CONTENTS

Contents i

List of Figures ii

List of Tables iii

8 ELECTRIC POWER **8-1**

8.1 Introduction 8-1

8.2 Offsite Power System 8-4

8.3 Onsite Power System 8-18

8.4 Station Blackout 8-32

LIST OF FIGURES

No figures were included in this chapter.

LIST OF TABLES

Table 8.3.1-1 Post Combined License Activities 8-31

8 ELECTRIC POWER

The electric power system is the source of power for station auxiliaries during normal operation and for the reactor protection system and engineered safety features (ESF) during abnormal and accident conditions. Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Final Safety Analysis Report (FSAR) Chapter 8 provides information on the functional adequacy of the offsite power systems and safety-related onsite electric power systems as applicable to the U.S. EPR design. This chapter also describes the redundancy, independence, and testability of these systems in conformance with the current criteria established by the Nuclear Regulatory Commission (NRC). The staff reviews this chapter to determine whether the utility grid is adequately described and its interconnection with the nuclear unit is defined, the onsite power system is described, and to confirm that the alternate alternating current (AAC) source is provided for station blackout (SBO). The staff's review consists of CCNPP Unit 3 combined license application (COL FSAR) Sections 8.1, "Introduction," 8.2, "Offsite Power System," 8.3, "Onsite Power System," and 8.4, "Station Blackout," of Chapter 8.

8.1 Introduction

8.1.1 Description of Electrical Power

Section 8.1 of the COL FSAR, under Docket No. 52-016, provides a brief description of the CCNPP Unit 3 site-specific transmission grid and its interconnection to the nuclear unit and other grid interconnections. This section describes CCNPP Unit 3 onsite alternating current (ac) and direct current (dc) loads that are added to the standard U.S. EPR electrical system design and the functions provided by these loads, and also includes the design bases, criteria, Regulatory Guides (RG), industry standards, and other documents, as applicable, that are to be implemented by the COL applicant in the design of the electrical systems that are beyond the scope of the U.S. EPR design certification.

The staff's review of Chapter 8 of the COL applicant's FSAR is coordinated closely with the staff's review of the U.S. EPR FSAR, Tier 2, Chapter 8.

8.1.2 Summary of Application

In the CCNPP Unit 3 FSAR (COL FSAR) Section 8.1, "Introduction," the COL applicant incorporated by reference U.S. EPR FSAR Tier 2, Section 8.1, "Introduction," with no departures and, as explained below, addressed COL information items as identified in U.S. EPR FSAR Tier 2, Table 1.8-2, "U.S. EPR Combined License Information Items."

COL Information Items

COL Information Item 8.1-1 states:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information describing the interface between the offsite transmission system, and the nuclear unit, including switchyard interconnections.

The COL applicant provided information describing the interface between the offsite transmission system, and the nuclear unit, including switchyard interconnections in COL FSAR Section 8.1.1.

COL Information Item 8.1-2 in COL FSAR Section 8.1.3, “Safety-Related Loads,” states:

> A COL applicant that references the U.S. EPR design certification will identify site-specific loading differences that raise the EDG or Class 1E battery loading and demonstrate the electrical distribution system is adequately sized for the additional load.

In COL FSAR Section 8.1.3, the COL applicant provided information that describes site-specific loads that are added to the U.S. EPR standard design emergency diesel generators (EDGs) and Class 1E uninterruptible power supply (EUPS) batteries in CCNPP Unit 3. Four tables (COL FSAR Tables 8.1-1, “Division 1 Emergency Diesel Generator Nominal Loads”; 8.1-2, “Division 2 Emergency Diesel Generator Nominal Loads”; 8.1-3, “Division 3 Emergency Diesel Generator Nominal Loads”; and 8.1-4, “Division 4 Emergency Diesel Generator Nominal Loads”) provide the added EDG loads for each of the four divisions.

Supplemental Information

COL FSAR Section 8.1.4.4, “NRC Generic Letters,” indicates that the information requested by NRC Generic Letter (GL) 2006-02, “Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power,” is presented in COL FSAR Section 8.2.1.1.

8.1.3 Regulatory Basis

The regulatory basis for acceptance of the COL information is established in General Design Criterion (GDC) 17, “Electric Power Systems.” Standard Review Plan (SRP) Section 8.1 of NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition,” (hereafter referred to as NUREG-0800 or the SRP), provides guidance to the staff in reviewing the COL FSAR to determine whether the relevant requirements of NRC regulations for this area of review have been met.

8.1.4 Technical Evaluation

The staff reviewed COL FSAR Section 8.1, “Introduction,” and checked the referenced sections of the U.S. EPR FSAR, Tier 2 to ensure that COL information items and supplemental information to be provided by the COL applicant have been addressed in the COL application. The U.S. EPR FSAR sections incorporated by reference and the information provided in COL FSAR Section 8.1 establish the design basis for the CCNPP Unit 3 plant.

COL Information Items

COL Information Item 8.1-1 in COL FSAR Section 8.1.1, “Offsite Power Description,” states:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information describing the interface between the offsite transmission system, and the nuclear unit, including switchyard interconnections.

The staff reviewed the information provided in COL FSAR Section 8.1.1, “Offsite Power Description,” which describes the existing transmission system of two circuits. One circuit connects the CCNPP site to the Waugh Chapel Substation existing 500 kV connection and the other circuit connects the CCNPP site to the Mirant Corporation Chalk Point Generating Station. The CCNPP Unit 3 switchyard is integrally connected to the existing CCNPP Units 1 and 2

switchyard by two 500 kV overhead lines. The offsite circuit routing corridor is presented in COL FSAR Figure 8.1-1, "CCNPP Site 500 kV Circuit Corridors." This description addresses COL Information Item 8.1-1.

The staff has determined that these two 500kV lines are physically separated and independent. Accordingly, the staff finds that the connections to the offsite power circuits are adequate to demonstrate compliance with GDC 17 with regard to the requirement for at least two physically independent offsite power circuit connections. Detailed evaluation of this information with respect to COL FSAR Section 8.2, "Offsite Power System," has been performed and is described in Section 8.2 of this report.

COL Information Item 8.1-2 in COL FSAR Section 8.1.3, "Safety-Related Loads," states:

> A COL applicant that references the U.S. EPR design certification will identify site-specific loading differences that raise EDG or Class 1E battery loading, and demonstrate the electrical distribution system is adequately sized for the additional load.

The staff reviewed the information presented in the COL FSAR Section 8.1.3, and divisional EDG load additions provided in COL FSAR Tables 8.1-1, 8.1-2, 8.1-3, and 8.1-4, and compared this information with U.S. EPR FSAR, Tier 2, Tables 8.3-4, 8.3-5, 8.3-6, 8.3-7, to determine whether the COL FSAR section and tables adequately describe the site-specific loads to be added to each EDG. The staff also reviewed this information to determine whether the added loads to each EDG are within the ten percent margin to account for future load growth provided by U.S. EPR FSAR, Tier 2, Section 8.3.1.2.4.

The staff also reviewed the information in the COL FSAR concerning additional site-specific loads powered from the Class 1E battery source, which operates breakers that provide electrical power for the ultimate heat sink (UHS) makeup water system. The feeder breakers require steady state control power of 0.04 kW. The staff finds that the site-specific Class 1E control power demand is within the design margin of the EUPS battery sizing calculation and does not change the dc load requirements specified in U.S. EPR FSAR, Tier 2, Tables 8.3-13 through 8.3-16. Therefore, the staff determined that the information provided by the COL applicant has adequately addressed this COL Information Item 8.1-2, and therefore is acceptable.

Supplemental Information

COL FSAR Section 8.1.4.4

COL FSAR Section 8.1.4.4, "NRC Generic Letters," indicates that the information requested by GL 2006-02, "Grid Reliability and the Impact on Plant Risk and the Operability of Offsite Power," is presented in COL FSAR Section 8.2.1.1.

In request for additional information (RAI) 91, Question 08.01-1, the staff requested that the COL applicant provide a description of the communication procedures, and the related operations and maintenance personnel training program, as requested in GL 2006-02. In an April 22, 2009, response to RAI 91, Question 08.01-1, the COL applicant provided additional descriptions of the communication agreements and protocols in place between CCNPP Unit 3 and the transmission system operator (TSO), and the CCNPP Unit 3 procedures and operator training program. The COL applicant's April 22, 2009, response states that CCNPP Unit 3 will have instructions to comply with North American Electric Reliability Council (NERC) and

Pennsylvania, New Jersey, Maryland Interconnection LLC (PJM), (a Mid-Atlantic region power pool) requirements to notify the TSO of any unplanned changes to the main generator output, status of voltage regulator, inability to comply with reliability directives, main generator outages, and changes in plant conditions that may affect the interconnection.

The staff reviewed COL FSAR Sections 8.1.4.4 and 8.2.1.1 and the COL applicant's April 22, 2009, response to RAI 91, Question 08.01-1, and determined that communication agreements, protocols, and operator training program prescribed in GL 2006-02 are in place between CCNPP Unit 3 and the TSO and will provide safe and reliable operation of the transmission system and equipment at CCNPP Unit 3. Therefore, the staff determined that the COL FSAR adequately addresses the information requested in GL 2006-02 and considers RAI 91, Question 08.01-1 resolved. The staff's review and evaluation of the information requested by GL 2006-02 is described in Section 8.2 of this report.

8.1.5 Post Combined License Activities

There are no post COL activities related to this section.

8.1.6 Conclusions

COL FSAR Section 8.1 incorporates by reference the U.S. EPR FSAR with no departures, and the COL FSAR also contains supplemental information. The staff determined that COL FSAR Section 8.1 provides an appropriate description of the interface between the offsite and onsite power systems, site-specific EDG and EUPS loads, and supplemental information related to GL 2006-02. The staff finds that this information is adequate to support the COL application.

The staff concludes that the information provided in COL FSAR Section 8.1 meets the appropriate regulatory requirements.

8.2 Offsite Power System

8.2.1 Introduction

The safety function of the offsite power system is to provide sufficient capacity and capability to ensure that the structures, systems, and components (SSCs) important to safety perform as intended when the onsite power system is not functioning. The objective of the staff's review is to determine whether the offsite power system satisfies the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, GDC 5, "Sharing of Structures, Systems, and Components," GDC 17, and GDC 18, "Inspection and Testing of Electrical Power Systems," and will perform its design function during all plant operating and accident conditions. In addition, the staff's review also includes evaluation of the offsite power system to ensure that it is properly coordinated with the onsite power distribution system.

8.2.2 Summary of Application

COL FSAR Section 8.2, "Offsite Power System," incorporates by reference U.S. EPR FSAR Tier 2, Section 8.2, "Offsite Power System," with no departures and provides interface items, as identified in U.S. EPR FSAR Tier 2, Table 1.8-1, COL information items, and supplemental information items as identified in U.S. EPR FSAR Tier 2, Table 1.8-2.

Interface Requirements

U.S. EPR FSAR Interface Item 8-1 requires the description of:

> Offsite ac power transmission system connections to the switchyard and the connection to the plant power distribution system.

The COL applicant provided information in COL FSAR Section 8.2.1.1, to address this interface item.

U.S. EPR FSAR Interface Item 8-3 requires the description of:

> Auxiliary power and generator transformer areas

The COL applicant provided additional information in COL FSAR Section 8.2.1.3, to address this information item.

U.S. EPR FSAR Interface Item 3-5 requires the description of:

> Buried conduits, and duct banks, and pipe and pipe ducts

The COL applicant provided additional information in COL FSAR Section 8.3.1.1.8, to address this interface item.

COL Information Items

U.S. EPR FSAR COL Information Item 8.2-1 states:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information regarding the offsite transmission system and their connections to the station switchyard.

The COL applicant provided additional site-specific information regarding the offsite transmission system and its connections to the station switchyard in COL FSAR Section 8.2.1.1.

U.S. EPR FSAR COL Information Item 8.2-2 states:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information for the switchyard layout design.

The COL applicant provided additional site-specific information describing the switchyard layout design in COL FSAR Section 8.2.1.2, “Station Switchyard.”

U.S. EPR FSAR COL Information Item 8.2-3 states:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information that identifies actions necessary to restore offsite power and use available nearby power sources when offsite power is unavailable.

The COL applicant provided additional site-specific information that identifies actions necessary to restore offsite power and use available nearby power sources when offsite power is unavailable in COL FSAR Section 8.2.2.7, “Compliance with 10 CFR 50.63.”

U.S. EPR FSAR COL Information Item 8.2-4, states:

> A COL applicant that references the U.S. EPR design certification will provide a site-specific grid stability analysis.

The COL applicant provided a site-specific grid stability analysis in COL FSAR Section 8.2.2.4, "Compliance with GDC 17."

U.S. EPR FSAR COL Information Item 8.2-5 states:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information for the protective devices that control the switchyard breakers and other switchyard relay devices.

The COL applicant provided site-specific information describing the protective devices that control the switchyard breakers and other switchyard relay devices in COL FSAR Section 8.2.1.2, to address this COL Information Item.

U.S. EPR FSAR COL Information Item 8.2-6 states:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information for the station switchyard equipment inspection and testing plan.

The COL applicant provided site-specific information describing the station switchyard equipment inspection and testing plan in COL FSAR Section 8.2.2.5, "Compliance with GDC 18, Inspection and Testing of Electrical Power Systems," to address this COL Information Item.

U.S. EPR FSAR COL Information Item 8.2-7 states:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information regarding the communication agreements and protocols between the station and the transmission system operator, independent system operator, or reliability coordinator/authority. Additionally, the COL applicant will provide a description of the analysis tool used by the transmission system operator to determine, in real time, the impact that the loss or unavailability of various transmission system elements will have on the condition of the transmission system to provide post-trip voltages at the switchyard. The information provided will be consistent with information requested in GL 2006-02.

The COL applicant provided site-specific information regarding the communication agreements and protocols between the station and the transmission system operator, independent system operator, or reliability coordinator/authority; a description of the analysis tool used by the transmission system operator to determine, in real time, the impact that the loss or unavailability of various transmission system elements will have on the condition of the transmission system to provide post-trip voltages at the switchyard; and the information requested in GL 2006-02, in COL FSAR Section 8.2.1.1.

U.S. EPR FSAR COL Information Item 8.2-8 states:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information regarding indication and control of switchyard components.

The COL applicant provided site-specific information regarding indication and control of switchyard components in COL FSAR Section 8.2.1.2, to address this COL Information Item.

Supplemental Information

In COL FSAR Section 8.2.2.8, the COL applicant provided supplemental information for CCNPP Unit 3 to comply with Section (a)(4) of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants."

8.2.3 Regulatory Basis

The regulatory basis for acceptance of the COL information incorporated by reference from the U.S. EPR FSAR is addressed in the U.S. EPR FSER, Section 8.2, "Offsite Power System." The relevant requirements of NRC regulations for this area of review and the associated acceptance criteria are described in SRP Section 8.2, which provides guidance to the staff in reviewing the COL FSAR to determine whether the relevant requirements of NRC regulations for this area of review have been met.

Generally, the regulatory basis for acceptance of the COL supplemental information is established in GDC 5, GDC 17, GDC 18, 10 CFR 50.63, "Loss of All Alternating Current Power," and 10 CFR 50.65(a)(4). GDC 5 pertains to offsite power SSCs important to safety that are shared between unit stations. Since the CCNPP Unit 3 is a single unit station, there are no offsite power SSCs important to safety that are shared between unit stations. Thus, the requirements of GDC 5 are not applicable to CCNPP Unit 3. The COL FSAR incorporates by reference all other regulatory bases related to the U.S. EPR FSAR with no departures or supplements.

8.2.4 Technical Evaluation

The staff reviewed COL FSAR Section 8.2, "Offsite Power Systems," and checked the referenced sections of the U.S. EPR FSAR to ensure that interface items, COL information items, and supplemental information required to be provided by the COL applicant have been addressed in the COL application. The sections of the U.S. EPR FSAR that the COL FSAR incorporates by reference with no departures or supplements and the information provided in COL FSAR Section 8.2 establish the design basis of the CCNPP Unit 3 plant.

Interface Requirements

To review the COL FSAR, the staff checked the U.S. EPR FSAR, Tier 2, Table 1.8-1, "Summary of U.S. EPR Plant Interfaces with Remainder of Plant," and interface requirement items 8-1, 8-3, and 3-5, to determine whether the following interface requirement items have been addressed:

> 8-1, Off-site ac power transmission system connections to the switchyard and the connection to the plant power distribution system

8-3, Auxiliary power and generator transformer areas

3-5, Buried conduits, duct banks, and pipe ducts

The staff's review of the manner in which the COL FSAR addressed the above interface items, 8-1, 8-3, and 3-5, is discussed and evaluated with COL Information Items 8.2-1, and 8.2-4 below in this report. The staff reviewed this information to determine whether the site-specific offsite transmission system is connected to the CCNPP Unit 3 station switchyard through auxiliary power and generator step-up (i.e., normal, emergency, and main generator output) transformers to the plant power distribution system. The staff also reviewed information on cable wetting and its potential long term submergence conditions for site-specific buried conduits and duct banks, as more fully described with the staff's review of COL information Item 8.2-4 below.

COL Information Items

The staff reviewed the information the COL FSAR contained to address the following COL information items given in U.S. EPR FSAR, Tier 2, Table 1.8-2, and supplemental information items:

COL Information Item 8.2-1: This COL information item requires that a COL applicant referencing the U.S. EPR design certification provide site-specific information for the offsite transmission system and the connections to the CCNPP Unit 3 station switchyard.

The COL applicant provided its offsite power system information in COL FSAR Section 8.2.1.1 and addressed the above COL Information Item, and Interface Items 8-1 and 8-3, as follows: CCNPP Unit 3 will be connected to the CCNPP Unit 3 switchyard by six overhead lines. One line connects to the plant main step up transformer for power output and the remaining five lines will be connected to five auxiliary transformers, two emergency auxiliary transformers (EATs) and three normal emergency auxiliary transformers (NATs). In addition, there are four new normally energized and physically independent transmission lines from the CCNPP Unit 3 switchyard to the outside grid. Two of these new 500 kV lines will connect the CCNPP Unit 3 switchyard from the existing CCNPP Unit 1 and 2 switchyards, while the other two new 500 kV lines will connect directly to the existing transmission system lines (See COL FSAR Figure 8.2-1). Thus, at least two of the overhead 500 kV transmission lines provide the preferred sources of power for the reactor protection system and ESFs during normal, abnormal, and accident conditions for CCNPP Unit 3.

The CCNPP Unit 3 main generator feeds electric power through an isolated phase bus to a bank of three single phase transformers stepping the generator voltage up to the transmission voltage of 500 kV.

COL FSAR Figure 8.2-1,"CCNPP Unit 3 500kV Switchyard and Transmission Line Layout," provides a 500 kV switchyard and transmission line layout for CCNPP Unit 3. COL FSAR Figure 8.2-2, "CCNPP Unit 3 500kV Switchyard Single Line Diagram," provides a single-line diagram of the 500 kV switchyard connecting the onsite and offsite systems, and COL FSAR Figure 8.3-3. "CCNPP Unit 3 Transformer 30BBT04 Distribution Single Line Drawing," provides single-line diagram of 500 kV connections to desalinization plant, demineralization plant, wastewater treatment facility, and circulating water system cooling tower dry fans.

The above four new transmission lines and towers connecting the CCNPP Unit 3 switchyard to the transmission system are as follows:

> Two new one mile long 500 kV overhead lines (Circuits 5056 and 5057) connect the CCNPP Unit 3 switchyard to the existing CCNPP Units 1 and 2 switchyard.
>
> Two new 500 kV overhead line extensions (Circuits 5052 and 5072) connect the CCNPP Unit 3 switchyard to the transmission system.

The existing three transmission lines (Circuits 5051, 5052 and 5072) connect the CCNPP Unit 3 site to the Baltimore Gas & Electric (BG&E) transmission system as follows:

> Waugh Chapel 500 kV Circuit 5051, approximately 48 miles
>
> Waugh Chapel 500 kV Circuit 5052, approximately 48 miles
>
> Chalk Point 500 kV Circuit 5072, approximately 18 miles

Two Waugh Chapel lines utilize a northward common right-of-way. The other single circuit to Chalk Point parallels the Waugh Chapel lines to the north approximately 9 miles before diverging in a northwestward direction to connect to Potomac Electric Power Company (PEPCO) Chalk Point Generating Station. A modification has been performed on the existing lines so as to avoid crossing of the 500 kV lines.

The above configurations show that at least two separate circuits from the transmission system to the onsite power distribution system are provided to satisfy the GDC 17 requirement for offsite power.

COL FSAR Section 8.2.1.1 indicates the outgoing transmission lines for Waugh Chapel and Chalk Point as running parallel on the same right-of-way for approximately 9 miles before the Chalk Point line diverges from Waugh Chapel lines.

In RAI 110, Question 8.02-1, the staff requested that the COL applicant provide information on how the likelihood of the simultaneous failure of the structures was minimized under any adverse environmental condition, by providing adequate clearances between the towers and lines. In a June 17, 2009, response to RAI 110, Question 8.02-1, the COL applicant stated that the transmission line towers for the four lines originating from CCNPP Unit 3, and, a 500 kV switchyard will be spaced such that if a tower collapsed due to severe natural phenomenon, it cannot fall on an adjacent line or tower. The COL applicant further stated that the installation of the towers and lines and the clearances between them are consistent with the National Electric Safety Code. Additionally, the COL applicant stated that consideration was given to the environmental conditions associated with normal operation, maintenance, testing and postulated accidents, and the protection of the SSCs to ensure compliance with GDC 4, "Environmental and Dynamic Effects Design Bases." On the basis of its review of the COL FSAR and the COL applicant's June 17, 2009, response to RAI 110, Question 8.02-1, the staff finds that the COL applicant adequately addressed this issue of establishing tower spacing, separation and clearances to minimize the likelihood of simultaneous failure of the structures, and considers this issue resolved.

Based on the above information, the staff finds that the COL applicant has met the requirements of GDC 17 and GDC 4, and has adequately addressed the COL Information Item 8.2-1, and Interface Items 8-1 and 8-3.

COL Information Item 8.2-2: This COL Information Item requires that a COL applicant referencing the U.S. EPR design certification provide site-specific information for the switchyard layout design.

COL FSAR Section 8.2.1.2, "Station Switchyard," describes the switchyard and transmission line layout, shown on COL FSAR Figure 8.2-1, and its 500 kV switchyard with a breaker-and-a-half scheme is shown on COL FSAR Figure 8.2-2. The breaker-and-a-half design provides the flexibility of the operation if one of the two switchyard buses is out of service. Disconnect switches are provided to individually isolate each circuit breaker from the switchyard bus and associated lines, permitting individual breaker maintenance and testing while the switchyard buses and lines remain energized. Equipment such as breakers and disconnect switches are sized in accordance with Institute of Electrical and Electronics Engineers (IEEE) Std C37.06.

The single line drawing COL FSAR Figure 8.2-2 shows a site-specific auxiliary transformer connected from the 500 kV red bus through a breaker. In RAI 110, Question 08.02-2, the staff requested that the COL applicant provide the purpose and connection details of this site-specific auxiliary transformer, rated 500 kV/6.9 kV. In a June 17, 2009, response to RAI 110, Question 08.02-2, the COL applicant stated that the site-specific transformer feeds electric power for the desalinization plant, demineralization plant, wastewater treatment facility, and circulating water system cooling tower dry fans, as described in COL FSAR Section 8.3.1.1.7, and the connection is shown in COL FSAR Figure 8.3-3. On the basis of the staff's review of the COL FSAR and the COL applicant's June 17, 2009, response to RAI 110, Question 08.02-2, the staff finds that the COL applicant has adequately addressed this issue, which is resolved.

Based on the above information, the staff finds that the COL applicant has adequately addressed COL Information Item 8.2-2.

COL Information Item 8.2-3: This COL Information Item requires that a COL applicant referencing the U.S. EPR design certification provide site-specific information that identifies actions necessary to restore offsite power and use available nearby power sources when offsite power is unavailable.

To demonstrate compliance with 10 CFR 50.63 of CCNPP Unit 3 for an SBO, in COL FSAR Section 8.2.2.7, the COL applicant stated that there are no special local power sources that can be made available to re-supply the plant following a loss of the offsite power grid or an SBO. The COL FSAR states that CCNPP Unit 3 will use two redundant and independent SBO diesel generators designed in accordance with 10 CFR 50.63 and RG 1.155, "Station Blackout." Since these two available power sources could be used when offsite power is unavailable, reliance on an additional offsite source as an alternate ac source is not required. Based on the above information, the staff finds that the COL applicant has adequately addressed COL Information Item 8.2-3.

The information the COL applicant has provided is also discussed with the staff's review of COL FSAR Section 8.4, "Station Blackout," COL Information Item 8.4-1.

COL Information Item 8.2-4: This COL Information Item requires that a COL applicant referencing the U.S. EPR design certification provide a site-specific grid stability analysis and demonstrate compliance with GDC 17.

COL FSAR Section 8.2.2.4 describes CCNPP Unit 3's compliance with GDC 17. A system impact study was performed by PJM that analyzed load flow, transient stability, and fault analysis for the addition of CCNPP Unit 3 as part of the PJM Interconnection Generator and Transmission Interconnection Planning Process. The study identified the system upgrades necessary to maintain the PJM reliability of the transmission system. The study concluded that, with the additional generating capacity of CCNPP Unit 3, the transmission system remains stable under the analyzed conditions, preserving the grid connection, and supporting the normal and shutdown requirements of CCNPP Unit 3. During certain maintenance outages, the output of the unit will need to be limited due to potential for grid instability. The study also determined that upgrading to selected circuit breakers to the existing substations will be required. COL FSAR Section 8.2.2.4 states that these modifications will be completed prior to initial fuel loading at CCNPP Unit 3. The impact study also showed that the grid will not be lost due to: (1) the loss of the largest generating unit (i.e., CCNPP Unit 3); (2) the loss of the most critical transmission line; or (3) the loss of the largest load on the grid. The design (i.e., tap range and bus regulation voltage setting) of the on-load tap changers for each EAT will ensure that the downstream emergency power sequencing subsystem 6.9 kV buses will have sufficient voltage to preclude the degraded voltage protection conditions from separating the buses from the preferred power source.

COL FSAR Section 8.2.2.4 states that PJM performed a system voltage study to determine the maximum and minimum voltage that the switchyard can maintain without any reactive support from CCNPP Unit 3. The study concluded that the new Calvert Cliffs substation 500 kV bus will operate within an acceptable voltage range to satisfy reliability criteria for pre-contingency conditions (500 to 550 kV) and post contingency conditions (5 percent max. voltage drop) with CCNPP Unit 3 at zero reactive power output. Based on the above site-specific voltage study cited by the COL applicant, CCNPP Unit 3 can be designed for a transmission system operating voltage range of -5 percent to +10 percent (as opposed to the ±10 percent voltage range assumed for the U.S. EPR).

The PJM grid is maintained at 60 Hz and during a system under-frequency, the Mid-Atlantic region of PJM will utilize an automatic load shedding scheme which will drop system load by 30 percent in 10 percent increments at 59.3 Hz, 58.9 Hz, and 58.5 Hz. Based on the review of the grid frequency data for the last 5 years, the COL applicant indicated that the reactor coolant pumps are not expected to be subject to sustained frequency decay greater than 3.5 Hz/sec.

The operating history of the grid that CCNPP Unit 3 will be connected to demonstrates that the transmission system will not subject the reactor coolant pumps to a sustained frequency decay of greater than 3.5 Hz/sec as bounded by the decrease in reactor coolant system flow rate transient and accident analysis. Therefore, the staff finds the grid remains reliable and stable under the analyzed conditions.

The COL applicant performed a failure mode and effects analysis (FMEA) of the switchyard components to supplement the FMEA performed for the U.S. EPR design. The 500 kV components addressed in the CCNPP Unit 3 FMEA included the transmission system, transmission line towers, transmission line conductors, switchyard, circuit breakers, and disconnect switches.

The staff's evaluation of FMEA indicated that failure of any one tower or any components within the tower structure, due to structural failure can, at most, disrupt and cause a loss of power distribution to only those circuits on the tower. Therefore, one of the preferred power sources remains available to maintain the component integrity and vital functions in the event of a postulated accident.

The CCNPP Unit 3 switchyard's breaker-and-a-half arrangement offers the following flexibility to control a failed condition within the switchyard: (1) any faulted transmission line into the switchyard can be isolated without affecting any other transmission line and (2) either bus can be isolated without interruption of any transmission line or other bus. Any circuit breaker can be isolated for maintenance or inspection without interruption of any transmission line or bus. Also, a fault in a tie-breaker or failure of the breaker to trip for a line or generator fault results only in the loss of adjacent circuits until it can be isolated by disconnect switches. Similarly, a fault in a bus side breaker or failure of the breaker to trip for a line or generator fault results only in the loss of the adjacent circuits and the adjacent bus until it can be isolated by disconnect switches. Based on the review of the above information, the staff finds that there are no single failures which would cause the simultaneous failure of both preferred sources of offsite power for CCNPP Unit 3.

In connection with the above information, in RAI 117, Question 08.02-9, the staff requested that the COL applicant define why the base case time frame for the system impact study is selected as year 2011, and not beyond, and also why the winter loading cases are not considered in the study. In a June 15, 2009, response to RAI 117, Question 08.02-9, the COL applicant stated that, for CCNPP Unit 3, the PJM Large Generator Interconnection Request (LGIR) was submitted in September 2006. The System Impact Studies are conducted by PJM based on a 5 year planning horizon. Interconnection projects submitted in 2006 were studied through the 2011 model year because PJM does not maintain a dynamic model of the transmission system beyond a five year planning stage and would not conduct any speculative studies conducted beyond a 5 year plan. In addition, the COL applicant stated that, within PJM, summer load conditions represent the worst case loading and more stressed transmission system and for this reason, PJM conducts the System Impact Study stability analysis under summer load conditions and it represents the bounding condition.

On the basis of the staff's review of COL FSAR Section 8.2.2.4 and the COL applicant's June 15, 2009, response to RAI 117, Question 08.02-9, and information that the grid stability is studied on an ongoing basis based on load growth, the addition of new transmission lines, or new generation capacity as stated by the COL applicant in COL FSAR Section 8.2.2.4, the staff finds that the COL applicant has adequately addressed the base case time frame issue and, therefore, the staff considers this issue resolved.

In RAI 110, Question 8.02-3, the staff requested that the COL applicant provide a summary of the grid stability system study results to verify the compliance of CCNPP Unit 3 with GDC 17 requirements. The staff also requested that the COL applicant address the real and reactive power support to the grid so as not to result in grid instability.

In an October 30, 2009, response to RAI 110, Question 8.02-3, the COL applicant provided a summary of the stability simulations conditions identifying the contingencies in the system studies that included loss of the CCNPP Unit 3 generation, loss of the largest transmission circuit, loss of largest unit supplying the grid, and loss of largest load on the grid. The COL applicant stated that no transient instability characteristics or voltage violations were discovered

on the CCNPP Unit 3, 500 kV bus for any of these contingencies. Based on the summary results of these system studies, the staff concurs that the switchyard voltage will be maintained; preferred power supply will remain stable; and the preferred power supply will not degrade below the acceptable criteria stated in U.S. EPR FSAR Tier 2, Section 8.2.2.4 for compliance with GDC 17.

In the October 30, 2009, response, the COL applicant further stated that CCNPP Unit 3 will reduce power as directed by the Transmission Line Operator, when the 500 kV Waugh Chapel to Brighton line is out of service. In this configuration, CCNPP Unit 3, 500 kV switchyard voltage is maintained such that the preferred power supply remains stable and is not degraded below the acceptable criteria stated in U.S. EPR FSAR Tier 2, Section 8.2.2.4 for compliance with GDC 17. This analysis was run for all contingencies stated above.

Neither the PJM 2007 System Impact study, nor the PJM 2008 Voltage Study identified any volt-amperes reactive (VARs) restrictions on the CCNPP Unit 3 generator or the need for any auxiliary transmission equipment, such as capacitor banks or static VAR compensators. The COL applicant also stated in the October 30, 2009, response to RAI 110, Question 8.02-3, that the 2008 Voltage Study demonstrated that with no VAR compensation from the CCNPP Unit 3 generator, the 500 kV switchyard voltage was maintained with no grid instability and subsequent loss of off-site power.

The staff accepted that the switchyard voltage will be maintained without the VAR compensator with no grid instability or subsequent loss of off-site power. The staff concurs with the results of the study that concludes "with the additional generation capacity of CCNPP Unit 3, the transmission system remains stable under the analyzed conditions." While this issue is resolved, the COL applicant must incorporate the changes described above to COL FSAR Section 8.2.2.4. **RAI 110, Question 08.02-3, is being tracked as a confirmatory item.**

In RAI 110, Question 08.02-8, the staff requested that the COL applicant describe the site-specific wetting conditions or submergence, if any, and how the proposed design for cable routing/layout/monitoring is to be implemented to prevent possible gradual degradation over the life of the plant, as addressed in GL 2007-01. This request was also made to evaluate whether Interface Item 3-5 related to buried conduits and duct banks was addressed. In a June 17, 2009, response to RAI 110, Question 08.02-8, the COL applicant stated that the COL FSAR Section 2.4, on Hydrological Engineering discusses the detail design considerations for the site-specific probable maximum flood level. The COL applicant also stated that the U.S. EPR FSAR Tier 2, Section 8.3.1.1.8, describes that power cables be installed in duct banks or raceways designed to provide a high level of protection against industrial hazards, long term degradation and other potential risks such as fire, missiles, pipe failure, water spray or earthquakes. Additionally, manholes are provided for access to the duct banks, and the duct banks are sloped to provide water drainage.

In a June 17, 2009, response to RAI 110, Question 08.02-8, as described above, the COL applicant did not explain the site-specific wetting or potential long-term submergence condition in detail or the effectiveness of the dewatering system, therefore the staff issued a supplementary RAI 170, Question 08.02-10, requesting additional information on these issues. In an October 28, 2009, response to RAI 170, Question 08.02-10, the COL applicant stated that both the duct bank and cable trench systems have a water level high/high point visual alarm system for permanent sump pumps. The visual alarms will not allow reset until the water is below the high/high point. The COL applicant indicated that COL FSAR Section 3.8.4.1.8 will

be supplemented with additional information on this matter in a future COLA revision. While this issue is resolved, the COL applicant must incorporate the changes described above to COL FSAR Section 3.8.4.1.8. **RAI 170, Question 08.02-10, is being tracked as a confirmatory item.**

Based on the above information the staff finds that the COL applicant met the requirements of GDC 17, and has addressed COL Information Item 8.2-4 and Interface Item 3-5.

COL Information Item 8.2-5: This COL Information Item requires that a COL applicant referencing the U.S. EPR design certification provide site-specific information for protective devices for its switchyard.

COL FSAR Section 8.2.1.2, "Station Switchyard," describes site-specific information for protective devices for its switchyard. The COL applicant stated that electrical protection of circuits from the CCNPP Unit 3 switchyard are provided by both a primary and secondary relaying scheme (i.e., for the four 500 kV transmission circuits, the switchyard buses, and the main and auxiliary transformers). The current input for the protective relaying schemes comes from separate sets of circuit breaker bushing current transformers. The potential input for the primary and secondary 500 kV transmission circuit relaying is supplied from fused branch circuits originating from a set of coupling capacitor potential devices connected to the associated transmission circuit. In addition to the above described relaying systems, each of the 500 kV circuit breakers has an associated circuit breaker failure relaying system. Also, the control power for all primary and secondary relaying schemes is supplied from separate switchyard 125 Vdc battery systems. Each battery has its own battery charger and each battery charger is connected to separate 480 Vac distribution panel boards also located in the switchyard control house.

In order to determine the redundancy and adequacy of the switchyard and offsite power system protection scheme, in RAI 110, Question 08.02-4, the staff requested that the COL applicant provide the relaying scheme showing the switchyard zone of protection, including those for main step-up transformers, EATs and NATs. In a June 17, 2009, response to RAI 110, Question 08.02-4, the COL applicant provided typical protection diagrams for the main step-up transformers, EATs and NATs indicating overlapping protection zones and primary and secondary relay protection schemes. The COL applicant stated that each outgoing line to the 500 kV grid is protected by redundant transmission line protection scheme, each switchyard bus is protected by redundant bus differential protection, each line between the switchyard and the plant transformers is protected by redundant tie line protection schemes and each transformer is protected by redundant protection schemes. Any fault within the transformers will trip the switchyard breakers to isolate the transformers. On the basis of this review, the staff determined that if one protective system fails, the back-up protective system is available to prevent the loss of offsite power, therefore, the staff considers this issue resolved.

Based on the above information, the staff finds that the COL applicant adequately addressed COL Information Item 8.2-5.

COL Information Item 8.2-6: This COL Information Item requires that a COL applicant referencing the U.S. EPR design certification provide site-specific information for the station switchyard equipment inspection and testing plan.

COL FSAR Section 8.2.2.5 addresses the compliance of CCNPP Unit 3 with GDC 18. This section states that CCNPP Unit 3 shall establish an interface agreement that defines the

interfaces and working relationships between various CCNPP Unit 3 site organizations and Baltimore Gas & Electric (BG&E). This agreement will define the necessary requirements of maintenance, calibration, testing, and modifications of transmission lines, switchyards, and related equipment. As an example, transmission line inspections are performed by helicopter twice a year, usually during the spring and fall, and a full climbing and/or detailed helicopter comprehensive inspection is done every 5 years. As a result of these inspections, any required maintenance is then performed. In addition, the need for painting of the structures is reviewed in conjunction with the 5-year inspections. Transmission tower painting is done approximately every 15 to 20 years. Vegetation is generally managed on a 5-year trimming/cutting schedule but is inspected once a year. Mowing is generally done once a year on cleared rows. The COL applicant also provided details that multiple levels of inspection and maintenance are performed on the CCNPP switchyards, substation facilities, and equipment (e.g., breakers, batteries, chargers, relays). Inspection and maintenance includes: Taking reading and measurements, calibrating equipment, protective relay system testing, oil sampling of large power transformers, and thermography, as appropriate.

In RAI 110, Question 08.02-5, the staff requested that the COL applicant provide details of the 500 kV switchyard equipment inspection and testing plan specific for CCNPP Unit 3 with respect to adequate procedures, administrative controls and protocols. The staff sought this information to determine whether modifications to offsite power system circuits necessary to meet the regulatory requirements of GDC 17 and GDC 18 might be performed without a proper evaluation by offsite transmission system authorities. In a June 17, 2009, response to RAI 110, Question 08.02-5, the COL applicant stated that an Operations Coordination and Interconnection Agreement between CCNPP Unit 3 and BG&E will be established to ensure adequate coordination and control of activities related to the CCNPP Unit 3 switchyard interface. The COL applicant further stated that agreements, procedures, administrative controls and protocols for maintenance and modifications of facilities, will be modeled after those in place between the operating CCNPP Units 1 and 2 and BG&E, and the current agreement between CCNPP Unit 1 and 2 and BG&E applies controls to ensure that no modifications to the offsite power system circuits credited for satisfying GDC 17 and GDC 18 are performed without a proper safety evaluation. On the basis of its review of the COL FSAR Section 8.2.2.5, and the COL applicant's June 17, 2009, response to RAI 110, Question 08.02-5, the staff finds that the COL applicant has met the requirements of GDC 17 and GDC 18 for site-specific procedures, administrative controls and inspection and testing for the switchyard equipment, and considers this issue resolved.

In RAI 110, Question 08.02-6, the staff requested that COL FSAR Section 8.2.2.5 be expanded to include the testing and inspection of the offsite system for switchyard grounding and lightning protection systems. Site-specific design aspects of the switchyard grounding, including lightning protection devices, need to be addressed to safeguard SSCs important to safety from lightning strikes and the resulting secondary effects. In a June 17, 2009, response to RAI 110, Question 08.02-6, the COL applicant stated that COL FSAR Section 8.2.2.5 incorporates by reference the U.S. EPR FSAR Tier 2, Section 8.2.2.5, and periodic testing and inspection of the offsite power system includes the switchyard grounding and lightning protection systems in accordance with RG 1.204, "Guidelines for Lightning Protection of Nuclear Power Plants." On the basis of the COL applicant's June 17, 2009, response to RAI 110, Question 08.02-6, the staff considers this issue resolved.

Based on the above information, the staff finds that the COL applicant has met the requirements of GDC 17 and GDC 18, and adequately addressed COL Information Item 8.2-6.

COL Information Item 8.2-7: A COL applicant that references the U.S. EPR design certification will provide site-specific information regarding the communication agreements and protocols between the station and the transmission system operator, independent system operator, or reliability coordinator/authority. Additionally, the COL applicant will provide a description of the analysis tool used by the transmission system operator to determine, in real time, the impact that the loss or unavailability of various transmission system elements will have on the condition of the transmission system to provide post-trip voltages at the switchyard. The information provided should be consistent with information requested in GL 2006-02.

According to COL FSAR Section 8.2.1.1, CCNPP Unit 3 will utilize transmission facilities that are owned and operated by BG&E under the direction and control of the PJM Interconnection. BG&E and UniStar Nuclear Operating Services (the CCNPP Unit 3 operator) have formal agreements in place to provide safe and reliable operation of the transmission system and equipment at CCNPP Unit 3. Initial planning for the addition of CCNPP Unit 3 required completion studies which identified transmission system modifications to accommodate the new generating unit (combined turbine-generator-exciter) and the main step-up transformer(s) including modifications to substations and switchyards.

The reliability of the transmission system is continuously (real time) analyzed through PJM's Energy Management System (EMS) program to assess the stability of the grid. BG&E continuously monitors and evaluates (e.g., using a state-estimator tool) grid reliability and switchyard voltages, and informs CCNPP Unit 3 of any grid instability or voltage inadequacies. The CCNPP Unit 3 operator informs BG&E prior to initiating any plant activities that may affect grid reliability. In addition, plant operators inform BG&E of changes in generation ramp rates and notify them of any developing problems that may impact generation.

The CCNPP Unit 3 operator and BG&E have an agreement which requires that transmission system studies and analyses be performed to minimize the probability of interruption of power such as a loss of offsite power (LOOP) and to assess whether the offsite sources are operable to meet GDC 17 and the plant technical specification (TS) requirements. BG&E performs short-term grid analyses to support CCNPP Unit 3 plant startup and shutdown. Longer-term grid studies are also performed and coordinated with the CCNPP Unit 3 operator. Projections of future load growth, including new generation additions, are performed in accordance with NERC and PJM standards. Future transmission system improvements resulting from these studies are planned to support CCNPP Unit 3.

In RAI 91, Question 08.01-1, the staff requested that the COL applicant provide a description of the communication procedures, and the related operators and maintenance personnel training program, as requested in GL 2006-02. In an April 22, 2009, response to RAI 91, Question 08.01-1, the COL applicant provided the requested information. The staff's review and evaluation of this response is described in Section 8.1.4 of this report. The COL applicant's response was determined to be acceptable. The staff considers this issue resolved.

Based on the above information, the staff finds that COL FSAR Section 8.2.1.1 has been revised to include the description of the communications agreements and protocols in place between CCNPP Unit 3 and the TSO, and the COL applicant has adequately addressed COL Information Item 8.2-7.

COL Information Item 8.2-8: This COL Information Item requires that a COL applicant referencing the U.S. EPR design certification provide site-specific information for indication and control of switchyard components.

COL FSAR Section 8.2.1.2, "Station Switchyard," describes the control house for the switchyard, which is located within the switchyard in order to support control and protection needs. Control power for switchyard breakers required to connect or disconnect any components of CCNPP Unit 3 from the transmission system is provided by the switchyard batteries. There is a dual set of batteries located inside the switchyard control house. COL FSAR Section 8.2.1.2 states that the circuit breakers are controlled remotely from the plant control room or by the system load dispatcher, and local tripping is also provided for each breaker. Administrative control of the switchyard breakers is shared between CCNPP Unit 3 and BG&E. The circuit breakers are controlled remotely from the plant control room or by the system load dispatcher.

Because the switchyard can be controlled remotely and the back-up control power is in place, the staff has determined that if one control system fails, a back-up control system is available to prevent the loss of offsite power. There will be redundant control power for indication and operation of switchyard circuit breakers and relays, and the staff finds the COL applicant has adequately addressed COL Information Item 8.2-8.

Supplemental Information

COL FSAR Section 8.2.2.8

The COL application includes supplemental information demonstrating compliance with 10 CFR 50.65(a)(4) which is discussed in COL FSAR Section 8.2.2.8. The COL applicant stated that the U.S. EPR FSAR Tier 2, Section 8.2.4.6, is incorporated by reference without departures.

In RAI 110, Question 08.02-7, the staff requested that the COL applicant identify how the plant-specific equipment identified in COL FSAR Section 8.2.2.8 will be included in the details of programs for reliability assessment (U.S. EPR FSAR Tier 2, Section 17.4, "Reliability Assurance Program") and maintenance rule program (MRP) implementation (U.S. EPR FSAR Tier 2, Section 17.6, "Description of Applicant's Program for Implementation of 10 CFR 50.65, the Maintenance Rule") for offsite power system/equipment. In a June 17, 2009, response to RAI 110, Question 08.02-7, the COL applicant stated that the MRP implementation (U.S. EPR FSAR Tier 2, Section 17.6) for offsite power system/equipment is addressed in COL FSAR Section 17.7.1.5, "Risk Assessment and Risk Management per 10 CFR 50.65 (a)(4)," which incorporates by reference Nuclear Energy Institute (NEI) 07-02A, "Generic FSAR Template Guidance for Maintenance Rule Program Descriptions for Plants Licensed under 10 CFR Part 52," endorsed by RG 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The template for COL FSAR Section 17.7.1.5, specifically addresses the offsite power system by stating that, "The MRP and procedures reflect, as appropriate, consideration of issues associated with grid/offsite power reliability as identified in GL 2006-02, items 5 and 6." The reliability assurance program (RAP) is also addressed in COL FSAR Section 17.4, Table 17.4-3, "Site Specific Systems Included within RAP," which includes switchyard and offsite power systems.

Based on the above RAI response, the COL applicant has adequately addressed the issue of MRP and the RAP with respect to 10 CFR 50.65 (a)(4) and, therefore, the staff considers this issue resolved.

8.2.5 Post Combined License Activities

There are no post COL activities related to this section.

8.2.6 Conclusions

The staff reviewed COL FSAR Section 8.2 and supplemental information addressed in the COL application, and checked the referenced U.S. EPR FSAR to ensure that the combination of the information incorporated by reference from the U.S. EPR FSAR and the information in the COL FSAR represent the complete scope of information relating to this review of the offsite power system. The staff finds that U.S. EPR FSAR Tier 2, Section 8.2, incorporated by reference in COL FSAR Section 8.2, and supplemental information provided in the COL FSAR Sections 8.2.1.1, 8.2.1.2, 8.2.2.4, 8.2.2.5, 8.2.2.7, and 8.2.2.8 are adequate to support the COL application.

Pending resolution of the confirmatory items identified above, the staff concludes that the information provided in COL FSAR Section 8.2 meets the appropriate regulatory requirements..

8.3 Onsite Power System

8.3.1 Alternate Current Power Systems

8.3.1.1 Introduction

This section of the COL FSAR provides descriptive information and analyses, and lists referenced documents, including electrical single-line diagrams, for the onsite ac power system. The onsite ac power system includes those standby power sources, distribution systems, and auxiliary supporting systems provided to supply power to safety-related equipment or equipment important to safety for all normal operating and accident conditions.

The safety function of the ac onsite power system is to provide sufficient capacity and capability to ensure that the SSCs important to safety perform as intended in the event that the offsite power is not available. The staff reviewed the COL application to determine whether the onsite ac power system satisfies the requirements of 10 CFR Part 50, Appendix A, GDC 5, GDC 17, GDC 18, and 10 CFR 50.65(a)(4), and will perform its design function during all plant operating and accident conditions.

8.3.1.2 Summary of Application

COL FSAR Section 8.3, “Onsite Power System,” incorporates by reference U.S. EPR FSAR Tier 2, Section 8.3, “Onsite Power System,” with no departures and provided interface items, as identified in U.S. EPR FSAR Tier 2, Table 1.8-1, COL information items, and supplemental information items as identified in U.S. EPR FSAR Tier 2, Table 1.8-2.

Interface Requirements

U.S. EPR Interface Item 8-2 requires a COL applicant referencing the U.S. EPR design certification to describe:

> On-site ac power transmission system connections to the switchyard and the connection to the plant power distribution system.

The COL applicant provided information in COL FSAR Section 8.3.1.1, "Description," showing interconnections in COL FSAR Figures 8.3-1 and 8.3-2, as Interface Item 8-2.

U.S. EPR FSAR Interface Item 8-4 requires a COL applicant referencing the U.S. EPR design certification to describe:

> Lightning protection and grounding system grid.

The COL applicant provided information in COL FSAR Section 8.3.1.3, "Electrical Power System Calculations and Distribution System Studies for AC Systems," to address Interface Item 8-4.

COL Information Items

U.S. EPR FSAR COL Information Item 8.3-1 states:

> A COL applicant that references the U.S. EPR design certification will monitor and maintain EDG reliability during plant operations to verify the selected reliability level target is being achieved as intended by RG 1.155.

The COL applicant provided the above pertinent EDG reliability information in COL FSAR Section 8.3.1.1.5, "Standby AC Emergency Diesel Generators," to address Information Item 8.3-1.

U.S. EPR FSAR COL Information Item 8.3-2 states:

> A COL applicant that references the U.S. EPR design certification will describe inspection, testing and monitoring programs to detect the degradation of inaccessible or underground power cables that support EDGs, offsite power, ESW and other systems that are within the scope of 10 CFR 50.65.

The COL applicant provided the above pertinent inaccessible or underground power cable management program in COL FSAR Section 8.3.1.1.8, "Raceway and Cable Routing," to address Information Item 8.3-2.

Supplemental Information

In COL FSAR Section 8.3.1.1, "Description," the COL applicant provided supplemental information as follows:

COL FSAR Section 8.3.1.1 identifies additional site-specific loads (i.e., in addition to those specified in the U.S. EPR FSAR) powered from the station EDGs. This section also provides the site-specific modifications to the emergency power supply system (EPSS) and normal power supply system (NPSS). COL FSAR Tables 8.3-1, "CCNPP Unit 3 AC Power System

Component Data Nominal Values," 8.3-2, "Emergency Power Supply System Switchgear, Load Center and Motor Control Center Numbering and Nominal Voltage," and 8.3-3, "CCNPP Unit 3 Normal Power Supply System Switchgear, Load Center, Numbering and Nominal Voltage," identify electrical information for the site-specific ac power system components.

COL FSAR Section 8.3.1.1.1, "Emergency Power Supply System," identifies four divisions of EPSS distribution equipment for the UHS makeup water system and explains that this equipment is located remotely in the Seismic Category 1 UHS Electrical Building. Each division is independent and physically separated from the others. The site-specific EPSS distribution equipment and their nominal voltages are provided in COL FSAR Table 8.3-2.

COL FSAR Section 8.3.1.1.2, "Normal Power Supply System," identified a revision to the site-specific NPSS distribution equipment located in the circulating water system cooling tower area; the nominal voltages of this equipment are provided in COL FSAR Table 8.3-3. The COL FSAR indicates that two 480 Vac load centers for Trains 5 and 6 in the U.S. EPR design are replaced in the site-specific design with 6.9 kV switchgear. The COL applicant states that the standard cooling tower electrical distribution system was in U.S. EPR conceptual design, and there is no change in total electrical load of 16,800 horse power (hp), so this change or difference is not considered to be a departure. The change resulted from an increase in the capacity of each cooling tower wet fan from 300 hp to 350 hp, but with a decrease in the total number of fans, from 56 to 48.

In COL FSAR Section 8.3.1.1.7, "Electrical Equipment Layout," the COL applicant indicated that all four EPSS 480 Vac motor control centers and transformers for the UHS makeup water system are located in the UHS Electrical Building. An additional site-specific transformer supplies power directly from the 500 kV switchyard to the desalination plant, demineralization plant, waste water treatment facility, and circulating water system cooling tower dry fans. A site-specific back-up power source is also provided for the desalination and demineralization plant loads.

In COL FSAR Section 8.3.1.3, "Electrical Power System Calculations and Distribution System Studies for AC Systems," the COL applicant indicated that the U.S. EPR FSAR conceptual design information, including U.S. EPR FSAR Tier 2, Figure 8.3-4, "Typical Station Grounding Grid," is applicable to CCNPP Unit 3. Additionally, the site-specific UHS Intake Structure and Electrical Building is designed with lightning protection and grounding consistent with U.S. EPR FSAR Tier 2, Section 8.3.1.3.5, "Insulation Coordination (Surge and Lightning Protection)," and U.S. EPR FSAR Tier 2, Section 8.3.1.3.8, "Grounding." The COL applicant also indicated that the switchyard grounding grid is interconnected with the nuclear island (NI) and power block ground grid. The switchyard ground grid, including conductor sizing, matrix pattern spacing, and connection with the power block ground grid is determined using the regulatory guidance and industry standards described in U.S. EPR FSAR Tier 2, Section 8.3.1.3.8.

In COL FSAR Section 8.3.1.4, "Electrical Heat Tracing," the COL applicant indicated that electrical heat tracing systems are installed to provide freeze protection for service components and process fluids, as required. Power for heat tracing is supplied from the onsite distribution system buses. If applicable, safety-related heat tracing is Class 1E and assigned to the appropriate division of safety-related power. The COL applicant also indicated that freeze protection is incorporated at the individual system level using insulation for external tanks, tubing, instruments, and piping that may freeze during winter weather.

8.3.1.3 Regulatory Basis

The regulatory basis for acceptance of the COL information incorporated by reference from the U.S. EPR FSAR is addressed in U.S. EPR FSER, Section 8.3.1, "Alternating Current Power Systems." The relevant requirements of NRC regulations for this area of review and the associated acceptance criteria are described in SRP Section 8.3.1, which provides guidance to the staff in reviewing the COL FSAR to determine whether the relevant requirements of NRC regulations for this area of review have been met.

Generally, the regulatory basis for acceptance of the COL supplemental information is established in GDC 17. The COL FSAR incorporates by reference all other regulatory bases related to the U.S. EPR FSAR with no departures or supplements.

8.3.1.4 Technical Evaluation

The staff reviewed COL FSAR Section 8.3.1, "Alternating Current Power Systems," and checked the referenced sections of the U.S. EPR FSAR to ensure that interface items, COL information items, and supplemental information required to be provided by the COL applicant have been addressed in the COL application. The sections of the U.S. EPR FSAR that the COL FSAR incorporates by reference with no departures or supplements and the information provided in the COL FSAR Section 8.3.1 establish the design basis for the CCNPP Unit 3 plant.

To review the COL FSAR, the staff reviewed the following interface items, COL information items listed in U.S. EPR FSAR, Tier 2, Tables 1.8-1 and 1.8-2, and supplemental information items, to determine whether the following interface requirement items have been addressed:

Interface Requirements

U.S. EPR Interface Item 8-2 requires a COL applicant referencing the U.S. EPR design certification to address the following:

> Onsite ac power transmission system connections to the switchyard and the connection to the plant power distribution system.

The COL applicant provided information in COL FSAR Section 8.3.1, to address this interface item. COL FSAR Sections 8.1.1 and 8.2.1 describe the connection to the plant power distribution system from the switchyard and interface connection shown on COL FSAR Figure 8.3-1, and COL FSAR Figure 8.3-2. These figures identify system connections to the switchyard and the plant for CCNPP Unit 3. The staff reviewed the COL FSAR to determine whether the COL applicant has addressed the requirements of U.S. EPR Interface Item 8-2. Based on the information cited above, the staff finds that the COL applicant has addressed U.S. EPR Interface Item 8-2.

U.S. EPR Interface Item 8-4 requires a COL applicant referencing the U.S. EPR design certification to address the following:

> Lightning protection and grounding system grid.

The COL applicant provided information in COL FSAR Section 8.3.1.3 to address Interface Item. A typical station grounding system grid is shown in U.S. EPR FSAR Tier 2, Figure 8.3-4. The COL applicant stated that this conceptual design information is applicable to CCNPP Unit 3.

The staff reviewed the COL FSAR Section 8.3.1.3 to determine whether the information provided is acceptable for lightning protection and grounding system grid for CCNPP Unit 3, and is consistent with U.S. EPR FSAR Tier 2, Section 8.3.1.3.5, for lightning protection and U.S. EPR FSAR Tier 2, Section 8.3.1.3.8, for grounding system grid. Based on the information cited above, the staff finds that the COL applicant has addressed U.S. EPR Interface Item 8-4.

COL Information Items

The staff reviewed the information contained in the COL FSAR to address the following COL information items given in U.S. EPR FSAR, Tier 2, Table 1.8-2:

COL Information Item 8.3-1: A COL applicant that references the U.S. EPR design certification must describe how the COL applicant will monitor and maintain EDG reliability during plant operations and verify that the selected reliability level target is being achieved as intended by RG 1.155.

The COL applicant addressed this COL Information Item in COL FSAR Section 8.3.1.1.5, "Standby AC Emergency Diesel Generators," which states that the COL applicant shall monitor and maintain EDG reliability to verify that the selected reliability level goal of 0.95 is being achieved, as prescribed by RG 1.155.

In RAI 106, Question 08.03.01-2, the staff requested that the COL applicant address processes and programs that will be used to ensure that the EDG reliability goal of 0.95 will be met. In a June 8, 2009, response to RAI 106, Question 08.03.01-2, the COL applicant stated that this COL Information Item 8.3-1 is contained in the Proposed Combined Licenses Conditions in Part 10 of COL FSAR, "Inspections, Tests, Analyses and Acceptance Criteria" (ITAAC), and ITAAC Closure, Appendix A. The COL applicant also explained the following:

> Prior to initial fuel load, the applicant shall establish procedures to monitor and maintain Emergency Diesel Generator reliability to verify the selected reliability level goal of 0.95 is being achieved.

The operational programs given in COL FSAR Application Table 13.4-1, "Operational Programs Required by NRC Regulations and Program Implementation," are those required by regulations and subject to program implementation license conditions. The subject table includes each of the operational programs listed in Section C.I.13.4, "Operational Program Implementation," of RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)."

CCNPP Unit 3 EDG reliability is accomplished through the monitoring and maintaining of the selected reliability value. The EDG reliability is established through the initial test program and monitored through the surveillance testing procedures and post-maintenance testing. The COL applicant will continue to monitor EDG reliability to assure that the target reliability level is being achieved throughout the life of the plant by complying with the MRP and Reliability Assurance Program for CCNPP Unit 3, as described in COL FSAR Section 17.4, "Reliability Assurance Program."

Since EDG reliability is established prior to initial fuel load, and the procedures will be established to monitor and maintain the reliability of the EDGs, the staff determined that the CCNPP Unit 3 EDG reliability issue is adequately addressed and complies with the requirements of 10 CFR 50.65(a)(4). Based on the information cited above, the staff finds that the COL applicant has addressed COL Information Item 8.3-1.

COL Information Item 8.3-2: This COL Information Item requires that a COL applicant referencing the U.S. EPR design certification will describe inspection, testing and monitoring programs to detect the degradation of inaccessible or underground power cables that support EDGs, offsite power, essential service water (ESW) and other systems that are within the scope of 10 CFR 50.65.

COL FSAR Section 8.3.1.1.8, "Raceway and Cable Routing," states that the COL applicant will put in place a cable management program prior to fuel load that will:

> Identify the inaccessible or underground cables that are within the scope of 10 CFR 50.65.
>
> Describe the inspection, testing, and monitoring programs that will be implemented to detect degradation of these cables.

The staff reviewed the COL FSAR and determined that because the COL applicant commits to implementing a program that will identify the inaccessible or underground cables that are within the scope of 10 CFR 50.65 and describe the programs that will be implemented to detect degradation of these cables, the staff finds that the COL applicant has addressed COL Information Item 8.3-2.

Supplemental Information

The staff reviewed the following COL FSAR supplemental information items:

COL FSAR Section 8.3.1.1

COL FSAR Tables 8.1-1, 8.1-2, 8.1-3, and 8.1-4, located in COL FSAR Section 8.1.3, provide site-specific loads which supplement the safety related loads identified in the corresponding tables of the U.S. EPR FSAR. In addition, the COL applicant revised COL FSAR Figure 8.3-1, Sheets 1 through 3, and COL FSAR Figure 8.3-2, Sheets 1 through 4, to include site-specific modifications to the Emergency and Normal Power Supply Systems Single Line Diagrams that supplement the U.S. EPR FSAR Tier 2, Figures 8.3-1, "CCNPP Unit 3 Emergency Power System Single Line Drawing," 8.3-2, "CCNPP Unit 3 Normal Power Supply Single Line Drawing," and 8.3-3, "CCNPP Unit 3 Transformer 30BBT04 Distribution Single Line Drawing."

In RAI 106, Question 08.03.01-1, the staff requested that the COL applicant resolve a discrepancy with COL FSAR Figure 8.3-1, page 8.0-35. COL FSAR Figure 8.3-1 shows two Emergency Auxiliary Transformers, with both designated as 30BDT02. In a June 8, 2009, response to RAI 106, Question 08.03.01-1, the COL applicant stated that the emergency auxiliary transformers would be designated as 30BDT02 to 30BDT01 in a future revision of the COL FSAR.

The staff reviewed the revised COL FSAR and finds the above designations have been incorporated. Therefore, the staff considers RAI 106, Question 08.03.01-1 resolved.

COL FSAR Section 8.3.1.1.1

There are four divisions of EPSS distribution equipment for the UHS makeup water system for CCNPP Unit 3. The COL applicant states that the EPSS distribution equipment for the UHS

makeup water system is in the Seismic Category I UHS Electrical Building, which is remotely located from the CCNPP Unit 3 power block.

In RAI 115, Question 08.03.01-3, the staff requested that the COL applicant provide the location of the four 6.9 kV safety-related switchgear, a list of equipment shown on COL FSAR Table 8.3-2, and demonstrate adequate voltage availability, such as 6.9 kV and 480 V buses, for remote equipment.

In a June 1, 2009, response to RAI 115, Question 08.03.01-3, the COL applicant stated that the four 6.9 kV switchgear, 31BDD, 32BDD, 33BDD, and 34BDD, that supply power to the UHS Makeup Water Intake Structure facilities, are not located in the remote UHS Electrical Building. These 6.9 kV switchgear are located in their respective divisions within the ESW Pump Buildings, as stated in U.S. EPR FSAR Tier 2, Table 8.3-2. The locations of the above 6.9 kV switchgear are incorporated in the COL FSAR by reference; therefore, no change to COL FSAR Table 8.3-2 is necessary. Subsequently the COL applicant revised COL FSAR Section 8.3.1.1.7 to remove any reference to the 6.9 kV switchgear in the UHS Electrical Building.

The COL applicant further stated that each of these 6.9 kV switchgears has a single feed to a 480 V motor control center (MCC) via a 6.9 kV to 480 V distribution transformer. The MCCs, 31BNG01, 32BNG01, 33BNG01, and 34BNG01, and their distribution transformers are located in respective division within the UHS Electrical Building.

Adequate voltage regulation and short-circuit capability is verified by power system analyses, including motor starting studies, for the buses that power UHS Makeup Water Intake Structure equipment. COL FSAR Table 8.3-1 has been revised to add information for the site-specific EPSS MCCs, 31BNG01, 32BNG01, 33BNG01, and 34BNG01, located in the remote UHS Electrical Building.

The staff reviewed the revised COL FSAR and finds the clarifications stated in the COL applicant's response to RAI 115, Question 08.03.01-3, have been incorporated. Therefore, the staff considers RAI 115, Question 08.03.01-3 resolved.

COL FSAR Section 8.3.1.1.2

In COL FSAR Table 8.3.3, the COL applicant has provided changes to site-specific NPSS major distribution switchgear and nominal bus voltages. U.S. EPR FSAR Tier 2, Table 8.3-3, "CCNPP Unit 3 Normal Power Supply System Switchgear and Load Center Numbering and Nominal Voltage," lists three 480 Vac load centers, 35BFB, 35BFC, and 35BFD, for Train 5 and three 480 Vac load centers, 36BFB, 36BFC, and 36BFD, for Train 6. However, the COL applicant has replaced these 480 Vac load centers in the site-specific design with two 6.9 kV switchgear, 35BBE and 35BBF, for Train 5 and two 6.9 kV Switchgear, 36BBE and 36BBF, for Train 6. The COL applicant stated that the changes resulted from increasing the size of the cooling tower wet fans from 300hp to 350 hp for each fan.

In RAI 115, Question 08.03.01-4, the staff requested that the COL applicant explain why the three 480 V load centers are replaced with two 6.9 kV switchgear for the site-specific cooling tower wet fans. The staff inquired if this is a departure from U.S. EPR FSAR standardized design for electrical distribution system and asked if there are any changes in load for the cooling tower system for CCNPP Unit 3.

In a June 1, 2009, response to RAI 115, Question 08.03.01-4, the COL applicant stated that the distribution system equipment located in the CWS cooling tower area is located in fully integrated power distribution centers. The number of cooling tower wet fans was reduced from 56 (rated 480 V, 300 Hp-total electrical load of 16,800 hp) to 48 (rated 6.9 kV, 350 Hp-total electrical load of 16,800 hp) for CCNPP Unit 3. Thus, the six, 480 V load centers have been replaced by four, 6.9 kV switchgears to accommodate the larger cooling tower fans with no change in the overall electrical loads. Because the above change is on NPSS, non safety-related loads, and there are no load changes, the staff does not consider this change a departure.

In RAI 115, Question 08.03.01-5, the staff inquired whether the safety related EPSS 6.9 kV switchgear, 31BDD, 32BDD, 33BDD, and 34BDD, require a separate dedicated DC battery/UPS system for control power. In a September 25, 2009, response to RAI 115, Question 08.03.01-5, the COL applicant stated that the above safety-related EPSS 6.9 kV switchgear are located in the ESW Pump Building. This building is considerably closer to the NI than the remote UHS Electrical Building. As described in the U.S. EPR FSAR Tier 2, Section 8.3.1.1.4, the control power for each switchgear is provided from its respective division Class 1E EUPS; therefore, these switchgear do not require separate dedicated dc battery or uninterruptible power supply systems for their control power requirements.

In RAI 115, Question 08.03.01-5, the staff also requested that the COL applicant address a fault on the single power supply to the desalination plant, demineralization plant, and waste water treatment facility that could result in a failure of the switchyard 500 kV red bus (COL FSAR Figure 8.2-2), and also asked whether a backup power supply could be provided from the NPSS 6.9 kV switchgear buses to these facilities.

In June 1, 2009, and September 25, 2009, responses to RAI 115, Questions 08.03.01-4 and 5, the COL applicant indicated that it will revise COL FSAR Section 8.3.1.1.2 to provide a backup power supply to NPSS 6.9 kV switchgear buses for the above desalination plant, and demineralization plant in case of power supply failure from red bus. These revisions will reflect modifications to the COL FSAR Sections 8.3.1.1.2 and 8.3.1.1.7 (to remove reference to the 6.9 kV switchgear), COL FSAR Figures 8.2-2, 8.3-2, and 8.3-3 (to add a backup power supply from NPSS 13.8 kV switchgear 36BBD), and COL FSAR Tables 8.3-1 and 8.3-3 (to accommodate the site-specific design changes).

The staff has reviewed the COL applicant's responses to RAI 115, Questions 08.03.01-4 and 5, and has determined that the above revisions to the respective COL FSAR Sections, Tables, and Figures are acceptable and considers this issue resolved.

The changes to COL FSAR Sections 8.3.1.1.2 and 8.3.1.1.7; COL FSAR Tables 8.3-1 and 8.3-3; and COL FSAR Figures 8.2-2, 8.3-2, and 8.3-3 need to be incorporated into the COL FSAR; to ensure that these changes are incorporated into the COL FSAR. **RAI 115, Question 08.03.01-5, is being tracked as a confirmatory item.**

COL FSAR Section 8.3.1.1.3

COL FSAR Section 8.2.2.4, "Compliance with GDC 17," mentions that the design of the system for the degraded voltage protection scheme is described in COL FSAR Section 8.3.1.1.3, and a site-specific system calculation will be performed to confirm the design. However, no site-specific description for the degraded voltage protection scheme is discussed in COL FSAR Section 8.3.1.1.3.

In RAI 116, 08.03.01-11, the staff requested that the COL applicant describe the design of the system degraded voltage protection (DVP) scheme and provide the site-specific system calculation that will be performed to confirm the design.

In a June 12, 2009, response to RAI 116, 08.03.01-11, the COL applicant responded that the site-specific DVP calculations described in COL FSAR Section 8.2.2.4 are addressed by the site-specific TS setpoint control program. This program, which controls the degraded and loss of voltage protection settings as well as the reactor trip and other Engineering Safety Feature Actuation System (ESFAS) setpoints, is addressed as part of Chapter 16, "Technical Specifications," and, therefore, COL FSAR Section 8.3.1.1.3 does not require any revisions.

Based on the staff's review of COL FSAR Chapter 16, the staff has determined that the above response is acceptable and, therefore, the staff considers RAI 116, Question 08.03.01-11 resolved.

COL FSAR Section 8.3.1.1.4

COL FSAR Section 8.3.1.1.4 incorporates by reference with no departures or supplements Section 8.3.1.1.4 of the U.S. EPR FSAR. In RAI 115, Question 08.03.01-10, the staff requested that the COL applicant address the need for local dc/UPS power for remote site specific systems, UHS facility safety-related electrical equipment, and the remote desalination, demineralization, and cooling tower area equipment, and explain how that power will be provided.

In a June 1, 2009, response to RAI 115, Question 08.03.01-10, the COL applicant stated that a separate local dc control power system is required for remote site-specific electrical equipment. The control power for 6.9 kV switchgear and 480 V load centers that are located in the cooling tower area is derived from the incoming power, and is part of the switchgear supplier scope. The dc control power for MCCs is generated by 480 Vac to 24 Vdc power supplies located in the MCC as described in the U.S. EPR FSAR Tier 2, Section 8.3.1.1.4, "Onsite AC Power System Controls and Instrumentation." This control power method is used in the MCCs located in the UHS Electrical Building and the cooling tower area. Thus, there are no control power requirements other than for the MCCs described above.

Since the COL applicant has shown that there is no need for local dc/UPS power for remote site specific systems, the staff determined that the COL applicant's response is acceptable. Therefore, the staff considers RAI 115, Question 08.03.01-10 resolved.

COL FSAR Section 8.3.1.1.7

COL FSAR Section 8.3.1.1.7 provides information on an additional site-specific transformer, as depicted on COL FSAR Figure 8.3-3, that is fed directly from the switchyard, and supplies a desalinization plant, demineralization plant, waste water treatment facility, and circulating water system cooling tower dry fans.

In a September 25, 2009, response to RAI 115, Questions 08.03.01-5, the COL applicant provided additional transformer information and the response is evaluated in this report under COL FSAR Section 8.3.1.1.2 above. To ensure that the changes described in the COL applicant's response will be incorporated, **RAI 115, Question 08.03.01-5, is being tracked as a confirmatory item.**

COL FSAR Section 8.3.1.1.8

The COL applicant identified that the UHS makeup water system is located in the applicable division of the Seismic Category I UHS Electrical Building for the UHS makeup water system but that site-specific details for the raceway and cable routing are not addressed in the COL FSAR.

In RAI 115, Question 08.03.01-6, the staff requested that the COL applicant address site-specific raceway and cable routing details for the UHS make-up water system in the UHS Electrical Building. The staff requested that the COL applicant confirm that the U.S. EPR FSAR is incorporated by reference for the raceway and cable routing design such as load group segregation and other design aspects for the electrical power distribution system in the UHS Electrical Building.

In a June 1, 2009, response to RAI 115, Question 08.03.01-6, the COL applicant responded that the U.S. EPR design for the raceway and cable routing design including load group segregation and other design aspects for the UHS Makeup Water Intake Structure and UHS Electrical Building, is incorporated by reference. Subsequently, the COL applicant revised the COL FSAR to incorporate U.S. EPR FSAR Tier 2, Section 8.3.1.1.8, by reference.

The staff reviewed the COL FSAR and determined that this revision has been incorporated as required. Therefore, the staff considers RAI 115, Question 08.03.01-6 resolved.

In RAI 164, Question 08.03.01-12, the staff requested that the COL applicant address cathodic protection for corrosion preventive measures for buried carbon steel piping; provide a description of cathodic protection design and method for site-specific buried piping, as applicable; and identify the industry standards which will be followed for design, installation and surveillance. In an October 27, 2009, response to RAI 164, Question 08.03.01-12, the COL applicant stated that cathodic protection will be provided for buried carbon steel pipe. The cathodic protection system for buried pipes will be either impressed current or sacrificial galvanic anode, depending on soil conditions and pipe size. The design, installation, and surveillance of the cathodic protection will be in accordance with National Association of Corrosion Engineers (NACE) standards and publications.

The staff determined that the above response is acceptable, because cathodic protection will be provided for buried carbon steel pipe in accordance with industry standards. The staff determined that this response adequately addresses this issue and no COL FSAR revisions are required. Therefore, the staff considers RAI 164, Question 08.03.01-12 resolved.

COL FSAR Section 8.3.1.1.9

COL FSAR Section 8.3.1.1.9 states that the UHS makeup water system is located in the applicable division of the Seismic Category 1 UHS Electrical Building, but site-specific details related to the independence of the redundant systems are not addressed.

In RAI 115, Question 08.03.01-7, the staff requested that the COL applicant confirm whether the U.S. EPR FSAR is incorporated by reference regarding the independence of the redundant systems for the UHS electrical distribution system housed in the UHS Electrical Building.

In a June 1, 2009, response to RAI 115, Question 08.03.01-7, the COL applicant stated that the U.S. EPR FSAR Tier 2, Section 8.3.1.1.9, “Independence of Redundant Systems,” is incorporated by reference to the COL FSAR for the UHS Makeup Water Intake Structure and

UHS Electrical Building. The COL applicant revised the COL FSAR Section 8.3.1.1.9, to indicate that the independence of the redundant systems described in U.S. EPR FSAR Tier 2, Section 8.3.1.1.9, is incorporated by reference.

The staff reviewed the COL FSAR and determined that COL FSAR Section 8.3.1.1.9 has been revised to incorporate by reference the independence of redundant equipment described in U.S. EPR FSAR Tier 2, Section 8.3.1.1.9. Therefore, the staff considers RAI 115, Question 08.03.01-7 resolved.

COL FSAR Section 8.3.1.2.2

In COL FSAR Section 8.3.1.2.2, "Compliance with GDC 4," the COL applicant stated that there are no departures or supplements. The 6.9 kV EPSS switchgear 31BDD, 32BDD, 33BDD, and 34BDD for the site-specific UHS makeup water system are not given in the COL FSAR Table 3.11-1, "List of Environmentally Qualified Electrical/I&C Equipment." In RAI 115, Question 08.03.01-8, the staff requested that the COL applicant explain why the 6.9 kV EPSS switchgear 31BDD, 32BDD, 33BDD, and 34BDD are not listed in COL FSAR Table 3.11-1.

In a June 1, 2009, response to RAI 115, Question 08.03.01-8, the COL applicant stated that emergency power supply system (EPSS) 6.9 kV switchgear 31BDD, 32BDD, 33BDD, and 34BDD are part of the U.S. EPR standard design, as described in the U.S. EPR FSAR, and are included in the U.S. EPR FSAR, Tier 2, Table 3.11-1. The subject switchgear are located in their respective divisions within the ESW Pump Buildings. The site-specific distribution transformers and MCCs located in the UHS Electrical Building that supplies the UHS makeup water system, are also provided in COL FSAR Table 3.11-1.

Because the COL applicant's response states that the emergency power supply system (EPSS) 6.9 kV switchgear 31BDD, 32BDD, 33BDD, and 34BDD are part of the U.S. EPR FSAR Tier 2, Table 3.11-1, and that table is incorporated by reference in the COL FSAR, no change to COL FSAR Section 8.3.1.2.2 is required. Therefore, the staff considers RAI 115, Question 08.03.01-8 resolved.

COL FSAR Section 8.3.1.3

The COL FSAR states that the conceptual design information in U.S. EPR FSAR, Tier 2, Section 8.3.1.3, "Electrical Power System Calculations and Distribution System Studies for ac Systems," including U.S. EPR FSAR Tier 2, Figure 8.3-4 for grounding system grid, is applicable to CCNPP Unit 3.

In RAI 115, Question 08.03.01-9, the staff requested that the COL applicant confirm whether electrical power system calculation and studies, which are used to analyze the ac distribution system, include the site specific UHS system/facilities with safety related equipment. The staff also requested that the COL applicant address the remote site-specific lightning/grounding layout for the UHS facility, and the overall site-specific integrated grounding plan that includes the 500 kV CCNPP Unit 3 switchyard and the interface between the NI and power block ground grid, and the switchyard. Additionally, the staff requested that the COL applicant address all site specific lightning and grounding systems as an ITAAC item.

In a July 16, 2009, response to RAI 115, Question 08.03.01-9, the COL applicant stated that voltage regulation and short-circuit capability is verified by power system analyses, including motor starting studies, for the buses that power UHS makeup water system safety-related

equipment. These analyses are performed to verify adequate equipment capacity and capability, and are performed for the site-specific electrical distribution system, which includes the safety-related equipment in the UHS makeup water system.

COL FSAR Section 8.3.1.3 was revised to incorporate by reference U.S. EPR FSAR Tier 2, Section 8.3.1.3.8, "Grounding," for the site-specific UHS Makeup Water Intake Structure, UHS Electrical Building, circulating water system cooling tower area, desalination plant, and 500 kV switchyard. The lightning protection design as described in U.S. EPR FSAR Tier 2, Section 8.3.1.3.5 is also incorporated by reference for these structures/facilities.

In addition, COL FSAR Section 8.3.1.3 was revised to state that the switchyard grounding grid will be interconnected with the NI and power block ground grid. The switchyard ground grid, including conductor sizing, matrix pattern spacing, and connection with the power block ground grid is determined using the regulatory guidance and industry standards described in U.S. EPR FSAR Tier 2, Section 8.3.1.3.8. COL FSAR Section 8.3.1.3 has been revised to describe the switchyard grounding system design and the interconnection to the NI and power block ground grid. In accordance with RG 1.206, the COL applicant stated that only those portions needed to support the Class 1E functions are required to be addressed by an ITAAC. The staff reviewed the COL FSAR Part 10, "Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)," and ITAAC Closure Table 2.4-31, "Class 1E Emergency Power Supply Components for Site-Specific Systems Inspections, Tests, Analyses, and Acceptance Criteria," and COL FSAR Section 8.3.1.3, and finds that these sections of the COL FSAR have been revised to address grounding and lightning protection for the safety-related site-specific portions (UHS Makeup Water Intake Structure and Electrical Building) of the ac electrical distribution system.

The COL applicant's response to RAI 115, Question 08.03.01-9 did not include ITAAC for grounding of the non-safety-related facilities. In RAI 169, Question 08.03.01-15, the staff requested the COL applicant to clarify why non-safety-related facilities are not included in the revised COL FSAR Section 8.3.1.3 and also requested the COL applicant to address an ITAAC for offsite power lightning protection and grounding or clarify why this was not considered necessary.

In an October 27, 2009, response to RAI 169, Question 08.03.01-15, the COL applicant stated that COL FSAR Section 8.3.1.3 will be revised to include the circulating water system cooling tower area, the desalination plant and the 500 kV switchyard and that COL FSAR Part 10, Table 2.4-29, "Offsite Power System Inspections, Tests, Analyses, and Acceptance Criteria," will be revised to include ITAACs for the 500 kV switchyard lightning protection and grounding systems.

The staff reviewed the proposed FSAR revisions and determined the above response is acceptable, because COL FSAR Section 8.3.1.3 will be revised to state that the circulating water system cooling tower area, the desalination plant, and the 500 kV switchyard will be designed with lightning protection and grounding conforming to U.S. EPR FSAR Tier 2, Sections 8.3.1.3.5 and 8.3.1.3.8. Also, COL FSAR Part 10, Table 2.4-29 will be revised to include ITAAC for the 500 kV switchyard lightning protection and grounding systems. As the applicant has committed to making these revisions, the staff considers RAI 169, Question 08.03.01-15 resolved.

To ensure that these changes are incorporated into the COL FSAR, **RAI 169, Question 08.03.01-15, is being tracked as a confirmatory item.**

In RAI 184, Question 08.03.01-14, the staff requested clarification on whether lightning protection and grounding for offsite power/switchyard is an ITAAC item. COL FSAR Chapter 14, “Verification Programs,” Table 14.3-3, “Interface Requirement Screening Summary,” states that interface requirements for the lightning protection and grounding system are provided in U.S. EPR FSAR Tier 1, Section 2.5.8. CCNPP Unit 3 FSAR, Table 14.3-3, Item 4.9, also indicates that CCNPP Unit 3 FSAR, Section 8.3 incorporates the U.S. EPR lightning and grounding system by reference. However, U.S. EPR FSAR Tier 1, Section 2.5.8 did not address offsite power/switchyard system grounding and lightning protection systems.

In a November 2, 2009, response to RAI 184, Question 08.03.01-14, the COL applicant stated that interface requirements for the lightning protection and grounding system have been selected for an ITAAC item. This change is reflected in the U.S. EPR FSAR Tier 1, Chapter 2, Section 2.5.8, "Lightning Protection and Grounding for the Switchyard," as ITAAC Item 5.8, and the COL FSAR Table 14.3-3 will be updated to reflect that the switchyard lightning protection and grounding systems are selected as ITAAC items. The staff reviewed the proposed COL FSAR revisions and determined the above response is acceptable, because interface requirements for the lightning protection and grounding systems were selected as an ITAAC item.

To ensure that the changes to COL FSAR Table 14.3-3, to include lightning and grounding system for the switchyard as an ITAAC item, are incorporated into the COL FSAR, **RAI 184, Question 08.03.01-14, is being tracked as a confirmatory item.**

COL FSAR Section 8.3.1.4

The COL FSAR did not include information pertaining to electrical heat tracing and freeze protection systems. In RAI 90, Question 14.02.01-34, the staff requested that the COL applicant address electrical heat tracing and demonstrate the operability of heat tracing and freeze protection systems in the initial test program. The staff requested that the COL applicant include testing to demonstrate the operability of heat tracing and freeze protection systems, or justify their exclusion. On May 20, 2009, the COL applicant responded that electrical heat tracing, insulation, and freeze protection systems have been provided, as required, for safety-related and non-safety-related applications susceptible to freezing. The general requirements for electrical heat tracing and freeze protection have been added to COL FSAR Sections 8.3.1.4, “Electrical Heat Tracing”, 8.3.1.4.1, “Analysis”, and 8.3.3, “References.”

The staff reviewed the COL FSAR revisions and determined that the COL applicant’s response to RAI 90, Question 14.02.01-34 is acceptable, because electrical heat tracing, insulation, and freeze protection is provided, as required, for safety-related and non-safety-related applications. Therefore, the staff considers RAI 90, Question 14.02.01-34 resolved.

8.3.1.5 Post Combined License Activities

U.S. EPR FSAR Tier 2, Table 1.8-2 contains COL information items that the applicant is required to address. The following COL information items in Table 8.3.1-1 of this report includes the proposed post combined license activities which the staff has evaluated in this report.

Table 8.3.1-1 Post Combined License Activities

Item No.	Description	COL FSAR Section	COL SER Section
8.3-1	A COL applicant that references the U.S. EPR design certification will monitor and maintain EDG reliability during plant operations to verify the selected reliability level target is being achieved as intended by RG 1.155.	8.3.1.1.5	8.3.1.4
8.3-2	A COL applicant that references the U.S. EPR design certification will describe inspection, testing and monitoring programs to detect the degradation of inaccessible or underground power cables that support EDGs, offsite power, ESW and other systems that are within the scope of 10 CFR 50.65.	8.3.1.1.8	8.3.1.4

8.3.1.6 Conclusions

The staff reviewed COL FSAR Section 8.3.1 and supplemental information addressed in the COL application, and checked the referenced U.S. EPR FSAR to ensure that the combination of the information incorporated by reference from the U.S. EPR FSAR and the information in the COL FSAR represent the complete scope of information relating to this review of the alternating current power systems. The staff finds that U.S. EPR FSAR Tier 2, Section 8.3.1, incorporated by reference in COL FSAR Section 8.3.1, and supplemental information provided in the COL FSAR Section 8.3.1 are adequate to support the COL application.

The staff concludes that the information provided in COL FSAR Section 8.3.1 meets the appropriate regulatory requirements, pending resolution of the confirmatory items identified above.

8.3.2 Direct Current Power Systems

The safety function of the direct current (dc) onsite power system is to provide motive or control power to safety-related equipment and to equipment used to respond to an SBO event. Batteries and battery chargers serve as the power sources for the dc system, and inverters convert dc from the dc distribution system to ac instrumentation and control power, as required.

The objective of the staff's review is to determine whether the onsite dc power system satisfies its design function during all plant operating and accident conditions.

COL FSAR Section 8.3.2 incorporates by reference U.S. EPR FSAR Tier 2, Section 8.3.2, with no departures or supplements, and there are no applicable COL Interface Items or Supplemental Items. However, the staff reviewed, and evaluated in Section 8.1.4, "Technical Evaluation," of this report, information in the COL FSAR for COL Information Item 8.1-2 concerning additional site-specific loads powered from the Class 1E battery source. The staff found that the information provided by the COL applicant adequately addressed COL Information Item 8.1-2. The staff also determined that COL FSAR Section 8.3.2 incorporates by reference U.S. EPR FSAR Tier 2, Section 8.3.2, and is adequate to support the COL application.

8.4 Station Blackout

8.4.1 Introduction

The term station blackout (SBO) refers to a complete loss of ac electric power to both the non-safety-related and safety-related switchgear buses. An SBO does not include loss of available ac power to buses fed by station batteries through inverters or by alternate ac (AAC) sources specifically provided for SBO mitigation. The objective of the staff's review is to determine whether COL FSAR demonstrates compliance with the requirements of 10 CFR 50.63.

8.4.2 Summary of Application

COL FSAR Section 8.4 incorporates by reference U.S. EPR FSAR Tier 2, Section 8.4 with no departures.

COL Information Items

U.S. EPR FSAR COL Information Item 8.4-1, states:

> A COL applicant that references the U.S. EPR design certification will provide site-specific information that identifies any additional local power sources and transmission paths that could be made available to resupply the power plant following a LOOP.

The COL applicant provided information in COL FSAR Section 8.4.1.3, "Alternate ac Power System Performance," to address this Information Item. The COL applicant indicated that there are no special local sources of power that can be made available to resupply power to the CCNPP Unit 3 following loss of the grid or an SBO.

U.S. EPR FSAR COL Information Item 8.4-2, states:

> A COL applicant that references the U.S. EPR design certification will address the Regulatory Guide (RG) 1.155 guidance related to procedures and training to cope with SBO.

The COL applicant provided information in COL FSAR Section 8.4.2.6.4, "Alternate ac Power System Performance," to address procedures and training that identify operator actions needed to cope with a station blackout according to RG 1.155, Regulatory Position C.3.1.

Supplemental Information

In COL FSAR Section 8.4.2.6.1, "RG 1.155 C.3.1-Minimum Acceptable Station Blackout Duration Capability," the COL applicant provided supplemental information whereby CCNPP Unit 3 could propose a site-specific coping duration of less than 8 hours.

The COL applicant stated that it will utilize the coping analysis described in the U.S. EPR FSAR Tier 2, Section 8.4.2.6, "RG1.155 – Station Blackout."

8.4.3 Regulatory Basis

The regulatory basis for acceptance of the COL information incorporated by reference from the U.S. EPR FSAR is addressed in U.S. EPR FSER, Section 8.4, "Station Blackout." The relevant requirements of NRC regulations for this area of review and the associated acceptance criteria are described in SRP Section 8.4, which provides guidance to the staff in reviewing the COL FSAR to determine whether the relevant requirements of NRC regulations for this area of review have been met.

The regulatory basis for acceptance of the COL supplemental information is established in GDC 17, GDC 18, 10 CFR 50.63, and 10 CFR 50.65(a)(4). The COL FSAR incorporates by reference all other regulatory bases related to the U.S. EPR FSAR with no departures or supplements.

8.4.4 Technical Evaluation

The staff reviewed COL FSAR Section 8.4, "Station Blackout," and checked the referenced section of the U.S. EPR FSAR to ensure that COL information items and supplemental information to be provided by the COL applicant have been addressed in the COL application. The sections of the U.S. EPR FSAR that the COL FSAR incorporates by reference with no departures or supplements and the information provided in COL FSAR Section 8.4 establish the design basis of the CCNPP Unit 3 plant.

COL Information Items

The staff reviewed the COL FSAR to determine whether it addressed the following COL information items given in U.S. EPR FSAR, Tier 2, Table 1.8-2:

COL Information Item 8.4-1: A COL applicant that references the U.S. EPR design certification will provide site-specific information that identifies any additional local power sources and transmission paths that could be made available to resupply the power plant following a LOOP.

The COL applicant provided information on any additional local power sources and transmission paths that could be made available to resupply power to the plant. This information is described in COL FSAR Section 8.4.1.3, "Alternate AC (AAC) Power System Performance." The COL applicant stated that there are no special local sources available to resupply power to the plant following loss of a grid or an SBO. The available paths available to CCNPP Unit 3 consist of three 500 kV power circuits and two feeds from the CCNPP Units 1 and 2 switchyard. In a CCNPP Unit 3 SBO condition, a loss of all three 500 kV power circuits would be considered a part of the LOOP. In such a situation, no offsite power would be available for the CCNPP Unit

3. Since the U.S. EPR design includes two AAC SBO diesel generators, power would be available to cope with and recover from an SBO.

Although there are no additional sources of offsite power, the two AAC SBO generators included in the U.S. EPR design will provide sufficient power to enable CCNPP Unit 3 to cope with and recover from an SBO. Therefore, the staff finds that the COL applicant has adequately addressed COL Information Item 8.4-1.

COL Information Item 8.4-2: A COL applicant that references the U.S. EPR design certification will address the RG 1.155 guidance related to procedures and training to cope with SBO.

The COL applicant addressed procedures and training to cope with an SBO in COL FSAR Section 8.4.2.6.4, "RG 1.155 C.3.4-Procedures and Training to Cope with Station Blackout." The staff reviewed this section of the COL FSAR to determine whether it includes specific positions prescribed in RG 1.155, which provides guidance related to procedures and training to cope with SBO. The COL FSAR states that the COL applicant commits to preparing procedures and training to cope with an SBO based on the following positions of RG 1.155: (1) Position C.1.3 to restore emergency ac power when the emergency ac power system is unavailable will be integrated with plant-specific technical guidelines and emergency operating procedures; (2) Position C.2 to restore offsite power and use nearby power sources when offsite power is unavailable; and (3) Position C.3.4 to include operator actions necessary to cope with an SBO for at least the duration determined.

The staff determined that the COL applicant's description of the CCNPP Unit 3 commitment adequately addresses RG 1.155 guidance related to procedures and training to cope with an SBO. Therefore, the staff finds that the COL applicant has adequately addressed COL Information Item 8.4-2.

Supplemental Information

The staff reviewed the following COL FSAR supplemental information items:

COL FSAR Section 8.4.2.6.1

This section of the COL FSAR addresses coping duration in the event of an SBO. U.S. EPR FSAR Tier 2, Section 8.4.2.6.1, "RG 1.155 C,3,3-Minimum Acceptable Station Blackout Duration Capability (Station Blackout Coping Duration)," states that, for U.S. EPR, the worst case SBO coping duration is 8 hours. However, COL FSAR also refers back to a statement in the U.S. EPR FSAR that, on a site specific basis, the coping durations may result in a reduction from 8 to between 4 to 2 hours.

In RAI 94, Question 08.04-1, the staff requested that the COL applicant address the specific coping duration for CCNPP Unit 3. The staff was concerned that the information provided in this section of the COL FSAR was not clear, as the coping duration evaluation (in hours) was not based on site-specific information.

In a May 12, 2009, response to RAI 92, Question 08.04-1, the COL applicant did not include a plant-specific analysis for incorporation into the COL FSAR as required by 10 CFR 50.63. Therefore, in RAI 163, Question 08.04-02, the staff requested further clarification, and asked that the coping duration for an SBO be explicitly provided for CCNPP Unit 3.

In an October 15, 2009, response to RAI 163, Question 08.04-2, the COL applicant provided a plant-specific analysis for CCNPP Unit 3, as required by 10 CFR 50.63. The response stated that the CCNPP Unit 3 SBO site-specific coping and recovery duration, calculated according to RG 1.155, Table 2, is 8 hours. The evaluation, based on RG 1.155, Regulatory Position 3.1 will be incorporated into the COL FSAR and revisions will be made in COL FSAR Sections 8.4.2.6.1 and 8.4.3, "References," of the COL FSAR. The staff determined that the COL applicant's October 15, 2009, response to RAI 163, Question 08.04-2, and the proposed changes are acceptable. While this issue is resolved, the COL applicant must incorporate the changes described above to COL FSAR Sections 8.4.2.6.1 and 8.4.3. To ensure that COL FSAR Sections 8.4.2.6.1 and 8.4.3 include a site specific 8 hour coping duration, **RAI 163, Question 08.04-2, is being tracked as a confirmatory item.**

COL FSAR Section 8.4.2.3

COL FSAR Section 8.4.2.3, "10 CFR 50.65-Requirements for Monitoring the Effectiveness of Maintenance of Nuclear Power Plants," states that there are no departures or supplements to U.S. EPR FSAR Tier 2, Section 8.4.2.3, which is incorporated by reference in the COL FSAR. The staff evaluated the COL FSAR information which addresses 10 CFR 50.65 requirements, as described in Section 8.2.2.8 of this report, and determined COL FSAR Section 8.4.2.3, which is a supplemental information item, meets the requirements of 10 CFR 50.65(a)(4). The staff's evaluation of this information is described in Section 8.2.2.8 of this report.

8.4.5 Post Combined License Activities

There are no post COL activities related to this section.

8.4.6 Conclusions

The staff reviewed COL FSAR Section 8.4, and checked the referenced U.S. EPR FSAR to ensure that COL information items and supplemental information to be provided by the COL applicant have been addressed in the COL application. The staff finds that U.S. EPR FSAR Tier 2, Section 8.4, which is incorporated by reference in COL FSAR Section 8.4, and supplemental information provided in the COL FSAR Section 8.4, are adequate to support the COL application.

The staff concludes that the information provided in COL FSAR Section 8.4, meets the provisions of 10 CFR 50.63, and 10 CFR 50.65, as they relate to the capability to achieve and maintain safe shutdown in the event of an SBO, pending resolution of the confirmatory item identified above.