applicant replaced the last sentence of the first paragraph in DCD Tier 2, Revision 3, Section 3.13.2, with the following:

> Compliance with the requirements of the ISI program relating to threaded fasteners, including any applicable PSI [preservice inspection] and IST [inservice testing], is implemented as part of the operational programs. The ISI program is baselined using PSI. A PSI program relating to threaded fasteners will be implemented after the start of construction and prior to initial plant startup to comply with the requirements of ASME Section XI (Reference 3.13-14). Additionally, in accordance with ASME Section XI, IWA-1200, the PSI code requirements may be performed irrespective of location (such as at manufacturer) once the construction Code requirements have been met.

The staff reviewed the information provided in STD COL 3.13(4) for consistency with the requirements of 10 CFR 50.55a, as it relates to pre-service and inservice inspections of Class 1, 2, and 3 components. 10 CFR 50.55a incorporates by reference Section XI of the ASME B&PV Code. Section XI defines, for each component Code Class (including fasteners), the specific ISI requirement (e.g., methodology, periodicity, acceptance criteria). ISI includes a PSI prior to initial plant start-up. Sections 5.2.4 and 6.6 of this FSER evaluates the CPNPP, Units 3 and 4, COL FSAR ISI program. Based on the above, the staff determined that the applicant adequately addressed STD COL 3.13(4) by stating compliance with ASME Section XI for the ISI of threaded fasteners. Therefore, the staff finds STD COL 3.13(4) complies with 10 CFR 50.55a for ISI and is acceptable.

- STD COL 3.13(5)

The staff reviewed STD COL 3.13(5) related to COL Information Item 3.13(5) included under Section 3.13.2 of the CPNPP, Units 3 and 4, COL FSAR. The applicant replaced the first sentence of the fifth paragraph in DCD Tier 2, Revision 3, Section 3.13.2, with the following:

> An ISI program for the pressure testing of mechanical joints utilizing threaded fasteners is implemented in accordance with the requirements of ASME Code, Section XI, IWA-5000, and the requirements of 10 CFR 50.55a(b)(2)(xxvi), Pressure Testing Class 1, 2, and 3 Mechanical Joints, and Removal of Insulation, paragraph (xxvii).

The staff reviewed the information provided in STD COL 3.13(5) for consistency with the requirements of 10 CFR 50.55a, as it relates to inspection of Class 1, 2, and 3 components. The applicant states that the ISI plan includes the pressure testing of mechanical joints utilizing threaded fasteners in accordance with the requirements of ASME Code, Section XI, IWA-5000, and the requirements of 10 CFR 50.55a(b)(2)(xxvi), Pressure Testing Class 1, 2, and 3 Mechanical Joints, and Removal of Insulation, paragraph (xxvii). 10 CFR 50.55a incorporates by reference Section XI of the ASME B&PV Code. Based on the above, the staff determined that the applicant adequately addressed STD COL Item 3.13(5) by stating that the ISI plan for ASME Class 1, 2, and 3 threaded fasteners complies with ASME Code, Section XI, IWA-5000, and the requirements of 10 CFR 50.55a(b)(2)(xxvi) and 10 CFR 50.55a(b)(2)(xxvii). Therefore, the staff finds STD COL 3.13(5) complies with 10 CFR 50.55a for pressure testing Class 1, 2, and 3 mechanical joints and removal of insulation and is acceptable.

3.13.5 Post-Combined License Activities

The following item was identified as the responsibility of the COL holder:

- STD COL 3.13(4) involving compliance with ISI requirements as summarized in Section 3.13.2.

3.13.6 Conclusions

The staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant addressed the required information relating to the use of threaded fasteners, and there is no outstanding information expected to be addressed in the CPNPP, Units 3 and 4, COL FSAR related to this section.

The staff is reviewing the information in DCD Tier 2, Section 3.13 under Docket Number 52-021. The results of the staff's technical evaluation of the information related to the use of ASME Code Class 1, 2, and 3 threaded fasteners, incorporated by reference in the CPNPP, Units 3 and 4, COL FSAR are documented in the staff's SER on the DC application for the US-APWR DCD. The SE on the US-APWR DCD is not complete to date, and this is being tracked as part of Open Item [1-1]. The staff will update Section 3.13 of the 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, COL FSAR is acceptable and complies with 10 CFR 50, Appendix B for quality records 10 CFR 50.55a for ISI.

The staff based its conclusion on the following:

- STD COL 3.13(3), as it relates to quality records including certified material test reports for property test and analytical work on threaded fasteners, is acceptable because the QAP complies with 10 CFR 50, Appendix B for quality records.

- STD COL 3.13(4), as it relates to compliance with ISI requirements, is acceptable because the applicant stated compliance with ASME Section XI for the ISI of threaded fasteners, which meets the requirements of 10 CFR 50.55a.

- STD COL 3.13(5), as it relates to complying with the requirements of ASME Code, Section XI, and 10 CFR 50.55a, is acceptable because the applicant stated that the ISI plan for ASME Class 1, 2, and 3 threaded fasteners complies with ASME Code, Section XI, IWA-5000, and also complies with10 CFR 50.55a(b)(2)(xxvi) and 10 CFR 50.55a(b)(2)(xxvii) for pressure testing Class 1, 2, and 3 mechanical joints and removal of insulation.