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LIST OF FIGURES

No figures were included in this chapter.

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9 AUXILIARY SYSTEMS

9.1 Fuel Storage and Handling

9.1.1 Criticality Safety of New and Spent Fuel Storage and Handling

Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Combined License (COL) Final Safety Analysis Report (FSAR) Section 9.1.1 incorporates by reference U.S. EPR FSAR Tier 2, Section 9.1.1, with supplementary information provided in COL FSAR Section 9.1.1, “Criticality Safety of New and Spent Fuel Storage and Handling.”

The regulatory basis of the information incorporated by reference is addressed within the Final Safety Evaluation Report (FSER) related to the U.S. EPR FSAR. The staff reviewed COL FSAR Section 9.1.1 and checked the referenced design certification FSAR to ensure that the combination of the information in the design certification application and the information in the COL application represent the complete scope of information relating to this review topic. The staff’s review confirmed that the information contained in the COL application and incorporated by reference addresses the required information relating to this section. U.S. EPR FSAR Tier 2, Section 9.1.1 is being reviewed by the staff under Docket No. 52-020. The staff’s technical evaluation of the information incorporated by reference related to criticality safety of new and spent fuel storage and handling will be documented in the staff safety-evaluation report on the U.S. EPR design certification application.

9.1.2 New and Spent Fuel Storage

COL FSAR Section 9.1.2 incorporates by reference U.S. EPR FSAR Tier 2, Section 9.1.2, with supplementary information provided in COL FSAR Section 9.1.2, “New and Spent Fuel Storage.”

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the U.S. EPR FSAR. The staff reviewed COL FSAR Section 9.1.2`and checked the referenced design certification FSAR to ensure that the combination of the information in the design certification application and the information in the COL application represent the complete scope of information relating to this review topic. The staff’s review confirmed that the information contained in the COL application and incorporated by reference addresses the required information relating to this section. U.S. EPR FSAR Tier 2, Section 9.1.2 is being reviewed by the staff under Docket No. 52-020. The staff’s technical evaluation of the information incorporated by reference related to new and spent fuel storage will be documented in the staff safety evaluation report on the U.S. EPR design certification application.

9.1.3 Fuel Pool Cooling and Purification System

All nuclear reactor plants include a spent fuel pool for the wet storage of spent fuel assemblies. The safety function to be performed by the spent fuel cooling system (in conjunction with the spent fuel pool itself) is to assure that the spent fuel assemblies are cooled and remain covered with water during all storage conditions. Other functions performed by the system but not related to safety include water cleanup for the spent fuel pool, refueling canal, in-containment refueling water storage tank (IRWST), and other equipment storage pools; means for filling and

draining the refueling canal and other storage pools; and surface skimming to provide clear water in the storage pool.

COL FSAR Section 9.1.3 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Revision 0. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in the U.S. EPR FSAR Tier 2, Section 9.1.3 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the spent fuel pool cooling and purification system incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The Safety Evaluation Report (SER) for the U.S. EPR FSAR is not yet complete. The staff issued Question 01-5 to track the ongoing review of the U.S. EPR design certification application. **RAI 222, Question 01-5 is being tracked as an open item.** The staff will update Section 9.1 of this report to reflect the final disposition of the design certification application.

9.1.4 Fuel Handling System

9.1.4.1 *Introduction*

The fuel handling system (FHS) provides a means of receiving, inspecting, and storing new fuel assemblies in the spent fuel pool. The FHS is also used to move fuel assemblies in and out of the reactor vessel and to place spent fuel assemblies into spent fuel casks for removal from the pool.

9.1.4.2 *Summary of Application*

COL FSAR, Revision 9, Section 9.1.4, incorporates by reference U.S. EPR FSAR Tier 1, Revision 5, Section 9.1.4, "Fuel Handling System," which contains COL Information Item 9 1-2:

COL Information Item 9.1-2

> A COL applicant that references the U.S. EPR design certification will perform appropriate tests and analyses, which demonstrate that an identified NRC-approved cask can be safely connected to the spent fuel cask transfer facility (SFCTF), and the cask and its adapter meet the criteria specified in Table 9.1.4-1, prior to initial fuel loading into the reactor.

In response to this COL information item, the COL applicant has proposed a License Condition, as indicated in COL application, Part 10, Appendix A, "Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) and ITAAC Closure," Revision 9 to provide a cask design that satisfies the requirement for interfacing with the Spent Fuel Cask Transfer Facility (SFCTF):

License Condition

> Before initial fuel loading into the reactor, the licensee shall perform an appropriate test and analysis that demonstrates that an identified NRC-approved cask can be safely connected to the SFCTF, and the cask and its adapter meet the criteria specified in U.S. EPR FSAR Table 9.1.4-1. Before initial fuel loading into the reactor, the licensee shall submit a report documenting the test and

analysis required above and the results obtained, to the Director of the Office of New Reactors or the Director's designee.

The licensee shall not use the SFCTF for initial cask loading operations until the licensee performs the tests identified below, verifies that the results of the tests fall within the acceptance criteria and submits a report to the Director of the Office of New Reactors or the Director's designee.

The tests are:

- Verify the penetration leak tightness with loading pit filled with water
- Verify the cask loading sequence and the sequential interlocking with the actual cask and a dummy assembly under water.

9.1.4.3 *Regulatory Basis*

The relevant requirements of U.S. Nuclear Regulatory Commission (NRC) regulations applying to the supplemental information for this area of review, and the associated acceptance criteria, are given in NUREG-0800, Section 9.1.4, "Light Load Handling System and Related Refueling Operations", Revision 3, March 2007, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR [light-water reactor] Edition," and Regulatory Guide (RG) 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)". Review interfaces with other Standard Review Plan (SRP) sections also can be found in NUREG-0800, Section 9.1.4.

9.1.4.4 *Technical Evaluation*

The staff reviewed COL FSAR, Revision 9, Section 9.1.4 where the COL applicant incorporated by reference U.S. EPR FSAR Tier 2, Revision 5, Section 9.1.4 with no departures or supplements and addressed one COL information item. The COL Information Item 9.1-2 is located in U.S. EPR FSAR Tier 2, Table 1.8-2. "U.S. EPR Combined License Information Items," which the COL applicant addressed in COL FSAR Section 9.1.4 and COL application, Part 10. The staff review was limited to the specific COL information item identified above.

<u>COL Information Item 9.1-2</u>

As indicated above, U.S. EPR FSAR Tier 2, Section 9.1, contains a statement that any COL applicant referencing the U.S. EPR design certification will perform appropriate test and analysis, which demonstrate that an NRC-approved cask can be used. This action is further defined in U.S. EPR FSAR Tier 2, Table 1.8-2 as COL Information Item 9.1-2, as follows:

> A COL applicant that references the U.S. EPR design certification will perform appropriate tests and analyses, which demonstrate that an identified NRC-approved cask can be safely connected to the spent fuel cask transfer facility (SFCTF), and the cask and its adapter meet the criteria specified in Table 9.1.4-1, prior to initial fuel loading into the reactor.

A COL applicant that references the U.S. EPR design certification will perform appropriate tests and analyses, which demonstrate that an identified NRC-approved cask can be safely

connected to the SFCTF, and the cask and its adapter meet the criteria specified in Table 9.1.4-1, prior to initial fuel loading into the reactor.

To address the availability of a cask, the license condition commits to submittal of a report documenting the test and analysis that demonstrate an identified NRC-approved cask is available to be safely connected to the SFCTF. Submittal of this report to NRC will ensure an NRC-approved cask is available prior to fuel load.

The license condition also disallows use of the SFCTF for initial cask loading operations until the licensee performs leakage and operability testing. The results of the tests should fall within an acceptance criteria and submittal of a report to NRC will provide assurance of safe operability of the SFCTF prior to initial cask loading.

Completion of the licensing condition will provide confidence of the SFCTF capability to remove fuel from the spent fuel pool prior to initial cask loading. Therefore, the staff finds the license condition acceptable.

9.1.4.5 *Post Combined License Activities*

As indicated in license condition, the licensee shall not use the SFCTF for initial cask loading operations until the licensee performs the tests, verifies that the results of the tests fall within an acceptance criteria, and submits a report to the Director of the Office of New Reactors or the Director's designee.

9.1.4.6 *Conclusions*

The staff is reviewing the information for the U.S. EPR on Docket No. 52-020. The results of the staff's technical evaluation of the information related to this section to be incorporated by reference in the COL FSAR will be documented in the staff's safety evaluation report on the design certification application for the U.S. EPR. The SER for the U.S. EPR is not yet complete. The staff will update this Chapter 9 of this report to reflect the final disposition of the design certification application.

The staff evaluated COL FSAR Section 9.1.4, provided by the COL applicant in response to COL Information Item 9.1-2 from the U.S. EPR FSAR. The staff's evaluation used relevant NRC guidelines and acceptance criteria defined in NUREG-0800, Section 9.1.4 and RG 1.206. Based on the results of this evaluation, the staff concludes that the COL FSAR Section 9.1.4, "Fuel Handling System," Section 9.1.4 is acceptable.

9.1.5 Overhead Heavy Load Handling System

9.1.5.1 *Introduction*

This section evaluates the safe handling of heavy loads in and around new and spent nuclear fuel at CCNPP Unit 3. The design basis and interface with the Reactor Building polar crane and Fuel Building auxiliary crane, and other load handling systems are addressed and compared to the applicable regulatory acceptance criteria.

9.1.5.2 *Summary of Application*

COL FSAR Section 9.1.5 incorporates by reference U.S. EPR FSAR Tier 2, Section 9.1.5, "Overload Heavy Load Handling System (OHLHS)."

In addition, in COL FSAR Section 9.1.5, the COL applicant provided the following:

COL Information Items

The COL applicant provided additional information in COL FSAR Section 9.1.5.2.5, "System Operation," to address COL Information Item 9.1-1 from U.S. EPR FSAR Tier 2, Table 1.8-2 as follows:

> A COL applicant that references the U.S. EPR design certification will provide site specific information on the heavy load handling program, including a commitment to procedures for heavy load lifts in the vicinity of irradiated fuel or safe-shutdown equipment, and crane operator training and qualification.

In response to this COL information item, the COL applicant provided details of procedures related to this subject, discussion relating to an inspection and testing program, a training and qualification program, and quality assurance measures to satisfy the requirements.

9.1.5.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed within the Final Safety Evaluation Report (FSER) related to the U.S. EPR FSAR.

In addition, the relevant requirements of U.S. Nuclear Regulatory Commission (NRC) regulations for the site specific information on the heavy load handling program, and the associated acceptance criteria, are given in NUREG-0800, Section 9.1.5, "Overhead Heavy Load Handling Systems,."

The applicable regulatory requirements for the site specific information on the heavy load handling program are as follows:

- General Design Criteria (GDC) 4, "Environmental and Dynamic Effects Design Bases," as it relates to environmental and dynamic design basis

The related acceptance criteria are as follows:

1. American Society of Mechanical Engineers (ASME) B30.2-2005, "Overhead and Gantry Cranes," as it relates to operators being trained and qualified to move heavy loads and as it relates to cranes being inspected, tested, and maintained prior to use.

2. RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," Section C.I.9.1.5, "Overhead Heavy Load Handling System."

9.1.5.4 *Technical Evaluation*

The staff reviewed COL FSAR Section 9.1.5 and checked the referenced design certification FSAR to ensure that the combination of the information in the U.S. EPR FSAR and the

information in the COL FSAR represents the complete scope of information relating to this review topic. The staff's review confirmed that the information contained in the COL application and incorporated by reference addresses the required information relating to this section. U.S. EPR FSAR Tier 2, Section 9.1.5 is being reviewed by the staff under Docket No. 52-020. The staff's technical evaluation of the information incorporated by reference related to the OHLHS will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR.

The staff reviewed the information contained in the COL FSAR:

COL Information Items

The staff reviewed COL Information Item 9.1-1 from U.S. EPR FSAR Tier 2, Table 1.8-2 included under COL FSAR Section 9.1.5.2.5.

The staff reviewed COL FSAR Section 9.1.5. In COL FSAR Section 9.1.5, the COL applicant incorporated by reference U.S. EPR FSAR Tier 2, Section 9.1.5, with no departures or supplements and addressed one COL information item. U.S. EPR FSAR Tier 2, Table 1.8-2, "U.S. EPR Combined License Information Items," identified one COL Information Item 9.1-1, which the COL applicant addressed in COL FSAR Section 9.1.5. The staff review was limited to the specific COL information item identified above. The staff reviewed the acceptability of the COL applicant's response to the COL information item with the criteria specified in SRP Section 9.1.5.

U.S. EPR FSAR Tier 2, Section 9.1.5.2.5, "System Operation," contains a statement that any COL applicant referencing the U.S. EPR design certification will provide a site specific heavy load program. This action identified in U.S. EPR FSAR Tier 2, Section 9.1.5.2.5 is further defined in U.S. EPR FSAR Tier 2, Table 1.8-2 as COL Information Item 9.1-1.

COL Information Item 9.1-1 states the following:

> A COL applicant that references the U.S. EPR design certification will provide site specific information on the heavy load handling program, including a commitment to procedures for heavy load lifts in the vicinity of irradiated fuel or safe-shutdown equipment, and crane operator training and qualification.

This COL information item was addressed in COL FSAR Section 9.1.5.2.5 by including paragraphs titled "Procedures," "Inspection and Testing," "Training and Qualification," and "Quality Assurance."

The first portion of COL Information Item 9.1-1 requested a commitment for training and qualification of the crane operator. The COL applicant addressed this portion by adding COL FSAR Section 9.1.5.2.5 paragraph, "Training and Qualification," and COL FSAR Section 13.5.1.1.5, "Crane Operation Procedures." These sections clarified the training and qualification of the personnel involved in crane operations over the refueling cavity and the spent fuel pool in accordance with ASME B30.2-2005. This information added to the COL FSAR followed the guidance of SRP Section 9.1.5 acceptance criteria which states, "Operators should be trained and qualified and conduct themselves in accordance with Chapter 2-3.1 of ASME B30.2-2005." Therefore, the staff finds that the paragraph added to COL FSAR. Revision 5, Section 9.1.5.2.5 addressed the training portion of the COL information item and meets the acceptance criteria of SRP Section 9.1.5.

The other portion of COL Information Item 9.1-1 requested that the COL applicant include a commitment to procedures for heavy load handling. SRP Section 9.1.5 provides additional guidance for the procedures to include:

- Identification of required equipment
- Inspection and acceptance criteria
- Steps to be followed in handling load
- Safe load path
- Other precautions

RG 1.206, Section C.I.9.1.5 provides a list of criteria to be included in the COL FSAR when describing the heavy load handling program. One item in RG 1.206 for the COL applicant to provide is a listing of all heavy loads and heavy load handling equipment outside the scope of loads described in the referenced certified design and the associated heavy load attributes (load weight and typical load paths). The staff was unable to locate this list of equipment in the COL FSAR. If equipment does exist outside the scope of certified design, RG 1.206 also requests that a safety evaluation for heavy loads outside the scope of loads described in certified design that are handled by non-single-failure-proof handling systems.

The COL applicant provided a paragraph titled, "Procedures," in COL FSAR Section 9.1.5.2.5 to address the portion of the COL information item for providing site specific procedures for overhead heavy load handling. The Procedures paragraph in COL FSAR Section 9.1.5.2.5 provided a detailed outline of information that will be included in the heavy load handling procedures. COL FSAR Section 9.1.5.2.5 also contained a commitment to develop procedures for heavy load lifts in the vicinity of irradiated fuel or safe-shutdown equipment prior to fuel load. The staff finds the details included in COL FSAR Section 9.1.5.2.5 meet the acceptance criteria of SRP Section 9.1.5. However, in RAI 132, Question 09.01.05-1, the staff requested that the COL applicant provide additional details regarding the list of equipment specified in RG 1.206.

In an August 20, 2009, response to RAI 132, Question 09.01.05-1, the COL applicant indicated that there are no additional site specific heavy loads or heavy load handling equipment in buildings within the scope of the certified design. It was also stated that some site specific buildings housing equipment that provide an essential safety function contain handling equipment that is rated for heavy loads. The COL applicant stated that these handling systems are part of detailed design work and a listing of the site specific loads, load handling systems, and load attributes (load weight and typical load paths) is not yet available. The COL applicant proposed to add a commitment in COL FSAR Section 9.1.5.2.5 to ensure the heavy load handling procedures address identification of any heavy loads and heavy load handling equipment outside the scope of the loads described in the U.S. EPR FSAR and associated heavy load attributes (load weight and typical load paths). As indicated in the COL FSAR, these procedures will be developed prior to fuel load. The staff finds this acceptable, because the additional commitment is in accordance with the guidance of RG 1.206 and SRP Section 9.1.5. The additional portion incorporated into the handling procedure reduces the probability and mitigates the consequences of an accidental load drop that could adversely affect essential safety functions.

COL FSAR Section 9.1.5.2.5 also included an additional paragraph titled “Inspection and Testing” describing the inspection, test, and maintenance in accordance with ASME B30.2. SRP Section 9.1.5 contains guidance for cranes to be inspected, tested, and maintained prior to use, in accordance with ASME B30.2-2005, Section 2-2. COL FSAR Section 9.1.5.2.5 included an exception that indicated tests and inspections may be performed prior to use for infrequently used cranes. ASME B30.2-2005, Section 2-2.1.4 specifies that cranes that are used in infrequent service should be inspected prior to being placed into service. In RAI 132, Question 09.01.05-2, the staff requested that the COL applicant provide a justification for this exception.

In an August 20, 2009, response to RAI 132, Question 09.01.05-2, the COL applicant proposed to remove the exception that specified a test and inspection may be performed prior to use of infrequently used cranes and only reference ASME B30.2 for test and inspection criteria. The OHLHS is designed in accordance with ASME B30.2, and B30.2, Section 2.2 includes specific guidelines for inspection of infrequently used cranes prior to being placed in service. The staff finds this change acceptable, because the use of ASME B30.2 conforms to the U.S. EPR FSAR and meets the guidance of SRP Section 9.1.5 for safe operation of OHLHS.

In COL FSAR Section 9.1.5.2.5, the COL applicant stated that the quality assurance (QA) program described in COL FSAR Section 17.5, “Quality Assurance Program Guidance” is applicable to the heavy loads handling program.

In the process of reviewing COL FSAR Section 13.5.1.1.5 and COL FSAR 9.1.5.2.5, the staff noticed an inconsistency in the edition of ASME B30.2. COL FSAR Section 13.5.1.1.5 specified that personnel involved in crane operation shall be qualified to American National Standards Institute (ANSI) B30.2-1976. However, COL FSAR Section 9.1.5.2.5 referred to the 2005 edition of ASME B30.2. Therefore, in RAI 132, Question 09.01.05-3, the staff requested that the COL applicant address this inconsistency.

In an August 20, 2009, response to RAI 132, Question 09.01.05-3, the COL applicant stated that the COL FSAR will be revised to reflect the 2005 version of B30.2 to resolve the inconsistency between the ASME code revisions. The staff finds the use of ASME B30.2-2005 acceptable, because the 2005 version of B30.2 conforms to the guidance of SRP Section 9.1.5 for heavy load handling.

9.1.5.5 *Post Combined License Activities*

There are no post COL activities related to this section identified in of the U.S. EPR FSAR Tier 2, Table 1.8-2. However, COL FSAR Section 9.1.5.2.5 contains a commitment stating that “Administrative procedures to control heavy loads shall be developed prior to fuel load to allow sufficient time for plant staff familiarization, to allow NRC staff adequate time to review the procedures, and to develop operator licensing examinations.”

9.1.5.6 *Conclusion*

The staff reviewed the COL application and checked the referenced design certification FSAR. The staff confirmed that the COL applicant addressed the required information relating to site specific information on the heavy load handling program, and there is no outstanding information expected to be addressed in the COL FSAR related to this section.

The staff is reviewing the information in the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the OHLHS incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR is not yet complete. The staff will update this Chapter 9 of this report to reflect the final disposition of the design certification application.

The staff evaluated the Overhead Heavy Load Handling System for the COL FSAR, Revision 9 in accordance with the guidance that is referred to in the Regulatory Evaluation Section. This section of the report includes compliance with GDC 4, and the guidance established in SRP Section 9.1.5 and RG 1.206. The staff finds that with the exception of the two remaining confirmatory items previously noted the CCNPP Unit 3 COL application as described under COL FSAR Section 9.1.5 is acceptable and that all the applicable COL Information Items and Interface Requirements have been adequately addressed.

9.2 Water Systems

9.2.1 Essential Service Water System

9.2.1.1 *Introduction*

U.S. EPR FSAR Tier 2, Section 9.2.1, provides description for essential service water system (ESWS). In COL FSAR Section 9.2.1, "Essential Service Water System," for CCNPP Unit 3, the COL applicant incorporates by reference U.S. EPR FSAR Tier 2, Section 9.2.1, "Essential Service Water System."

9.2.1.2 *Summary of Application*

COL FSAR, Revision 9, Section 9.2.1 incorporates by reference U.S. EPR FSAR Tier 2, Revision 4, Section 9.2.1 with no departures.

U.S. EPR COL Information Item 9.2-4

> A COL applicant that references the U.S. EPR design certification will provide a description of materials that will be used for the essential service water system (ESWS) at their site location, including the basis for determining that the materials being used are appropriate for the site location and for fluid properties that apply.

Supplemental Information

In COL FSAR Section 9.2.1.1, "Design Bases," the COL applicant provided additional information.

> The ESW System is designed to permit periodic inspection of components necessary to maintain the integrity and capability of the system to comply with 10 CFR 50 Appendix A, General Design Criterion 45.

In COL FSAR Section 9.2.1.3.5, "Piping, Valves, and Fittings," the COL applicant provided additional information to resolve COL Information Item 9.2.4. The following is a summary of this additional information.

- The ESWS piping, valves, and fittings are made of carbon steel. This is compatible with the water chemistry in the ultimate heat sink (UHS) tower basin. Buried piping is coated and wrapped and provided with appropriate cathodic protection. Appropriate chemical treatment is used to maintain the quality of water in the basin at an acceptable level to reduce corrosion, scaling, etc., of ESWS components during normal operation.

- Under normal operation the ESWS is exposed to desalinated water treated with corrosion inhibitors. During a post-design-basis accident (DBA) scenario, the ESWS may be exposed to brackish water if the non-safety related source of desalinated water is unavailable from 72 hours to 30 days after the DBA.

- Above ground ESWS piping, valves, and fittings are made of bare carbon steel (internally) having corrosion allowances.

- The buried portion of 25.4 cm (10 inch (in.)) diameter ESW system piping and fittings is constructed of carbon steel with two-layer fusion bonded epoxy internal lining, in accordance with the recommendation of ANSI/American Water Works Association (AWWA) C213, and installed a qualified installation program. The buried portion of 76.2 cm (30 in.) diameter ESW system piping and fittings is constructed of carbon steel internally lined with mortar using Type II cement per American Society for Testing and Materials (ASTM) C 150, in accordance with the recommendation of ANSI/AWWA C205, and installed with a qualified installation program. For both 25.4 cm and 76.2 cm (10 in. and 30 in.) diameter ESW piping, appropriate external coating (e.g., epoxy) is also used to protect from external corrosion.

- The buried piping with appropriate internal lining (e.g., 2-layer fusion-bonded epoxy, Type II cement) that is exposed to normal operating condition desalinated ESWS water quality, with corrosion inhibitors in the buried piping is not expected to have any detrimental corrosive effects on the ESWS over the 60-year design life. Appropriate internal lining (e.g., 2-layer fusion-bonded epoxy, Type II cement) exposed to the Chesapeake Bay water quality during the 30-day DBA scenario is not expected to have any detrimental effects, even without the chemical treatment. Additionally, exterior surfaces of both 25.4 cm and 76.2 cm (10 in. and 30 in.) diameter buried piping exposed to soil shall be cathodically protected.

In COL FSAR Section 9.2.1.6, "Inspection and Testing Requirements," the COL applicant provided additional information. The following is a summary of this additional information.

- Inservice inspection of the ESW System including piping, valves, pumps, and components is performed in accordance with the requirements of ASME. The installation and design of the ESW System provides accessibility for the performance of periodic inservice inspection. The frequency of inservice inspection, via flow or pressure tests to ensure system integrity beyond the ASME Code requirements.

Supplemental information addressing the Post-DBA UHS makeup keep fill line and ESW pump margin is addressed in Section 9.2.5.4.2.3.5 of this report. (Reference RAI 332,

Question 09.02.05-22) The proposed COL FSAR Section 9.2.1.2 change is also addressed in Section 9.2.5.4.2.3.5 and this departure is addressed in Section 9.2.5.2 of this report.

9.2.1.3 *Regulatory Basis*

The relevant requirements of NRC regulations for this area of review, and the associated acceptance criteria, are specified, for the most part, in NUREG-0800, Section 9.2.1, “Essential Service Water,” Revision 5, and are summarized below. Review interfaces with other Standard Review Plan (SRP) sections can also be found in NUREG-0800, Section 9.2.1.

1. GDC 2, “Design Basis for Protection Against Natural Phenomena,” as it relates to the capabilities of structures housing the system and the system itself having the capability to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of safety related functions.

2. GDC 4, “Environmental and Dynamic Effects Design Bases,” as it relates to effects of missiles inside and outside containment, effects of pipe whip, jets, environmental conditions from high- and moderate-energy line-breaks, and dynamic effects of flow instabilities and attendant loads (e.g., waterhammer) during normal plant operation, as well as upset or accident conditions.

3. GDC 5, “Sharing of Structures, Systems, and Components,” as it relates to the requirement that structures, systems, and components (SSCs) important to safety not be shared among nuclear power units unless it can be shown that sharing will not significantly impair their ability to perform their safety functions.

4. GDC 5, “Cooling Water,” as it relates to the capability to transfer of heat from structures, systems, and components important to safety to an ultimate heat sink during both normal and accident conditions, with suitable redundancy, assuming a single active component failure coincident with either the loss of offsite power or loss of onsite power.

5. GDC 45, “Inspection of Cooling Water System,” as it relates to design provisions for inservice inspection of safety related components and equipment.

6. GDC 46, “Testing of Cooling Water System,” as it relates to design provisions for pressure and operational functional testing of cooling water systems and components with regard to the following:

   - Structural integrity and system leak-tightness of its components

   - Operability and adequate performance of active system components

   - Capability of the integrated system to perform credited functions during normal, shutdown, and accident conditions

7. 10 CFR 52.47, “Contents of applications, technical information,” Item (b)(1), as it relates to the requirement that the proposed ITAAC that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a facility that incorporates the design certification has been constructed and will be operated in conformity with the design certification, the provisions of the Atomic Energy Act of 1954, and NRC regulations.

8. 10 CFR 52.80, "Contents of applications; technical information," Item (a), as it relates to the requirements that a COL application contain the proposes inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, test, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act of 1954, and NRC regulations.

9. 10 CFR 20.1406, "Minimization of Contamination," as it relates to the standard plant design certifications and how the design and procedures for operation will minimize contamination of the facility and the environment facilitate eventual decommissioning and minimize to the extent practicable, the generation of radioactive waste.

Acceptance criteria adequate to meet the above requirements include:

- RG 1.29, "Seismic Design Classification," March 2007 (Seismic Design Criteria), Regulatory Position C.1 for safety related and Regulatory Position C.2 for non-safety related portions of the ESWS.

9.2.1.4 *Technical Evaluation*

The staff reviewed COL FSAR, Revision 9, Section 9.2.1 and checked the referenced design certification FSAR. The staff confirmed that the information contained in the COL application and incorporated by reference addresses the relevant information related to the ESWS. U.S. EPR FSAR Tier 2, Section 8.2.1 is being reviewed by the staff under Docket No. 52-020. The staff's technical evaluation of the information incorporated by reference related to the ESWS will be documented in the corresponding safety evaluation.

COL Information Item

As stated above, in COL FSAR Section 9.2.1, the COL applicant provided additional information to address COL Information Item 9.2.4 related to ESWS materials.

The staff reviewed the supplemental information related to GDC 45 and inspection testing requirements and finds the supplemental information acceptable. Inservice inspection of the ESW System including piping, valves, pumps and components is performed as indentified in COL FSAR Section 6.6 in accordance with the requirements of ASME Section XI and ASME Operations Manual (OM) Code. The installation and design of the ESW System provides accessibility, as described in COL FSAR Section 6.6.2, for the performance of periodic inservice inspection. The frequency of inservice inspection, via rate of pressure loss or the change in flow rate, for buried piping segments is described in COL FSAR Section 6.6.4, to ensure system integrity beyond the ASME Section XI Code requirement and will be performed at a 4 year frequency.

Section 6.6 of this report provides further information related to inservice inspections of Class 3 components.

The staff finds the COL Information Item related to material, acceptable. Carbon steel piping materials are typical industry acceptable safety related materials; however, over time the piping system could degrade due to potential corrosion, and the inside diameter may begin to

decrease due to biofouling. Coating and wrapping of exterior of the buried ESWS piping, along with the material selected above for the cooling tower, tower fill, spray piping, and tower nozzles are all appropriate. However, related to post-DBA and the lack of chemical treatment in the basin, the COL applicant stated that corrosive effects of the Chesapeake Bay water on the ESWS piping and components have been evaluated and determined to have a negligible effect on the ability of the ESWS to perform its safety function for a short term operation post-DBA. In RAI 277, Question 09.02.01-3, the staff requested that the COL applicant describe in the COL FSAR and provide an explanation to support this statement that chemical treatment is not necessary from 72 hours post-DBA out though 30 days.

In a May 3, 2011, response to RAI 277, Question 09.02.01-3, the COL applicant provided the following:

> COLA FSAR Section 9.2.1.3.5 will be revised to provide a justification that no chemical treatment is required in the ESWS from 72 hours post-design-basis accident through 30 days.
>
> The FSAR markup for 9.2.1.3.5 states that under normal operation, the ESWS is exposed to desalinated water treated with corrosion inhibitors. During post-DBA scenario, the ESWS may be exposed to brackish water if the nonsafety related source of desalinated water is unavailable from 72 hours to 30 days after the DBA.
>
> Above ground ESWS piping, valves and fittings are made of bare carbon steel (internally) having 2.250 inches corrosion allowance accounting for a period of 60 years (0.24 inches) plus a 30-day DBA scenario the expected loss of wall thickness is approximately 0.002 inches. Therefore, the total loss of wall thickness due to internal corrosion of plain carbon steel is approximately 0.242 inches or less. The selection of carbon steel wall thickness includes additional allowance for corrosion.
>
> For buried portions of the ESWS piping and fittings, carbon steel with appropriate internal lining per the recommendation of ANSI/AWWA C213/ASTM C150, is used with a qualified installation program. Appropriate external coating (e.g. epoxy) is also used to protect from external corrosion. Additionally, exterior surfaces of the buried piping exposed to the soil are cathodically protected. Appropriate internal lining exposed to the Chesapeake Bay water quality during the 30-day DBA scenario is not expected to have any detrimental effects, even without the chemical treatment.

The staff finds the COL applicant’s May 3, 2011, response to RAI 277, Question 09.02.01-3 acceptable since chemical treatment if the ESWS is not needed from 72 hours post-DBA out through 30 days. Under normal operations, the ESWS makeup desalinated water is treated with corrosion inhibitors. Under DBA conditions, brackish water is utilized only if the normal ESWS desalinated water is unavailable. The above ground ESWS is designed with adequate piping corrosion allowances. The buried portions of the ESWS are designed including internally lined and exterior coated piping with cathodic protection. The ESWS piping is not expected to have any detrimental corrosive effects on the ESWS over the 60 year design life. The staff has confirmed that the COL applicant has incorporated the proposed changes in the latest revision of the COL FSAR. Accordingly, the staff considers RAI 277, Question 09.02.01-3 resolved.

Section 9.2.5, Section 9.2.5.4.3, "ESWS/UHW Treatment; COL Interface 9-2 and COL Information Items 9.2-1 and 9.2-9," of this report further describes UHS basin water chemical post-DBA.

The plant chemistry program is further discussed in Section 13.1 of this report. In addition, COL FSAR Section 13.1.1.1.2.10.1, "Engineering," several programs including the inservice inspection (ISI) inservice testing (IST) and Maintenance Rule that monitor material conditions of the ESWS. The staff finds these programs appropriate to maintain the ESWS components for the life of the plant in order for the ESWS to perform its intended functions.

Also, as a follow-up to RAI 224, Question 08.03.01-12, and the cathodic protection system, the staff determined that the COL applicant did not adequately describe this system. Since the COL applicant has taken credit for cathodic protection to provide system longevity and ESWS corrosion protection, the staff determined this cathodic protection system should be adequately described in the COL FSAR. Therefore, in RAI 277, Question 09.02.01-2, the staff requested that the COL applicant address this issue.

In a May 3, 2011, response to RAI 277, Question 09.02.01-2, the COL applicant provided the following response:

> COLA FSAR Subsection 3.3.1.1 will be revised by adding a description of the Cathodic Protection (CP) System for corrosion protection of underground pipes (including ESWS pipes) in CCNPP Unit 3.

The staff finds the COL applicant's May 3, 2011, response to RAI 277, Question 09.02.01-2 acceptable since the ESWS underground metallic piping system is coated wrapped and will be provided with appropriate cathodic protection system and the details of the cathodic protection system has been added to COL FSAR Section 3.3.1.1. The cathodic protection for the ESWS underground metallic piping system provides system longevity and ESWS corrosion protection. The staff's evaluation of the cathodic protection system is discussed in Section 8.3 of this report. The staff has confirmed that the proposed changes have been incorporated into the most recent version of the COL FSAR. Accordingly, the staff considers RAI 277, Question 09.02.01-2 resolved.

9.2.1.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.2.1.6 *Conclusion*

The staff evaluated the ESWS for the COL FSAR Revision 9 in accordance with the guidance that is referred to in the Regulatory Basis section. This includes compliance with GDC 2, GDC 4, GDC 5, GDC 44, GDC 45, and GDC 46, including 10 CFR 20.1406 and the guidance established in SRP Section 9.2.1. The staff finds the COL application as described under COL FSAR Section 9.2.1.

9.2.2 Component Cooling Water System

The component cooling water system (CCWS) is a closed loop system that functions with the ESWS and the UHS to remove heat generated from safety related and non-safety related components. Heat transferred by these components to the CCWS is transferred to the ESWS

via the component cooling water heat exchangers (CCW heat exchanger). The four independent safety related trains of the CCWS cool the safety related equipment, as required, during all phases of operation. Two non-safety related headers of the CCWS cool the common users located inside the Fuel Building (FB), Reactor Building (RB), Radioactive Waste Building (RWB), and Nuclear Auxiliary Building (NAB).

COL FSAR Section 9.2.2 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.2.2. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in the U.S EPR FSAR Tier 2, Section 9.2.2 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the component cooling water system incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.2.2 of this report to reflect the final disposition of the design certification application.

9.2.3 Demineralized Water Distribution System

As indicated in NUREG-0800, on December 18, 2006, the Demineralized Water Makeup System SRP section was withdrawn, because this system typically has no safety related application. U.S. EPR FSAR Tier 2, Section 9.2.3 indicates that the demineralized water distribution system (DWDS) stores water in the demineralized water storage tanks and delivers it to the plant. The U.S. EPR FSAR states that there are no safety related functions or back-up functions utilizing the system.

COL FSAR Section 9.2.3 of incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.2.3. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in the U.S EPR FSAR Tier 2, Section 9.2.3 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the Demineralized Water Distribution System incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.2.3 of this report to reflect the final disposition of the design certification application.

9.2.4 Potable and Sanitary Water Systems

9.2.4.1 *Introduction*

In the U.S. EPR FSAR, the potable and sanitary water is treated as a single system. The COL applicant stated that, while the function of these systems is the same in the COL FSAR, they are treated as two, independent systems; the potable water system and the sanitary waste water system. Potable water is used for human consumption, sanitation and cleaning, and other process purposes in the nuclear island (NI) and the conventional island (CI). The sanitary waste water system collects waste water discharged from water closets, urinals, showers, sinks, etc., and with the exception of that from sources within the radiologically controlled area (RCA),

directs it to the sewage treatment plant for processing. The sanitary water from sources within the RCA is directed to the liquid radwaste system by the NI vents and drains system.

9.2.4.2 *Summary of Application*

COL FSAR Section 9.2.4 3 incorporates by reference U.S. EPR FSAR Tier 1, Revision 1, Section 9.2.4.

In addition, in COL FSAR Section 9.2.4, the COL applicant provided the following:

COL Information Items:

The COL applicant provided additional information in COL FSAR Section 9.2.4.2.1 to address COL Information Item 9.2-2 from the U.S. EPR FSAR Tier 2, Table 1.8-2 as follows:

> A COL applicant that references the U.S. EPR design certification will provide site specificsite specific details related to the sources and treatment of makeup to the potable and sanitary water system along with a simplified piping and instrumentation diagram.

In the COL FSAR, the COL applicant provided two flow diagrams, Figure 9.2-1, "Potable Water System," and Figure 9.2-2, "Sanitary Waste Water System," which details the potable and sanitary water systems. The COL applicant indicated that the source of water for the potable water system is the desalinization plant with appropriate treatment for the system to which it is being directed. The outflow from the non-radiologically contaminated sanitary systems is to the waste water treatment facility where it is processed into effluent suitable for release into the Chesapeake Bay and sludge which is transferred offsite to a suitable municipal land fill.

Potentially radiologically contaminated fluid is processed through the NI vents and drains system and is handled by the liquid waste management system as indicated in U.S. EPR FSAR Tier 2, Section 11.2, "Liquid Waste Management System."

9.2.4.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the U.S. EPR FSAR.

In addition, the relevant requirements of NRC regulations for the potable and sanitary water systems, and the associated acceptance criteria, are given in NUREG-0800, Section 9.2.4.

The applicable regulatory requirements for the potable and sanitary water system are as follows:

- GDC 60, "Control of releases of radioactive materials to the environment," of 10 CFR Part 50, Appendix A.

9.2.4.4 *Technical Evaluation*

The staff reviewed COL FSAR Section 9.2.4 and checked the referenced design certification FSAR to ensure that the combination of the design certification FSAR and the information in the COL FSAR represents the complete scope of information relating to this review topic. The staff

confirmed that the information contained in the COL application and incorporated by reference addresses the required information relating to this section. U.S. EPR FSAR Tier 2, Section 9.2.4 is being reviewed by the staff under Docket No. 52-020. The staff's technical evaluation of the information incorporated by reference related to the potable and sanitary water systems will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR.

The staff reviewed the information contained in the COL FSAR:

Potable Water System

The CCNPP Unit 3 potable water system is designed to supply potable water throughout the plant for human consumption, cleaning and sanitation, and other domestic and selected process purposes during the peak anticipated demand for potable water during all phases of plant. The COL applicant stated that the potable water system supplies water meets the requirements of local, State and Federal codes and specifications regarding potability. The potable water system includes treatment of incoming water, potable water storage tank, pumps, distribution piping and valves, water heaters, and the appropriate electrical components and instrumentation for monitoring, operation and control of the system.

There are no interconnections with the potable water system and other systems that may potentially carry radiological material. Backflow preventers and isolation valves, and air gaps are provided where appropriate to prevent possible contamination from backflow. Siphon breakers will be included where necessary on supply risers.

Since the potable water system does not contain interconnections to any other system with the potential to carry radiological material, and design features are provided to prevent backflow, the staff finds that GDC 60 is satisfied with respect to preventing contamination by radioactive water.

Sanitary Water System

The CCNPP Unit 3 sanitary water system includes the waste water treatment facility which processes sanitary waste water to prepare it for discharge and disposal. Treated liquid effluent from the waste water treatment facility is discharged through the seal well and discharge structure to the Chesapeake Bay. Dewatered sludge (solids) is transported offsite for disposal at a municipal landfill.

The sanitary water system is separated into two streams based on the potential to contain radioactive material. Potentially radiologically contaminated sanitary waste water from decontamination showers in the Access Building and the laundry facility in the Radioactive Waste Processing Building are collected in the nuclear island vents and drains (the nuclear island vents and drains are discussed in Section 9.3.3 of this report) and directed to the liquid waste processing system (the liquid waste processing system is discussed in Section 11.2 of this report). Waste water from areas outside the radiologically controlled area (non-RCA), including the Access Building, Safeguard Buildings, and hand wash sinks in the Emergency Power Generating Buildings is directed to the waste water treatment facility.

The sanitary waste piping is completely separate from the nuclear island vents and drains system. The COL applicant stated that the portion of the sanitary waste water system that collects domestic waste water in the Access Building, the Safeguard Buildings, and outside

(underground) areas in the nuclear island is not connected to any other system. Therefore, there would be no potential for inadvertent contamination with radioactive material. The remainder of the sanitary waste water system is outside the nuclear island portion of the plant, and does not connect to any system or equipment that has the potential to contain radiological contamination.

Potentially contaminated sanitary waste water from decontamination showers, decontamination sinks, and the laundry is directed to the liquid waste management system, through the nuclear island vents and drains system. The sanitary waste piping is separated from the nuclear island vents and drains system, and the portion outside the nuclear island does not have any interconnections with any systems or equipment that have the potential to contain radiological contamination. Therefore, the staff finds that GDC 60 is satisfied with respect to preventing contamination of the sanitary waste system by radioactive water.

The staff reviewed the information provided by the COL applicant to address COL Information Item 9.4.2.1 discussed above and finds the information adequate. Specifically, the inclusion of COL FSAR Figures 9.2-1 and 9.2-2 and the identification of the source of potable water as the desalinization plant satisfy the COL information item. The staff finds this acceptable.

9.2.4.5 *Post Combined License Activities*

There are no Post COL Activities related to this section.

9.2.4.6 *Conclusions*

The staff reviewed the COL application and checked the referenced design certification FSAR. The staff review confirmed that the COL applicant addressed the required information relating to potable and sanitary water systems, and there is no outstanding information expected to be addressed in the COL FSAR related to this section.

The staff is reviewing the information in the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the potable and sanitary water systems incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR is not yet complete. The staff will update this SER to reflect the final disposition of the design certification application.

The staff finds that sufficient information was provided by the COL applicant to conclude that the proposed design is acceptable. This conclusion was based on demonstration of compliance with GDC 60 with respect to preventing contamination of the potable and sanitary water system by radioactive water.

9.2.5 Ultimate Heat Sink

9.2.5.1 *Introduction*

COL FSAR Section 9.2.5, "Ultimate Heat Sink," describes the UHS for the CCNPP Unit 3. The UHS functions to dissipate heat rejected from the ESWS during normal operating, accident, and shutdown conditions. The UHS includes four independent, redundant, safety related, dual cell mechanical draft cooling towers and four cooling tower basins. Each cooling tower basin is

sized to provide for a minimum 72-hour supply of water for the ESWS without makeup during DBA conditions.

Normal make-up water sources from the raw water supply system (RWSS) ensure the 72-hour water supply is maintained during normal operations. Emergency make-up water sources provide additional water supply to the basin for up to 30 days following an accident. The basin and makeup sources (emergency and normal) provide the cooling water source for the ESWS. One of the four cooling towers (division four) can also function to remove heat from the non-safety related dedicated ESWS division for severe accidents. In the event two UHS divisions are lost (considering preventative maintenance in one division and a single failure in another division), the remaining two UHS divisions have the ability to achieve the safe shutdown state under a design-basis accident as each UHS division is sized to handle 50 percent of the required cooling capacity. The system interface heat loads include the CCWS heat exchangers, emergency diesel generator (EDG) heat exchangers, ESW pump room coolers, the dedicated component cooling water heat exchanger, and the dedicated ESW pump room cooler. Each safety related division is powered by a Class 1E electrical bus with emergency power from an EDG.

ESWS and RWSS are described in Sections 9.2.1 and 9.2.9, respectively of this report.

9.2.5.2 *Summary of Application*

COL FSAR, Revision 4, Section 9, incorporates by reference U.S. EPR FSAR Tier 2, Section 9.2.5, "Ultimate Heat Sink," with two departures. In addition, in the COL FSAR Section 9.2.5, the COL applicant provided supplemental information to better describe site specificsite specific design features and to address any U.S. EPR FSAR COL information items. Conceptual design information that was part of the U.S. EPR FSAR is also addressed. These COL information items are shown below.

- U.S. EPR FSAR Tier 2, Table 1.8-1, "Summary of U.S. EPR Plant Interfaces with Remainder of Plant"

  <u>U.S. EPR Interface Item 9-2</u>

  > Provide support systems such as makeup water, blowdown and chemical treatment (to control biofouling) for the UHS. To be addressed under Section 9.2.5

- U.S. EPR FSAR Tier 2, Table 1.8-2, "U.S. EPR Combined License Information Items"

  <u>COL Information Item 9.2-1</u>

  > A COL applicant that references the U.S. EPR design certification will provide site specific information for the UHS support systems such as makeup water, blowdown, and chemical treatment (to control biofouling). To be addressed under Section 9.2.5.2.

  <u>COL Information Item 9.2-5</u>

  > A COL applicant that references the U.S. EPR design certification will provide a description of materials that will be used for the UHS at their

site location, including the basis for determining that the materials being used are appropriate for the site location and for the fluid properties that apply. To be addressed under Section 9.2.5.2.

COL Information Item 9.2-6

A COL applicant that references the U.S. EPR design certification will confirm by analysis of the highest average site specificsite specific wet bulb and dry bulb temperatures over a 72-hour period from a 30- year hourly regional climatological data set that the site specificsite specific evaporative and drift losses for the UHS are bounded by the values presented in Table 9.2.5-3. To be addressed under Section 9.2.5.3.3.

COL Information Item 9.2-7

A COL applicant that references the U.S. EPR design certification will confirm that the site characteristic sum of 0% exceedance maximum non-coincident wet bulb temperature and the site specific wet bulb correction factor does not exceed the value provided in Table 9.2.5-2. If the value in Table 9.2.5-2 is exceeded, the maximum UHS cold-water return temperature of 95°F is to be confirmed by analysis (see Section 9.2.5.3.3). To be addressed under Section 9.2.5.3.1.

COL Information Item 9.2-8

A COL applicant that references the U.S. EPR design certification will confirm that the site specific UHS makeup capacity is sufficient to meet the maximum evaporative and drift water loss after 72 hours through the remainder of the 30-day period consistent with RG 1.27. To be addressed under Section 9.2.5.3.3.

COL Information Item 9.2-9

A COL applicant that references the U.S. EPR design certification will compare site specific chemistry data for normal and emergency makeup water to the parameters in Table 9.2.5-5. If the specific data for the site fall within the assumed design parameters in Table 9.2.5-5, then the U.S EPR standard design is bounding for the site. For site specific normal and emergency makeup water data or characteristics that are outside the bounds of the assumptions presented in Table 9.2.5-5, the COL applicant will provide an analysis to confirm that the U.S. EPR UHS cooling towers are capable of removing the design basis heat load for a minimum of 30 days without exceeding the maximum specified temperature limit for ESWS and minimum required basin water level. To be addressed under Section 9.2.5.2.

COL Information Item 9.2-10

A COL applicant that references the U.S. EPR design certification will perform an evaluation of the interference effects of the UHS cooling tower on nearby safety related air intakes. This evaluation will confirm that

potential UHS cooling tower interference effects on the safety related air intakes does not result in air intake inlet conditions that exceed the U.S. EPR Site Design Parameters for Air Temperature as specified in Table 2.1-1. To be addressed under Section 9.2.5.3.1.

COL Information Item 9.2-11

A COL applicant that references the U.S. EPR design certification will confirm that the maximum UHS cold-water return temperature of 95 °F is met by an analysis that confirms that the worst combination of site specific wet bulb and dry bulb temperatures over a 24-hour period, from a 30-year hourly regional climatological data set, is bounded by the values presented in Table 9.2.5-4. To be addressed under Section 9.2.5.3.3.

- COL FSAR Section 9.2.5 and COL FSAR Figure 9.2.5-3, “Normal Makeup, Emergency Makeup, Blowdown & Chemical Treatment”; COL FSAR Figure 9.2-4, “General Area - UHS Makeup Water and CW Intake Structures”; COL FSAR Figure 9.2-5, “UHS Makeup Water Intake Structure - Plan View at Elevation 11’-6”; and COL FSAR Figure 9.2-6, “UHS Makeup Water Intake Structure - Section View at Elevation 26’-6,” set forth the design basis and a detailed description of the UHS. Each safety related UHS cooling tower division contains two cooling tower cells, with a multi-speed vital bus powered fan, a tower basin shared between cells, and basin support design features. The support features provide the capabilities for basin blowdown (BD), safety related emergency basin makeup, non-safety related normal makeup, and chemical addition.

COL FSAR Section 14.2.14.2, “Ultimate Heat Sink (UHS) Makeup Water System,” describes the UHS makeup water system preoperational testing. In addition, COL FSAR Section 14.2.14.3, “Essential Service Water Blowdown System,” and COL FSAR Section 14.2.14.4, “Essential Service Water Chemical Treatment System,” describe the UHS blowdown and chemical treatment testing, respectively.

- COL application, Part 4, Technical Specifications (TS) and Bases

Technical specifications for the UHS are provided in TS Section 3.7.19, “Ultimate Heat Sink (UHS).”

- COL application, Part 7, UHS Departures (#9 and #10)

Departure #9: Post-DBA UHS Keep-Fill line - UHS Makeup Water System (see 9.2.5.4.2.3.5.1 – GDC 44, waterhammer for discussion)

The U.S. EPR Figure 9.2.5-1 does not contain a provision to compensate for the UHS Makeup Water System leakage and maintain the water level in the piping full at all times. The Post-DBA UHS Makeup Keep-Fill line is added to deliver makeup water to the UHS Makeup Water System to compensate for the leakage loss due to pressure boundary isolation valves, and to keep the UHS Makeup Water System piping full of water at all times. Therefore, the ESWS Emergency Makeup Water line piping and the ESW System return line piping are modified.

Departure #10: UHS Makeup Water Pump Starting Logic (see 9.2.5.4.2.3.1 – GDC 44)

The U.S. EPR FSAR Figure 9.2.1-3 contains a pump start permissive based on Cooling tower basin water level. The UHS Makeup Water System at CCNPP Unit 3 is a manually initiated system with no pump start interlocks or permissives based on UHS tower basin water level.

Note: An additional departure related to peak ambient temperature profile was added as a result of RAI 287, Question 09.02.05-19 and is described in Section 9.2.5.4.7 of this report.

- CCNPP Unit 3, Part 10, Inspection, Tests, Analysis, and Acceptance Criteria (ITAAC)

  CCNPP Unit 3, Revision 9, Part 10 - ITAAC, Table 2.4-7, "Ultimate Heat Sink Makeup Water Intake Structure Inspection, Tests, Analysis, and Acceptance Criteria," Table 2.4-22, "Ultimate Heat Sink Makeup Water System Inspection, Tests, Analysis, and Acceptance Criteria," and Table 2.4-28, "Class 1E Emergency Power Supply Components for Site specific Systems System Inspection, Tests, Analysis, and Acceptance Criteria," describe the site specific ITAAC for the UHS makeup water system.

  CCNPP Unit 3, Part 10 – ITAAC, Table 2.4-8, "Buried Conduit and Duct Banks, and Pipe and Pipe Ducts Inspections, Tests, Analyses, and Acceptance Criteria," describes the ESWS and UHS makeup water pipes.

  CCNPP Unit 3, Part 10 – ITAAC, Figure 2.4-1, "Ultimate Heat Sink Makeup Water System Functional Arrangement," provides the UHS makeup water system functional arrangement.

  Mechanical design information is provided in CCNPP Unit 3, Part 10 – ITAAC, Table 2.4-29, "Ultimate Heat Sink (UHS) Makeup Water System Component Mechanical Design," which provides system component physical locations, functions, ASME Code Class, Section III applicability and seismic category.

  Audit #8 - Calculation that support site specific changes related to [U.S.] EPR RAI 351, Question 09.02.05-27; changes to the cooling tower basin volume (2 feet lower) and wet bulb correction faction of 2.5 °F.

9.2.5.3 *Regulatory Basis*

The relevant requirements of NRC regulations for this area of review, and the associated acceptance criteria, are specified for the most part in NUREG-0800, Section 9.2.5, "Ultimate Heat Sink, Revision 3 – March 2007" and are summarized below. Review interfaces with other SRP sections also can be found in NUREG-0800, Section 9.2.5.

1. GDC 2, "Design Basis for Protection Against Natural Phenomena," as it relates to the capabilities of structures housing the system and the system itself having the capability to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of safety related functions.

2. GDC 4, "Environmental and Dynamic Effects Design Bases," as it relates to effects of missiles inside and outside containment, effects of pipe whip, jets, environmental conditions from high- and moderate-energy line-breaks, and dynamic effects of flow

instabilities and attendant loads (e.g., waterhammer) during normal plant operation, as well as upset or accident conditions.

SRP Section 9.2.5 does not specifically address GDC 4 requirements; however, the UHS transfer system is added to comply with the 30 day UHS water system and volume requirements and shall meet the requirements of GDC 4 which is described in SRP Section 9.2.1.

3. GDC 5, “Sharing of Structures, Systems, and Components,” as it relates to the requirement that SSCs important to safety not be shared among nuclear power units unless it can be shown that sharing will not significantly impair their ability to perform their safety functions.

4. GDC 44, “Cooling Water,” as it relates to the capability to transfer of heat from systems, structures, systems, and components important to safety to an ultimate heat sink during both normal and accident conditions, with suitable redundancy, assuming a single active component failure coincident with either the loss of offsite power or loss of onsite power.

5. GDC 45, “Inspection of Cooling Water System,” as it relates to design provisions for inservice inspection of safety related components and equipment.

6. GDC 46, “Testing of Cooling Water System,” as it relates to design provisions for pressure and operational functional testing of cooling water systems and components in regard to;

   - Structural integrity and system leak-tightness of its components

   - Operability and adequate performance of active system components

   - Capability of the integrated system to perform credited functions during normal, shutdown, and accident conditions.

7. 10 CFR 52.80, “Contents of applications; technical information,” Item (a), as it relates to the requirement that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act of 1954, and NRC regulations.

8. 10 CFR 20.1406, “Minimization of Contamination,” as it relates to the standard plant design certifications and how the design and procedures for operation will minimize contamination of the facility and the environment facilitate eventual decommissioning and minimize to the extent practicable, the generation of radioactive waste.

Acceptance criteria adequate to meet the above requirements include:

- RG 1.27, “Ultimate Heat Sink for Nuclear Power Plant”, Revision 2, January 1976

- RG 1.29, "Seismic Design Classification," March 2007, (Seismic Design Criteria), Regulatory Position C.1 for safety related and Regulatory Position C.2 for non-safety related portions of the UHS

9.2.5.4 *Technical Evaluation*

The staff reviewed COL FSAR, Revision 9, Section 9.2.5; COL application, TS (Part 4); COL application, Departures (Part 7); and ITAAC (Part 10) and considered the referenced U.S. EPR design certification. The staff's review confirmed that the information contained in the COL application and incorporated by reference addresses the relevant information related to the UHS. U.S. EPR FSAR Tier 2, Section 9.2.5 is being reviewed by the staff under Docket No. 52-020. The staff's technical evaluation of the information incorporated by reference related to the UHS will be documented in the corresponding SE.

As discussed in the Introduction Section of this report, the UHS consists of four separate safety related trains with one dedicated, non-safety related train for severe accident management. The UHS functions to dissipate heat rejected from the ESWS during normal operating, accident, and shutdown conditions

9.2.5.4.1 Normal Make-up Water to the ESWS (and UHS); COL Interface 9-2 and COL Information Item 9.2-1

This COL information item is related to NRC Regulatory Bases, GDC 2, and GDC 4.

U.S. EPR FSAR Tier 2, Section 9.2.1.3.5, "Piping Valves and Fittings," states that the ESWS normal makeup water isolation valve, 30PED10/20/30/40 AA019, is cycled open and shut as necessary during normal operations to maintain cooling tower basin water level within the established operating band. Upon receipt of a safety injection (SI) signal, the valve shuts automatically, isolating the non-safety related normal makeup water system from the safety related emergency makeup system.

COL FSAR, Section 9.2.5.1, "Design Basis," states that for the two operational cooling tower basins, normal essential service water makeup provides a maximum of 648 gpm (2452.68 Lpm) of desalinated water to replenish ESWS inventory losses due to evaporation, blowdown, and drift, during normal operations and shutdown/cooldown. ESWS cooling tower blowdown discharges up to 61 gpm (231 Lpm) of water to the retention basin to maintain ESWS chemistry. This quantity is based on maintaining ten cycles of concentration in the cooling tower basin.

COL FSAR, Section 9.2.5.2.1, "Normal ESWS Makeup," states that normal ESWS makeup water is provided to the ESWS cooling tower basins using desalinated water from the desalinization plant. COL FSAR Section 9.2.9 provides additional discussion of the raw water supply system and the desalinization plant.

Normal ESWS makeup water is delivered from the desalinization plant to the power block area. A separate line feeds each ESWS division. Each ESWS division's normal makeup line ties into its ESWS emergency makeup line (i.e., UHS makeup water line) through a safety related motor operated valve (MOV) in the ESWS pumphouse at the ESWS cooling tower basin. The tie-in point is inboard of (or downstream of) the UHS makeup water system isolation MOV. The safety related normal makeup water isolation MOV ensures the integrity of the ESWS cooling tower basin and the UHS makeup water system by closing in the event of a DBA.

The staff finds that COL Information Item 9.2-1 and Interface 9-2 (normal makeup water only) are acceptable and the referenced regulations have been met, specifically GDC 2 and GDC 4. The safety related normal makeup water MOV 30PED10/20/30/40AA019 (U.S. EPR FSAR Tier 2, Figure 9.2.5-1) isolation on an accident signal ensures the integrity of the ESWS cooling tower basin and the UHS makeup water system by closing in the event of a DBA. Thus, the non-safety related normal makeup cannot negatively affect the safety related function of providing makeup water to the ESWS/UHS, which is further described in this report.

9.2.5.4.1.1 *ESWS/UHS Blowdown; COL Interface 9-2 and COL Information Item 9.2-1*

This COL information item is related to NRC Regulatory Bases, GDC 2 and GDC 4.

U.S. EPR FSAR Tier 2, Section 9.2.1.3.5 states that the normal blowdown flow path extends from the ESWS supply header just downstream of the debris filter to the plant waste water retention basin. Flow from the ESWS to the retention basin is established when the ESWS normal blowdown isolation valve opens. The valve positions of the ESW normal blowdown isolation valves, 30PEB10/20/30/40AA016, are adjusted from the MCR as necessary during normal operations to maintain ESW water chemistry within established limits. Upon receipt of an SI signal, the ESW normal blowdown isolation valve automatically receives a signal to close.

The cooling tower emergency blowdown system isolation valves, 30PEB10/20/30/40AA003, are motor operated valves capable of being throttled to obtain the desired blowdown flow rate based on water chemistry analysis results. Upon receipt of an SI signal, the cooling tower emergency blowdown system isolation valves automatically receive a signal to close.

COL FSAR Section 9.2.5.2.2, “Blowdown,” states that blowdown from the ESWS cooling tower basins is a non-safety related function. The site specific blowdown arrangement for each ESWS cooling tower basin is a line that runs from the ESWS pump's discharge piping to a header in the yard area where all four blowdown lines join. The header then runs to the waste water retention basin.

The connection at the ESWS pump discharge is made through a safety related MOV that closes automatically in the event of a DBA to ensure ESWS integrity. An alternate blowdown path is provided from the same pump discharge connection through a second safety related MOV in case the normal path is unavailable.

Under normal operating conditions and shutdown/cooldown conditions, the normal blowdown valves automatically modulate blowdown flow from their ESWS trains to the retention basin to help ensure cooling water chemistry remains within established limits.

During a DBA, blowdown flow can be manually controlled from the main control room by adjustment of the safety related MOV.

Based on the staff’s review, the ESWS/UHS blowdown function has been adequately addressed. Blowdown function is not credited for UHS performance over the 30-day DBA period assuming all chemistry parameters are maintained under normal operating conditions prior to the start of a DBA. However, blowdown, which also can control UHS basin water level, can be initiated by operators in the MCR by opening either of the safety related blowdown isolation valves (described in the U.S. EPR FSAR). These valves are powered from Class 1E emergency power from their respective divisions.

The staff finds that COL Information Item 9.2-1 and Interface 9-2 (blowdown) are found acceptable and the referenced regulations have been met, specifically GDC 2 and GDC 4. The safety related blowdown MOVs 30PED10/20/30/40AA003 and AA016 (U.S. EPR FSAR Tier 2, Figure 9.2.5-1) isolation on an accident signal ensures the integrity of the ESWS cooling tower basin and the UHS makeup water system by closing in the event of a DBA. Thus, the non-safety related normal makeup cannot negatively affect the safety related function of providing makeup water to the ESWS/UHS which is further described in this report.

9.2.5.4.2 Safety related UHS Makeup Water (Emergency Makeup Water to the ESWS) and Piping Materials; COL Interface 9-2, COL Information Items 9.2-1 and 9.2-5

These COL information items are related to NRC Regulatory Bases, GDC 2, GDC 4, GDC 5, GDC 44, GDC 45, GDC 46, and 10 CFR 20.1406.

COL Information Item 9.2-5 (piping materials) is discussed in Section 9.2.5.4.2.3.2 of this report.

9.2.5.4.2.1 *GDC 2 and GDC 4*

COL FSAR Section 9.2.5.2.3, "UHS Makeup Water System," states that the emergency makeup water for the ESWS is provided by the site specific, safety related UHS makeup water system that draws water from the Chesapeake Bay. The Chesapeake Bay is channeled through the existing Units 1 and 2 intake channel under the CCNPP Units 1 and 2 baffle wall into the CCNPP Unit 3 inlet area then piped to the CWS and UHS common forebay. The common forebay is shared between the CWS makeup water system and UHS makeup water system. During normal plant operation the maximum flow of water from the CCNPP Unit 3 inlet area is approximately 185,485 Lpm (49,000 gpm) for both the CWS demand and surveillance testing of the UHS Makeup Water. Two buried 1.5 m (60 in.) safety related pipes provide a flow path for Chesapeake Bay water to enter the common forebay. Both pipes are designed to account for head losses in the pipe and provide sufficient flow for the CWS makeup and UHS makeup. Both pipes are normally in operation, however, either pipe can be isolated for maintenance as the other pipe is capable of providing 100 percent flow for CWS makeup and UHS makeup. Due to the head loss through the pipes, the design low water level at the common forebay for the UHS makeup intake is at EL. 3 m (-10.2 ft) NGVD29, which is lower than the predicted minimum low water level in the Chesapeake Bay of -2.26 m (-7.7 ft) NGVD29. The common forebay invert elevation is at -6.63 m (-22.5 ft) NGVD29, which provides ample additional margin in pump submergence during UHS operation with one or two intake pipes. The Chesapeake Bay is the largest estuary in the U.S with a watershed area in excess of 165,700 square km (64,000 square miles (sq mi)). The existing CCNPP Unit 1 and 2 inlet area draws over 7,570,000 Lpm (2 million gpm) of Chesapeake Bay water through the inlet area. With the CCNPP Unit 3 safety related UHS Makeup Water system draw of 5,678 Lpm (1,500 gpm) during a design-basis accident and combined CWS makeup and UHS Makeup Water maintenance testing draw of approximately 185,485 Lpm (49,000 gpm) during normal plant operation, the CCNPP Unit 3 Chesapeake Bay draw will not impact the ability of the bay to provide water through the CCNPP Unit 1 and 2 Intake Forebay to safely bring any unit to an orderly shutdown or cooldown following a design-basis accident.

There are four independent UHS makeup water system trains, one for each ESWS division. Each train has one vertical turbine type wet pit pump, a discharge check valve, a manual isolation valve, a self-cleaning strainer, and a pump discharge isolation MOV (all housed in four separate rooms at the UHS Makeup Water Intake Structure), plus the buried piping running up

to and into the ESWS pumphouse at the ESWS cooling tower basin. The UHS makeup water system isolation MOV is located inside the ESWS pumphouse at the connection to the ESWS cooling tower basin.

The Post-DBA UHS Makeup Keep-Fill line delivers water from the safety related ESW System return line to the UHS Makeup Water System to keep the system piping full of water and replenish the system water losses due to leakage. The Post-DBA UHS Makeup Keep-Fill line runs from upstream of the ESW System return line motor operated isolation valve 30PED10/20/30/40 AA010) at the ESWS cooling tower basin, through safety related isolation valve (30PED10/20/30/40 AA029), safety related check valve (30PED10/20/30/40 AA223), and safety related flow restriction orifice, to the UHS Makeup Water System line upstream of the safety related ESWS Emergency Makeup line motor operated isolation valve(s) (30PED10/20/30/40 AA021). The flow restriction orifice restricts the makeup flow to the UHS Makeup Water System based on the system leakage rate specified by the plant owner. The safety related Post-DBA UHS Makeup Keep-Fill isolation valve(s) are normally opened, and remain opened during post DBA. The Post-DBA UHS Makeup Keep-Fill line check valve(s) will ensure the system's integrity.

In addition, each train has a test bypass line that runs from just upstream of the isolation MOV at the ESWS cooling tower basin, through a safety related valve, to the blowdown line upstream of the blowdown flow meter. The latter safety related valve is normally closed, and will remain closed, providing assurance of UHS makeup water system integrity. The bypass valves are locked closed to provide assurance of the UHS Makeup Water System integrity.

Instrumentation and controls are provided in the main control room (MCR) and remote shutdown station (RSS) for monitoring and controlling individual components and system functions. Switchgear and electrical equipment supplying power to the pump, traveling screen, and MOVs of each train are located in its associated UHS Makeup Water pump room and UHS Makeup Water transformer room. Safety related components of each of the four UHS makeup water system trains are powered by the Class 1E electrical bus for each division and the respective EDG.

COL FSAR Section 9.2.5.3.2 states that the UHS Makeup Water Intake Structure has four bar screens and four dual-flow traveling screens. The screens prevent debris from passing into the UHS Makeup Water System. The traveling screens are equipped with a safety related Seismic Category I screen wash system. The UHS Makeup Water pumps provide a high pressure spray to remove debris from the traveling screens. The traveling screens are sized to resist high flow-induced loading to the screens, which includes a full 3 m water column (w.c.) (9.8 ft) static differential head across the screens, a starting head differential of 2 m w.c. (6.6 ft w.c.) by the screen driver, and a full 1 m w.c. (3.3 ft w.c.) dynamic differential across the screen during screen operation. These traveling screens are classified as safety related and are designed as Seismic Category I. The structure housing the traveling screens will protect them from natural phenomena, such as earthquakes, tornados, hurricanes, floods, and external missiles. The concrete UHS Makeup Water Intake structure also provides separation between the screens for each of the four divisions. During normal operation, the traveling screens are powered from the Normal Power Supply System. Backup (Class 1E) power supply is provided to operate the traveling screens post-DBA through the Emergency Power Supply System. The framing of traveling screens and the bars screens are equipped with heat tracing as defense-in-depth to prevent potential ice buildup during freezing water conditions.

The UHS Makeup water traveling screen wash isolation valve, 30PED10/20/30/40 AA005 is closed during normal plant operation. The traveling screen wash isolation valve automatically opens on a differential water level across the screens or on a timer basis, once the UHS makeup pump has established the minimum required pump flow. With the traveling screen wash isolation valve open, pressurized water cleans the traveling screens of debris as the screens rotate. The travelling screen wash isolation valve automatically closed once the differential water level across the screens is at normal operating level or when the timer sequence is completed.

The staff reviewed the UHS design to ensure that it was in compliance with GDC 2 and GDC 4 and that the makeup water structure, bar screens, traveling screens, screen wash, makeup pumps, associated piping, safety related valves are seismically qualified and missile protected. These previously noted components of the UHS are safety related, Seismic Category I as described in COL FSAR Table 3.2-1, "Classification Summary for Site specific SSCs," and COL FSAR Table 3.10-1,"Seismic and Dynamic Qualifications of Mechanical and Electrical Equipment". In addition, the staff notes that the UHS makeup water system piping and valves are in accordance with ASME III, quality group classification C.

The UHS Makeup Water traveling screens are located in a separate room and there is no non-safety related rotating equipment that can initiate a missile. Adequate separation is provided by concrete walls, ceilings and floors that protect the traveling screens from seismic and missile hazards. The non-safety related heating ventilation air conditioning (HVAC) ductwork in pump room is designed as Seismic Category II and will not impact the safety related screen wash system piping in that same area of the ultimate heat sink makeup water intake structure (UHS-MWIS). Two out of the four UHS makeup water system trains are required to support the heat removal from the unit during a DBA; therefore, a failure of one UHS makeup water traveling screen or screen wash system will not impact the ability of the UHS makeup water system to perform its safety function.

The staff reviewed COL FSAR Section 9.2.5 related to GDC 2 and determined that the COL application was incomplete related to addressing ice accumulation on the track racks and travelling screens. Therefore, in RAI 330, Question 09.02.05-20, the staff requested that the COL applicant describe in COL FSAR Chapter 9 the measures in place related to the trash racks and traveling screen heat tracing (COL FSAR 2.4.7.7, "Ice Accumulation on the Intake and ESWS Cooling Tower Basin and Preventive Measures"), in the event that heat tracing fails post-DBA.

In a December 20, 2012, response to RAI 330, Question 09.02.05-20, the COL applicant stated that the heat tracing of the UHS Makeup Water trash racks (bar screens) and traveling screen frame are designed as non-safety related and provide defense-in-depth against the buildup of ice on the traveling screen and bar screens. The UHS Makeup Water Intake Structure is designed such that the water entering the pump bays flows under the skimmer walls, which extend 0.6 m (2 ft) below the design minimum water level of the common forebay. Based on the analysis performed to consider the maximum ice thickness that could form at the CCNPP site using historical air temperature data, the corresponding ice thickness is estimated to be approximately 0.32 m (13 in). This estimate is conservative since the analysis considered a fresh water freezing point of 0 °C (32 °F). This maximum estimated ice thickness of 0.32 m (13 in.) is also conservative to the5.1 cm to 20.3 cm (2 to 8 in.) of ice thickness observed south of the Chesapeake Bay Bridge in early February of 1977, the iciest winter on record for the region. The bar screens in the UHS Makeup Water Intake Structure wall are well below

postulated maximum ice thickness of 0.32 m (13 in.), therefore, surface ice will not impact the flow of makeup water to the pumps. Frazil ice, which starts when surface water becomes super-cooled during turbulent conditions, has not been observed in the intake structure of the existing CCNPP Units 1 and 2 since the start of operation. Additionally, there is no public record of frazil ice obstructing other water intakes in the Chesapeake Bay. This historical information, along with the low velocity of the UHS Makeup Water intakes at less than 0.5 feet per second (fps), will minimize the potential for frazil ice formation on the traveling screens and bar screens. The safety related unit heaters in the traveling screen rooms of the UHS Makeup Water Intake Structure will ensure that the traveling screen rooms are maintained at a minimum temperature of 5 °C (41 °F). During low ambient conditions the traveling screens will be periodically rotated to help restrict icing build up on the screens.

The staff reviewed the COL applicant's December 20, 2012, response to RAI 330, Question 09.02.05-20 and proposed COL FSAR changes to Question 09.02.05-20, Part 9 and finds the response and proposed COL FSAR changes acceptable. Neither frazil ice nor anchor ice have been observed in the CCNPP Units 1 and 2 intake structure since the start of operation. The UHS makeup water intake structure traveling screen room will be maintained by safety related unit heaters for each train, and the screen wash system will operate continuously to provide high pressure spray as required to clean the screen from debris. Non-safety related heat tracing will be applied to the bar screens as a defense-in-depth function to ensure postulated ice build-up does not impact the ability of the system to provide makeup water to the UHS cooling tower basin 72-hours post-DBA. The staff considers RAI 330, Question 09.02.05-20 resolved.

COL FSAR Section 3.9.6.1, "Functional Design and Qualification of Pumps, Valves, and Dynamic Restraints," states that particular attention will be given to flow-induced loading and degraded flow conditions in the UHS Makeup Water System to account for debris, impurities, and contaminants.

COL FSAR Section 9.2.5.3.2 states that the UHS Makeup Water Intake Structure has four bar screens and four dual-flow traveling screens. The screens prevent debris from passing into the UHS Makeup Water System. The traveling screens are equipped with a safety related Seismic Category I screen wash system. The UHS Makeup Water pumps provide a high pressure spray to remove debris from the traveling screens. The traveling screens are sized to resist high flow-induced loading to the screens, which includes a full 3 m w.c. (9.8 ft w.c.) static differential head across the screens, a starting head differential of 2 m w.c. (6.6 ft w.c.) by the screen driver, and a full 1 m w.c. (3.3 ft w.c.) dynamic differential across the screen during screen operation. These traveling screens are classified as safety related and are designed as Seismic Category I. The structure housing the traveling screens will protect them from natural phenomena, such as earthquakes, tornados, hurricanes, floods, and external missiles.

The staff evaluated the adequacy of the screens and finds that the traveling screens are sized to resist high flow-induced loading, which includes static differential head across the screens, a starting head differential by the screen driver, and a full dynamic differential across the screen during screen operation. In addition, the operation of the screens will be initiated based on a differential setting or on a timer basis.

COL FSAR Section 9.2.5.5 states that, as described in COL FSAR Section 3.5.2, the UHS makeup water system buried components, including underground piping, cables, and instrumentation from the UHS makeup water intake structure to the essential service water

pump building are buried at a sufficient depth to withstand the effects of postulated missile hazards.

COL FSAR Section 9.2.3.2 states that leakage rates for boundary isolation valves are based on ASME OM Code 2004 Edition, Subsection ISTC. The design of the UHS makeup water system pump capacity considers the expected valve seat leakage for the boundary isolation valves. Since UHS Makeup pump capacity has significant margin, boundary valve leakage rates are inconsequential.

The staff finds COL Information Items 9.2-1 and 9.2-5 acceptable and the referenced regulations have been met, specifically GDC 2 and GDC 4. These COL information items ensure that UHS makeup system components that are important to safety are properly classified, are capable to withstand the effects of natural phenomena, and are designed against missiles and dynamic effects. Potential icing affecting the UHS makeup water system has been adequately addressed with safety related heating and non-safety related heat tracing.

Design features to mitigate the effects of waterhammer are not described in this subsection, but will be are described under Section 9.2.5.4.2.3.5 below.

9.2.5.4.2.2 *GDC 5*

10 CFR Part 50, Appendix A; GDC 5 states, in part, that the structures, systems, and components important to safety shall not be shared among nuclear power units unless it can be shown that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units.

COL FSAR Section 9.2.5.5 states that the function of the UHS is assured because the UHS makeup water system meets the requirements of GDC 5. COL FSAR Section 3.1.1.5.1, "U.S.EPR Compliance," states that CCNPP Unit 3 shares the following related UHS structures, system and components with CCNPP Units 1 and 2:

Existing Chesapeake Bay intake channel and embayment which consists of the:

- existing CCNPP Units 1 and 2 intake channel that extends 1,380 m (4,500 ft) offshore
- existing embayment that is defined by a deep curtain wall
- CCNPP Unit 3 intake inlet area
- non-safety related CWS Makeup Water Intake Structure; safety related UHS Makeup Water Intake Structure

The structures, systems, and components are designed such that an accident in one unit would not impair their ability to perform their function for any other unit.

COL FSAR Section 9.2.5.2.3 states that the Chesapeake Bay is channeled through the existing CCNPP Units 1 and 2 intake channel, under the CCNPP Units 1 and 2 baffle wall into the CCNPP Unit 3 inlet area, then piped to the CWS and UHS common forebay. The common forebay is shared between the CWS makeup water system and UHS makeup water system. During normal plant operation the maximum flow of water from the CCNPP Unit 3 inlet area is

approximately 185,485 Lpm (49,000 gpm) for both the CWS demand and surveillance testing of the UHS makeup water. The Chesapeake Bay is the largest estuary in the U.S. with a watershed area in excess of 165,700 square km (64,000 sq mi). The existing CCNPP Unit 1 and 2 inlet area draws over 7,570,000 Lpm (2 million gpm) of Chesapeake Bay water through the inlet area. With the CCNPP Unit 3 safety related UHS makeup water system draw of 5,678 Lpm (1,500 gpm) during a design-basis accident and combined CWS makeup and UHS makeup water maintenance testing draw of approximately 185,485 Lpm (49,000 gpm) during normal plant operation, the CCNPP Unit 3 Chesapeake Bay draw will not impact the ability of the bay to provide water through the CCNPP Unit 1 and 2 intake forebay to safely bring any unit to an orderly shutdown or cooldown following a design-basis accident.

The staff reviewed the UHS design to ensure that it complied with GDC 5 and finds it acceptable. The CCNPP Unit 3 intake area is located in a different part of the embayment and separated from the CCNPP Units 1 and 2 intake forebay by the south segment of the CCNPP Units 1 and 2 baffle wall. The CCNPP Unit 3 intake area is a wedge shaped pool area formed by a CCNPP Unit 3 sheet pile wall, the south segment of baffle wall, and the shoreline. Chesapeake Bay water is supplied to the CCNPP Unit 3 intake area from the CCNPP Units 1 and 2 intake channel through the openings below the baffle wall.

The existing CCNPP Unit 1 and 2 inlet area draws over 7,570,824 Lpm (2 million gpm) of Chesapeake Bay water through the inlet area. The CCNPP Unit 3 safety related UHS makeup water system draw of 5678 Lpm (1,500 gpm (less than 0.001 of 2 million gpm)) during a design-basis accident and combined CWS makeup and UHS Makeup Water maintenance testing draw of approximately 185,485 Lpm (49,000 gpm (less than 0.03 of 2 million gpm)) during normal plant operation. The CCNPP Unit 3 Chesapeake Bay draw will not impact the ability of the bay to provide water through the CCNPP Unit 1 and 2 intake forebay to safely bring CCNPP Unit 3 to an orderly shutdown or cool-down following a design-basis accident. Based on the design features of the CCNPP Unit 1 and 2 forebay area and CCNPP Unit 3 intake and the low flow rated required during a DBA, the staff finds that the CCNPP Unit 3 COL application meets the requirements of GDC 5.

The staff's evaluation of GDC 5 as it relates to the UHS is also discussed in Section 3.1 of this report.

The staff finds COL Information Items 9.2-1 and 9.2-5 acceptable and the referenced NRC regulations have been met, specifically GDC 5. CCNPP Unit 3 hydraulically shares the CCNPP Units 1 and 2 intake channel and CCNPP Units 1 and 2 intake forebay. These COL information items ensure that the shared intake and forebay areas from the Chesapeake Bay, that provides cooling water to all three CCNPP units, is adequately designed and the shared areas will not significantly impair their ability to perform their safety function for CCNPP Unit 3.

9.2.5.4.2.3 *GDC 44*

9.2.5.4.2.3.1 *Electrical, Instrumentation and Controls*

COL FSAR Tables 8.1-1, 8.1-2, 8.1-3, and 8.1-4 describe the emergency diesel generator nominal load for each of the four divisions.

COL FSAR Section 9.2.5.2.3 states that safety related components of each of the four UHS makeup water system trains are powered by the Class 1E electrical bus for each division and the respective EDG.

The staff finds that the electrical information in COL FSAR Section 9.2.5 and COL FSAR Tables 8.1-1, 8.1-2, 8.1-3, and 8.1-4 adequate. Safety related components of each of the four UHS makeup water system trains are powered by the Class 1 E electrical bus for each division and the respective EDG. The UHS makeup water system has several MOVs that need to close and are sequenced onto their associated safety bus that is carried by the EDG. In addition, components such as the traveling screen and screen wash pumps (including MOVs); can also be manually loaded to their applicable 1E power source, post-DBA.

COL FSAR Section 9.2.5.7, "Instrumentation Applications," states that safety related Instrumentation and Control (I&C) functions of the UHS Makeup Water System, as well as the local supporting power systems equipment, will be allocated to the Safety Automation System (SAS). The Human Machine Interface (HMI) for monitoring and operating the safety related equipment associated with the UHS Makeup Water System is the Safety Information and Control System (SICS) and the Process Information and Control System (PCIS). The PICS displays and workstations are located in the Main Control Room and Remote Shutdown Stations.

Instrumentation is applied to the ESWS Normal Makeup Water System, UHS Makeup Water System and blowdown, to the extent necessary to monitor essential component conditions and verify real time system performance. This includes limit switches that provide remote position indication for valves. It also includes pressure, temperature and differential pressure sensors that provide local and remote display of system pressure, temperature and flow. In addition, temperature and amperage sensors can be used for indirect flow indication and direct indication of component status. Radiation monitors in the ESWS will detect a potential radiation leak and provide an alarm in the main control room for operator action. System performance can also be assessed using level indication on the cooling tower basins.

System monitoring and system alarms are described in COL FSAR Section 9.2.5.7.1 and 9.2.5.7.2, respectively. In addition, COL FSAR Table 9.2-2 describes the UHS makeup water system alarms.

The staff's review of this section concluded that important instruments (system monitoring parameters) and alarms for monitoring a safety-related system were adequately described including flow instruments, strainer differential pressures, pump operating status, strainer operating status, traveling screen operating status, screen wash flow, travelling screen differential pressures, radiation monitors, MOV positions, heat tracing, MOV positions, and intake structure water level.

To ensure system interactions between the U.S.EPR ESWS and the CCNPP Unit 3 UHS makeup water system the staff assembled a list of essential components in Table 9.2.5-1 of this report to identify any undesired interactions. U.S.EPR FSAR Tier 2, Figure 9.2.5-1, COL FSAR Figures 9.2-3 and 9.2-9 were also utilized in order to assemble this table. Based on the staff's review of the components and valves that automatically open/close, the U.S.EPR design and CCNPP Unit 3 UHS makeup water system are adequately designed. The U.S. EPR valves that change positions during a designed event close as required. The UHS makeup water system is manually initiated by the operators, after 72 hours, post-accident and AA021 modulated to control cooling tower basin water level for the duration post-DBA. The staff notes there are no adverse interactions and the staff finds this UHS and UHS makeup water system design acceptable.

The staff finds that the UHS makeup water system electrical and I&C has been adequately addressed related to GDC 44. Safety related power and safety related I&C has been incorporated into the design for the four independent UHS makeup water system trains and essential components needed to support long term water makeup to the UHS cooling tower. The staff notes that this includes the UHS water makeup pumps, MOVs, strainers, screens, and associated instrumentation and controls. Also included is the water level for the intake structure.

See Section 9.2.5.4.11, "Technical Specifications," of this report for additional description on the forebay water level instrumentation.

See Section 9.2.5.4.2.3.5 of this report for level instrumentation discussion associated with the unfilled conditions of the UHS makeup water system (waterhammer related).

Table 9.2.5-1 UHS Operating Status

Tag Number (30PED10/20/30/40)	Description	Normal Operations Position	SI Signal Position	Accident Position or Function
AP001	UHS makeup pump	Off	N/A	Manual started after 72 hours, post-DBA.
AA001	Pump discharge MOV	Closed	N/A	Closed during pump start, auto. Open based on exceed minimum flow valve, auto. Full closed on pump stop.
AA002	Pump minimum flow MOV	Closed	N/A	Closed during pump start. Auto modulate after pump start to maintain minimum flow. Auto closes after flow established.to basin.
AA006	Pump straining blowdown MOV	Closed	N/A	Cycles open/closed for debris removal.
30PEB10/20/30/40 AA016 (ESWS)	Normal blowdown MOV	Open/closed	Auto close	Closed
30PEB10/20/30/40 AA003 (ESWS)	Emergency blowdown MOV	Closed	Auto close	Throttled as desired (operator controlled)
AA0019	Normal makeup MOV	Open	Auto close	Closed
AA0021	Emergency makeup MOV	Closed	Auto open	Modulate to control UHS basin water level

9.2.5.4.2.3.1.1 COL Application Part 7 Departure #10 (I&C)

U.S. EPR FSAR Tier 2, Figure 9.2.1-3 contains a pump start permissive based on cooling tower basin water level (Lo-Lo-Lo). The UHS Makeup Water System at CCNPP Unit 3 is a manually initiated system with no pump start interlocks or permissives based on UHS tower basin water level.

The staff evaluated the pump start permissive and finds that the UHS Makeup Water System is started manually from the control room within 72 hours for the limiting design-basis accidents. The UHS Makeup Water System is used to provide water to the UHS tower basins to mitigate accidents when the normal UHS makeup system is not available. Operating procedures and operator judgment based on safety related indications and alarms will determine the appropriate timing to initiate the UHS Makeup Water System. The staff finds this departure acceptable.

9.2.5.4.2.3.2 ***RG 1.27 (30 day supply) and COL Information Item 9.2.5 (piping materials)***

COL Information Item 9.2-5 states that a COL applicant that references the U.S. EPR design certification will provide a description of materials that will be used for the UHS at their site location, including the basis for determining that the materials being used are appropriate for the site location and for the fluid properties that apply. This COL information item will be addressed in Section 9.2.5.2 of this report.

RG 1.27 states that the capacity of the sink should be sufficient to provide cooling both for the period of time needed to evaluate the situation and for the period of time need to take corrective action. A period of 30 days is considered adequate for these purposes. In addition, RG 1.27 Section C3, which states, in part, the UHS should consist of at least two highly reliable water sources.

COL FSAR Section 9.2.5.5 states that the UHS water makeup function is assured because the UHS makeup water system meets the requirements RG 1.27.

COL3 FSAR Section 9.2.5.2.3 states that the Chesapeake Bay is channeled through the existing CCNPP Units 1 and 2 intake channel, under the CCNPP Units 1 and 2 baffle wall into the CCNPP Unit 3 inlet area then piped to the CWS and UHS common forebay. The common forebay is shared between the CWS makeup water system and UHS makeup water system. During normal plant operation, the maximum flow of water from the CCNPP Unit 3 inlet area is approximately 185,485 Lpm (49,000 gpm) for both the CWS demand and surveillance testing of the UHS Makeup Water. Two buried 1.5 m (60 in.) safety related pipes provide a flow path for Chesapeake Bay water to enter the common forebay. Both pipes are designed to account for head losses in the pipe and provide sufficient flow for the CWS makeup and UHS makeup. Both pipes are normally in operation, however, either pipe can be isolated for maintenance as the other pipe is capable of providing 100 percent flow for CWS makeup and UHS makeup. Due to the head loss through the pipes, the design low water level at the common forebay for the UHS makeup intake is at EL. 3 m (-10.2 ft) NGVD29, which is lower than the predicted minimum low water level in the Chesapeake Bay of 2.26 m (-7.7 ft) NGVD29. The common forebay invert elevation is at 6.34 m (-22.5 ft) NGVD29, which provides ample additional margin in pump submergence during UHS operation with one or two intake pipes. The Chesapeake Bay is the largest estuary in the U.S. with a watershed area in excess of 165,700 sq km (64,000 sq mi). The existing CCNPP Unit 1 and 2 inlet area draws over 7,570,000 Lpm

(2 million gpm) of Chesapeake Bay water through the inlet area. With the CCNPP Unit 3 safety related UHS Makeup Water system draw of 5,678 Lpm (1,500 gpm) during a design-basis accident and combined CWS makeup and UHS Makeup Water maintenance testing draw of approximately 185,485 Lpm (49,000 gpm) during normal plant operation, the CCNPP Unit 3 Chesapeake Bay draw will not impact the ability of the bay to provide water through the CCNPP Unit 1 and 2 intake forebay to safely bring any unit to an orderly shutdown or cooldown following a design-basis accident.

COL FSAR Sections 9.2.5.2.3 and 9.2.5.3.2 describe materials to be utilized in the UHS. This includes;

- The normal ESWS Makeup Water System isolation valves are safety related MOVs designed to ASME Section III, Class 3 requirements, and made of super austenitic stainless steel, which is compatible with the brackish UHS makeup water.

- The four vertical pumps are designed to ASME Section III, Class 3 requirements, and constructed of super austenitic stainless steel, which is compatible with the brackish UHS makeup water.

- There are four UHS Makeup Water System self-cleaning strainers, one on the discharge side of each UHS Makeup Water pump. These strainers are designed to ASME Section III, Class 3 requirements, and constructed of super austenitic stainless steel, which is compatible with the brackish UHS makeup water.

- The 20.3 cm (8 in.) diameter buried and aboveground UHS Makeup Water System piping and fittings that perform safety functions are designed to ASME Section III, Class 3 requirements, including normal operation and anticipated transient conditions. The piping and fittings are constructed of super austenitic stainless steel, which is compatible with the brackish UHS makeup water.

- The buried portion of the 1.5 m (60 in.) diameter CWS/UHS Makeup Water System piping, which travels from the CCNPP Unit 3 Inlet area to the common CWS/UHS Forebay, is constructed of carbon steel internally lined with mortar using Type II cement per ASTM C 150, per the recommendation of ANSI/AWWA C205, and installed with a qualified installation program. For the buried portion of the 1.5 m (60 in.) diameter CWS/UHS Makeup Water piping, appropriate external coating (e.g., epoxy) is also used to protect from external corrosion.

Since the earlier revisions of COL FSAR Section 9.2.5 did not adequately address COL Information Item 9.2-5, in RAI 287, Question 09.02.05-19, the staff requested that the COL applicant address design conditions related to piping material.

In an April 30, 2013, response to RAI 287, Question 09.02.05-19, the COL applicant stated:

> The Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 Ultimate Heat Sink (UHS) Makeup Water System is a safety related system designed to ASME Code Section III, Class 3 requirements. The system is designed to provide a backup source of makeup water to the UHS Cooling Tower basin starting 72 hours post-accident, when the normal source of makeup water is unavailable and the post-accident basin storage volume requires replenishment. The UHS Makeup Water System is designed to be a wet layup configuration. During plant normal

operation and shutdown/cooldown conditions, the UHS Makeup Water System is in a standby mode. During standby mode, the UHS Makeup Water piping is filled with brackish water from Chesapeake Bay. Considering the potential for performance degradation and subsequent system failure due to silting, erosion, corrosion, and the presence of organisms that may subject the system to microbiological influenced corrosion as well as macro fouling, the UHS Makeup Water System piping, valve, and fitting materials are super austenitic stainless steel. Super austenitic stainless steel is compatible with the brackish water of Chesapeake Bay. The description and basis of the materials used for the UHS Makeup Water System is described in the COLA FSAR Subsection 9.2.5.3.2.

The staff reviewed the COL applicant's April 30, 2013, response to RAI 287, Question 09.02.05-19, related to COL Information Item 9.2-9, and finds the response and proposed COL FSAR changes acceptable. The UHS makeup water system piping components and materials that are in contact with the brackish water of Chesapeake Bay are compatible with the Chesapeake Bay and are super austenitic stainless steel. The staff considers RAI 287, Question 09.02.05-19 resolved for COL Information Item 9.2-5. **RAI 287, Question 09.02.05-19 is being tracked as a confirmatory item** until the next revision of the COL FSAR.

The staff notes that material details of the two 1.5 m (60 in.) diameter pipes which travels from the CCNPP Unit 3 inlet area to the common CWS UHS forebay area was missing from the COL FSAR; therefore, in RAI 333, Question 03.08.04-29, the staff requested that the COL applicant address this issue.

In December 20, 2012, and April 25, 2013, responses to RAI 333, Question 03.08.04-29, the COL applicant stated:

> Design reference information is being added to the FSAR Sections 3.7.3 and 3.8.4. The new design information includes structural geometry and dimensions, key structural elements and descriptions, engineering drawings, tabulation of capacities, and other attributes for Seismic Category I buried duct banks (FSAR Appendix 3E Section 3E.6) and buried piping for the Essential Service Water System (ESWS), UHS Makeup Water System (UHSMWS), and Ultimate Heat Sink Makeup Water Intake Structure (UHS MWIS) (FSAR Appendix 3E Section 3E.5). These are the only site specific systems/structures that employ Seismic Category I buried duct banks and/or buried piping. Designs have been performed using the best industry practice and conservative approach. Also, specific materials for the 60" for the piping system which travels from the Unit 3 inlet area to the common CWS UHS forebay area are included in a proposed FSAR change for Section 9.2.5.3.2. The buried portion of the 60" diameter CWS/UHS Makeup Water System piping is constructed of carbon steel internally lined with mortar using Type II cement per ASTM C 150, per the recommendation of ANSI/ AWWA C205, and installed with a qualified installation program. For the buried portion of the 60" diameter CWS/UHS Makeup Water piping, appropriate external coating (e.g. epoxy) is also used to protect from external corrosion. The buried intake pipes are safety related, seismic category I, quality group C (ASME III, Subsection ND).
>
> The ability to visually inspect the interior lining of ESWS buried 30" diameter and 10" diameter piping will be designed into the system (e.g., vaults with removable

spool pieces, bypass sections). Periodic inspection requirements of interior lining of the buried 30" diameter and 10" diameter piping will be part of an appropriate plant inspection program. The ability to visually inspect the interior of 60" diameter UHS System buried piping (e.g., vaults with removable spool pieces) and provision for dewatering any of the two pipes will be designed into the system during detailed design phase.

The staff detailed review of RAI 333, Question 03.08.04-7 is found in Section 3.8.4 of this report. The staff notes that the safety related and Seismic Category I classification meet the guidance stated in RG 1.27 since this water supply is needed to support accident and decay heat removal for 30 days. Cement lined inside of the piping system provides corrosion protection for the water in the Chesapeake Bay.

The staff finds that the CCNPP Unit 3 design meets Regulatory Guide 1.27, Section C3, which states in part the UHS should consist of at least two highly reliable water sources.

The staff notes that two pipes connecting the UHS makeup system forebay has adequate capacity (two buried 1.5 m (60 in.) diameter safety related pipes). The Atlantic Ocean via the Chesapeake Bay is considered a highly reliable water source. The probability of the loss of function of the Chesapeake Bay is extremely low and the design low water level at the common forebay for the UHS makeup intake is lower than the design low water level in the Chesapeake Bay.

9.2.5.4.2.3.3 *Net Positive Suction Head, Vortex, and Dynamic Head*

COL FSAR Section 9.2.5.1 states that during the post-72 hour design-basis accident condition, the ESWS cooling tower for one train has a maximum evaporative loss of 943 Lpm (249 gpm). To replenish the UHS cooling tower basin losses due to evaporation, system leakages and other losses, starting 72 hours post-accident, the UHS Makeup Water pumps provide makeup water to each operating UHS cooling tower basin at a maximum flow rate of approximately 2835 Lpm (750 gpm), and when the intermittent traveling screen wash system is operating, the makeup flow rate to the basin is reduced to approximately 1930 Lpm (510 gpm).

The staff finds this acceptable since the UHS makeup pumps exceed the maximum evaporative loss with margin. Once placed in service, the system flow rate requirements of 943 Lpm (249 gpm) is well below the capacity of the UHS makeup pumps of 2,835 Lpm (750 gpm). In addition, when the screen wash system is placed in to service, there remains 988 Lpm (261 gpm) between the required and available flow to the cooling tower basin. COL FSAR Section 9.2.5.3.2 states that the minimum water levels in the UHS Makeup Water Intake Structure basin considers minimum submergence requirements to prevent vortex effects and net positive suction head (NPSH) to prevent cavitation of the UHS Makeup Water pump. The minimum available NPSH is approximately 12 m (40.5 ft). The excess margin at the most limiting condition between the available and required NPSH is approximately 9.82 m (33.3 ft). The total developed head (TDH) for the UHS Makeup Water pump is 53.1 m (180 ft). TDH is calculated considering the pressure drop through the piping, valves and components, suction head, and the static head. In order to provide a more conservative result for the UHS Makeup Water pump TDH, a 10 percent margin is included in the calculated value of 53.1 m (180 ft). Water level is continuously measured and monitored by safety related instrumentation in the UHS Makeup Water Intake Structure to initiate proper (automatic or operator initiated) operation of the traveling screen. Hence the minimum water level is maintained for safe pump operation. The design low water level at the UHS Makeup Water pump suction pit is at EL -3.45 m

(-11.7 ft). The minimum water level at the UHS Makeup Water pump suction pit considers a head loss of .44 m (1.5 ft) across the traveling screen.

Additional information provided by the COL applicant in the September 29, 2011, response to RAI 279, Question 09.02.05-9 stated that the minimum water level for the required submergence level to prevent vortex formation based on ANSI/Hydraulic Institute (HI) 9.8.1-1998 is calculated to be 0.63 m (2.08 ft). The required NPSH for the UHS makeup water pumps provided by a prospective vendor is 2.19 m (7.2 ft). The minimum water head above the pump impeller is 2.94 m (9.63 ft) and the minimum available NPSH is calculated to be approximately 12 m (40.5 ft) at the design low water level condition at the UHS makeup water pump suction pit, considering the maximum Chesapeake Bay water temperature.

The staff finds that the NPSH and TDH with respect to the UHS makeup water system pump are adequately addressed. The margin associated with NPSH of 10.45 m (33.3 ft) and 10 percent for TDH ensure safety related makeup water can be provided for up to 30 days following a DBA. The 10 percent margin for TDH is consistent with the U.S EPR SER Section 9.2.1 staff's review and acceptable based on industry practice using engineering judgment. Vortexing formation was also considered and is not limiting due to the designed minimum water level.

The staff finds that the COL applicant has adequately addressed UHS makeup water pump TDH, NSPH, and vortex considerations. As stated above, adequate margins have been incorporated into the design of the system.

9.2.5.4.2.3.4 *Generic Letter 89-13 (flow blockage and fouling)*

COL FSAR, Revision 9, Section 9.2.5.6 states that pursuant to the recommendations included in Generic Letter (GL) 89-13, the design of safety related UHS makeup system considers the potential for capability and performance degradation and subsequent system failure due to silting, erosion, corrosion, protective coating failure, and the presence of organisms that subject the system to microbiological influenced corrosion as well as macro fouling.

To identify and reduce the incidence of flow blockage problems from biofouling near the intake structure and traveling screens, the UHS Makeup intake pipes, traveling screens and pump forebay will be inspected once per refueling cycle to ensure that there is no biological growth, sedimentation and corrosion. Inspection will be performed by either scuba divers or by dewatering the intake structure or by other comparable methods, and fouling accumulations will be removed.

UHS Makeup Water System supplies makeup water to the UHS cooling tower basin starting 72 hours post-accident, as needed. Silting, erosion, corrosion and biological fouling are a concern for normally operating wet systems. However, the UHS Makeup Water System piping is super austenitic stainless steel, which is compatible with the Chesapeake Bay brackish water to prevent erosion and corrosion pitting. Silting and biological fouling are prevented by quarterly flushing of the system.

Routine inspection and maintenance activities as established by the plant procedures identify any degradation and correct performance gaps due to corrosion, erosion, protective coating failure, silting, and biofouling.

The staff finds that the COL applicant has adequately addressed GL 89-13, since the design of the UHS makeup water system considers the potential for capability and performance

degradation due to silting, erosion, corrosion, protective coating failure, and the presence of organisms that subject the system to microbiological influenced corrosion as well as macro fouling. System flushing will take place on a quarterly frequency to ensure an opened water flow path to support the UHS related to biological growth, sedimentation and corrosion. In addition, the UHS makeup water system piping components are made from super austenitic stainless steel which is compatible with the Chesapeake Bay brackish water prevents erosion and corrosion pitting.

Chemical treatment for the ESW/UHS cooling tower basin is further described in Section 9.2.5.4.3 of this report.

9.2.5.4.2.3.5 *Waterhammer Review and Design Features to Prevent Waterhammer*

COL FSAR Section 9.2.5.2.3 states that the UHS Makeup Water system is equipped with UHS Makeup Keep-Fill line and Post- DBA UHS Makeup Keep-Fill line. The UHS Makeup Keep-Fill line delivers makeup water from the site specific non-safety related normal makeup water system to the safety related UHS Makeup Water system to keep the system piping full of water and replenish the system water losses due to leakage.

The UHS Makeup Keep-Fill line runs from upstream of the normal makeup water motor operated isolation valve (30PED10/20/30/40 AA019) at the ESWS cooling tower basin, through safety related isolation valve (30PED10/20/30/40 AA028) and safety related check valve (30PED10/20/30/40 AA222), to the UHS Makeup Water System line upstream of the safety related ESWS Emergency Makeup Water line motor operated isolation valve(s) (30PED10/20/30/40 AA021). The safety related UHS Makeup Keep-Fill isolation valve(s) are normally opened, and remain opened during post-DBA. The UHS Makeup Keep-Fill line check valve(s) will ensure the system's integrity.

The Post-DBA UHS Makeup Keep-Fill line delivers water from the safety related ESW System return line to the UHS Makeup Water System to keep the system piping full of water and replenish the system water losses due to leakage. The Post-DBA UHS Makeup Keep-Fill line runs from upstream of the ESW System return line motor operated isolation valve (30PED10/20/30/40 AA010) at the ESWS cooling tower basin, through safety related isolation valve (30PED10/20/30/40 AA029), safety related check valve (30PED10/20/30/40 AA223), and safety related flow restriction orifice, to the UHS Makeup Water System line upstream of the safety related ESWS Emergency Makeup line motor operated isolation valve(s) (30PED10/20/30/40 AA021). The flow restriction orifice restricts the makeup flow to the UHS Makeup Water System based on the system leakage rate specified by the plant owner. The safety related Post-DBA UHS Makeup Keep-Fill isolation valve(s) are normally opened, and remain opened during post DBA. The Post-DBA UHS Makeup Keep-Fill line check valve(s) will ensure the system's integrity.

In RAI 332, Question 09.02.05-22, which is a follow-up to RAI 279, Question 09.02.05-10, the staff requested that the COL applicant clarify why the UHS description does not adequately consider and address waterhammer vulnerabilities when the system is manually started after the system has been in standby for long periods of time. Specifically, the staff requested that the COL applicant address the design and ASME Code classification of the keep fill subsystems.

In December 20, 2012, and May 17, 2013, responses to RAI 332, Question 09.02.05-22, the COL applicant provided the following response. Note, the COL applicant's response and

proposed changes have been incorporated into Revision 4 of the COL FSAR. This report will only discuss changes as a result of the May 17, 2013 response.

The UHS Makeup Water System safety related SSCs are designed in accordance with ASME Section III, Class 3, and Seismic Category 1 requirements, including the UHS Makeup Keep-Fill line and the Post- Design Basis Accident (DBA) UHS Makeup Keep-Fill line, which are located in the Essential Service Water (ESW) building. The ESW building is designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, and external missiles (GDC-2). The Keep-Fill Line and Post-DBA UHS Makeup Keep-Fill Line safety related manual isolation valves and check valves are designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, and external missiles (GDC- 2).

The UHS Makeup Water System is designed to provide a backup source of makeup water to the UHS cooling tower basin 72 hours post accident and beyond, when the normal source of makeup water is not available. The UHS Makeup Water System is also designed to operate during system performance and functional testing every three months.

The UHS Makeup Keep-Fill line and Post-DBA UHS Makeup Keep-Fill lines are designed to provide makeup water to keep the UHS Makeup Water System full during normal operation and post DBA when the UHS Makeup Water System is in standby.

The UHS Makeup Keep- Fill Line delivers desalinated makeup water from site specific no safety related normal makeup water system, through a safety related manual isolation valve and safety related check valve, to the safety related UHS Makeup Water System. This is to maintain the system full and replenish the UHS makeup water system losses due to valve seat leakage during plant normal operation.

Material of piping, fittings, and valves in this line is super austenitic stainless steel. During the UHS Makeup Water System testing and accident conditions, safety related check valves are provided in the UHS Makeup Keep-Fill line and Post-DBA UHS Makeup Keep-Fill line, to prevent the brackish water from getting into the Normal Makeup Water System and Essential Service Water System lines, respectively. Therefore, manual action is not required for proper system operation and to prevent backflow from the UHS Makeup Water System to the Normal Makeup Water system and Essential Service Water System.

The UHS Makeup Keep-Fill line and Post-DBA UHS Makeup Keep-Fill line are operational during normal plant operation and accident conditions. During normal plant operation, the Normal Makeup Water System and ESWS are at a higher pressure than the UHS (Emergency) Makeup Water System of the operating and non-operating trains. Therefore, the UHS Makeup Water System piping is continuously maintained full of water. To indicate a postulated unfilled condition of the UHS Makeup Water System line, level instrumentation with alarm is provided for each train of the UHS (Emergency) Makeup Water System. CCNPP Unit 3 FSAR Chapter 9, Table 9.2-2 - UHS Makeup Water System Alarm Summary, is updated to include the UHS Makeup Water System full level alarms.

The Post-DBA UHS Makeup Keep-Fill line delivers water from safety related ESW System return line through safety related manual isolation valve, safety related check valve, and flow restricting orifice to the UHS Makeup Water System, to maintain the system full due to postulated valve seat leakage during post DBA operating condition.

The site specific normal makeup water system provides a maximum of 660 gpm (2,498 lpm) of desalinated water to replenish ESWS basin inventory losses due to evaporation, blowdown, and drift, seepage, and ESW System valve leakage. This is a change from the 648 gpm value in Revision 4 of the COL FSAR. The normal makeup water system also provides makeup water to the UHS Makeup Water System to maintain the system line full at all times during normal shutdown/cooldown condition. Since the normal makeup water pump capacity has approximately 130 gpm margin, flow through the UHS Makeup Keep-Fill line, due to UHS Makeup Water System boundary valve leakage, is inconsequential. The safety related ESW System pump provides a maximum of 19,340 gpm (73,210 lpm) to the CCWS heat exchanger, diesel generators heat exchangers, and ESW pump room ventilation Air Handling unit (AHU). Since the ESW pump capacity has approximately 140 gpm margin, flow through the Post-DBA UHS Makeup Keep-Fill line, to maintain UHS Makeup Water System full due to valve seat leakage, is inconsequential. During a DBA, water which passes through the post-DBA UHS Makeup Keep-Fill line is returned to the UHS cooling tower basin through the open ESWS emergency makeup water isolation valve.

CCNPP Unit 3 FSAR Section 9.2.1.2 (Revision 9) will be revised to add:

> The ESWS interfaces the UHS Makeup Water System through the Post-DBA UHS Makeup Keep-Fill Line. The Post-DBA UHS Makeup Water Keep-Fill line provides makeup water to the UHS Makeup Water System through a safety related manual isolation valve, safety related check valve, and a safety related flow restriction orifice.

CCNPP Unit 3 FSAR Section 9.2.5.2.3 will be revised to add:

> During post-DBA operation, the UHS Makeup Water System becomes operational and the UHS Makeup Water System is pressurized by the makeup water pump. The safety related check valve installed in the Post-DBA UHS Makeup Keep-Fill line prevents UHS (emergency) makeup water from flowing into the ESWS. Depending on the differential pressure between the two systems, during post- DBA operation, the safety related check valve may or may not allow ESW water to flow to the UHS Makeup Water System. There is no loss of water from the ESWS during this operation as the ESWS water returns to the cooling tower basin.

The staff reviewed the COL applicant’s response to RAI 332, Question 09.02.05-22 and proposed COL FSAR changes to Question 09.02.05-22, and finds the response and proposed changes acceptable. The staff notes that the UHS Makeup Water System is designed to the ASME Code, safety- Section III, Class 3, and is designed to Seismic Category 1 requirements. In addition, the system is designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, and external missiles (GDC 2). Related to keep fill,

both the ESW pumps and normal makeup pumps have at least 4.29 Lpm (130 gpm) of flow margin to support keep fill operations.

In addition, to indicate a postulated unfilled condition of the UHS Makeup Water System line a level instrumentation with alarm is provided for each train of the UHS (Emergency) Makeup Water System. The staff finds the COL applicant's response to RAI 332, Question 09.02.05-22 acceptable. **RAI 332, Question 09.02.05-22 is being tracked as a confirmatory item** until the next revision of the COL FSAR.

COL FSAR Section 9.2.5.5 states that following the receipt of a safety injection signal, operating procedures and low water level alarms associated with the UHS cooling tower basin will direct operators to start the UHS Makeup Water pumps. The pumps are started manually against the closed motor operated discharge isolation valves. Automatic air release vents are provided to release air at the discharge of the pump to expel any entrapped air. The minimum recirculation valves are opened to ensure that minimum flow required for the pumps is achieved. Once minimum flow through the pumps is achieved, the pump discharge isolation valves are fully opened and the recirculation valves are closed. Once the UHS Makeup Water pumps are started manually, subsequent operations are accomplished automatically to provide flow to the UHS cooling tower basins. The traveling screen wash isolation valves are opened as required to provide high pressure spray water to the traveling screens.

The UHS Makeup Water System will incorporate additional design provisions that minimize the effect of hydraulic transients upon the functional capability and the integrity of the system components. These design features include slow stroke motor-operated isolation valves, automatic air release valves, UHS Makeup Keep-Fill Line and Post-DBA UHS Makeup Keep-Fill Line to maintain the system full at all times, valve control and interlock features that ensure correct valve line up prior to pump start, and discharge isolation valves that open and close with pump start and stop signals.

The staff finds that the UHS makeup water system piping is adequately designed to minimize the effects of waterhammer. The UHS pumps do not automatically start on any accident signal. The UHS makeup water system is designed with automatic air release vents to expel any air which may be trapped during manual startup of the pumps and includes slow stroke motor-operated valves. The recirculation valves are opening to achieve minimum flow and then once minimum flow is achieved, the pump discharge isolation valves are fully opened.
In addition, the UHS Makeup Keep-Fill line and Post- DBA UHS Makeup Keep-Fill line maintain the system full of water so that a waterhammer event and damage as a result of a water hammer is less likely.

Verification for the absences of waterhammer during system startup and testing is described in Section 9.2.5.4.9 of this report.

The staff finds COL Interface 9-2, COL Information Items 9.2-1 and 9.2-5 acceptable and the referenced regulations have been met, specifically GDC 44. These COL information items ensure that UHS makeup system has the capability to support the transfer of heat via adequate water makeup for the UHS, post-accident out to 30 days. The staff notes that the UHS makeup system has suitable redundancy, assuming a single active component failure coincident with either the loss of offsite power or loss of onsite power.

9.2.5.4.2.3.5.1 COL Application, Part 7 Departure #9 (Makeup keep fill from ESWS)

U.S. EPR FSAR Tier 2, Figure 9.2.5-1 does not contain a provision to compensate for the UHS Makeup Water System leakage and maintain the water level in the piping full at all times. The Post-DBA UHS Makeup Keep-Fill line is added to deliver makeup water to the UHS Makeup Water System to compensate for the leakage loss due to pressure boundary isolation valves, and to keep the UHS Makeup Water System piping full of water at all times. Therefore, the ESWS Emergency Makeup Water line piping and the ESW System return line piping are modified.

The staff finds that the CCNPP Unit 3 site specific UHS Makeup Water System wet layup configuration will require the system piping to be full of water at all times to ensure system readiness. Makeup water is required to compensate for UHS Makeup Water System boundary valve leakage. To maintain water level in the piping and provide makeup water to offset valve seat leakage, a tie in point between ESWS Emergency Makeup Water piping and the ESW System return piping is provided. This tie in allows makeup water to enter the UHS Makeup Water System piping.

Since the ESW pump capacity has approximately 530 Lpm (140 gpm) margin, flow through the Post-DBA UHS Makeup Keep-Fill line, to maintain UHS Makeup Water System full due to valve seat leakage, is inconsequential. During a DBA, water that passes through the post-DBA UHS Makeup Keep-Fill line is returned to the UHS cooling tower basin through the open ESWS emergency makeup water isolation valve. The staff finds this departure acceptable.

9.2.5.4.2.4 *GDC 45 and GDC 46*

COL FSAR Section 9.2.5.1 states that the UHS makeup water system is designed to permit periodic inspection of components necessary to maintain the integrity and capability of the system to comply with 10 CFR Part 50, Appendix A, GDC 45.

The UHS makeup water system is designed to permit operational functional testing of safety related components to ensure operability and performance of the system to comply with 10 CFR Part 50, Appendix A, GDC 46.

COL FSAR Section 9.2.5.6, “Inspection and Testing Requirements,” states that the inservice inspection of the UHS Makeup Water System including piping, valves, pumps and components is performed as identified in COL FSAR Section 6.6, in accordance with the requirements of ASME Section XI and ASME OM Code. The installation and design of the UHS Makeup Water System provides accessibility, as described in COL FSAR Section 6.6.2, for the performance of periodic inservice inspection. The frequency of inservice inspection, via flow or pressure tests, for buried piping segments is described in COL FSAR Section 6.6.4, to ensure system integrity beyond the ASME Section XI Code requirement.

Inservice testing of the UHS Makeup Water System including valves, pumps and components, is performed as identified in COL FSAR Section 3.9.6, in accordance with the requirements of the ASME OM Code. The installation and design of the UHS Makeup Water System provides accessibility for the performance of periodic inservice testing. Periodic testing of safety related equipment verifies its structural and leak-tight integrity, availability, and ability to fulfill its safety function. The staff notes that inservice inspection and testing are in accordance with ASME Section XI and ASME OM Code requirements. Refer to U.S EPR FSAR Tier 2 Chapter 16,

Generic Technical Specification Surveillance Requirements (SR) 3.7.19.5 and SR 3.7.19.6 for surveillance requirements that verify continued operability of the UHS Makeup Water System.

COL FSAR Section 6.6.2, "Accessibility," states that the design considerations other than access provisions described in ASME Section XI paragraph IWA-1500 will be needed for specific buried Essential Service Water (ESW) and UHS Makeup Water System components to render inservice inspections practical. In lieu of a visual examination of buried components, the examination requirement shall be satisfied by performing a test that determines the rate of pressure loss or a test that determines the change in flow rate between the isolation valves at each end of the buried piping-segment, in accordance with ASME Section XI, paragraph IWA5244.

COL FSAR Section 6.6.4, "Inspection Intervals," states that testing will be performed to determine the rate of pressure loss or the change in flow rate between the ends of buried components (i.e., to verify any leak) coincident with alternate test cycles of U.S. EPR Generic Technical Specification SR 3.7.8.2 for ESW System and SR 3.7.19.5 for the UHS Makeup Water System. Since most of the piping is buried, for additional assurance of system integrity and availability, testing will be performed at the 4-year frequency, which conservatively bounds the requirements per ASME Section XI, paragraph IWD-2411 and Tables IWD-2411-1 and IWD-2500-1.

The staff finds that GDC 45 and GDC 46 requirements for inspection and testing has been adequate addressed. For GDC 45, the UHS makeup water system is designed to permit periodic inspections. Design considerations will be needed for specific buried UHS makeup water system components to render in-service inspections practical. In lieu of a visual examination of buried components, the examination requirement shall be satisfied by performing a test that determines the rate of pressure loss or a test that determines the change in flow rate between the isolation valves at each end of the buried piping-segment. System leak-testing, since most of the UHS makeup water system piping is buried, will be performed at a 4 year frequency. For GDC 46, TS 3.7.19.6 Surveillance Requirements adequately address that testing will occur in accordance with the IST program to verify the ability to supply emergency makeup water to each UHS cooling tower basin $\geq$ 1135.6 Lpm (300 gpm), which will include valves operations and pump flow. System leak tightness is verified via periodically testing. In addition, the ASME components will be inspected in accordance with COL FSAR Section 3.9.

9.2.5.4.2.5 *Minimization of Contamination 10 CFR 20.1406*

COL FSAR Section 9.2.5.7 states that the radiation monitors in the ESWS will detect a potential radiation leak and provide an alarm in the MCR for operator action.

The staff reviewed the COL applicant's discussion and finds that requirements of 10 CFR 20.1406 are met since the U.S. EPR Design Certification has adequately addressed radiation monitors. The UHS makeup water system, being supplied by the Chesapeake Bay, is not expected to be radioactive. Radiation monitors in the ESWS (downstream of the CCWS heat exchanger) will detect a potential radiation leak and provide an alarm in the main control room for operator actions.

As stated above, that staff finds that, for the UHS makeup water system, the applicable NRC Regulatory Bases, GDC 2, GDC 4, GDC 5, GDC 44, GDC 45, GDC 46, and 10 CFR 20.1406 have been satisfied.

9.2.5.4.3 ESWS/UHS Treatment; COL Interface 9-2 and COL Information Item 9.2-1 and 9.2-9

COL FSAR Section 9.2.5.2.4, "ESWS Makeup Water Chemical Treatment," states that there are chemical additives used in the ESWS cooling towers to reduce scaling and corrosion, and to treat potential biological contaminants, which are added via the normal ESWS piping. The ESW makeup chemical treatment system provides the chemistry control in both instances. The treatment system consists of multiple skid-mounted arrangements, one for each division's ESWS cooling tower. Each skid contains the equipment, instrumentation and controls to fulfill the system's function of both monitoring and adjusting water chemistry. The specific chemicals and addition rates are determined by periodic water chemistry analyses. The chemicals are divided into six categories (biocide, algaecide, pH adjusted, corrosion inhibitor, scale inhibitor and silt dispersant), based on function.

Additions to the ESWS cooling towers are made as necessary on a periodic or continuing basis.

The staff notes that the ESW/UHS cooling tower basin is chemically treated to reduce scaling and corrosion, and to treat potential biological contaminants. Skid mounted equipment is utilized to inject chemicals based on water chemistry analysis. In addition, the emergency UHS makeup water system remains in standby and is subject to the effects of silting, erosion, corrosion, and biological fouling. The UHS makeup water system piping, valves, and fittings material of construction is super austenitic stainless steel, which is compatible with the brackish water from Chesapeake Bay. Additionally, the UHS makeup water system will be completely flushed on a quarterly basis. A chemical treatment system is not required for the UHS makeup water system. The staff finds this acceptable.

Performance degradation related to water quality and GL 89-13 was previously described in Section 9.2.5.4.2.3.4 of this report for the UHS makeup water system.

COL FSAR, Revision 9, Section 9.2.5.6 states that the design of safety related UHS makeup system considers the potential for capability and performance degradation and subsequent system failure due to silting, erosion, corrosion, protective coating failure, and the presence of organisms that subject the system to microbiological influenced corrosion as well as macro fouling.

To identify and reduce the incidence of flow blockage problems from biofouling near the intake structure and traveling screens, the UHS Makeup intake pipes, traveling screens and pump forebay will be inspected once per refueling cycle to ensure that there is no biological growth, sedimentation and corrosion.

UHS Makeup Water System supplies makeup water to the UHS cooling tower basin starting 72 hours post-accident as needed. Silting, erosion, corrosion, and biological fouling are a concern for normally operating wet systems. However, the UHS Makeup Water System piping is super austenitic stainless steel, which is compatible with the Chesapeake Bay brackish water to prevent erosion and corrosion pitting. Silting and biological fouling are prevented by quarterly flushing of the system.

Routine inspection and maintenance activities as established by the plant procedures identify any degradation and correct performance gaps due to corrosion, erosion, protective coating failure, silting and biofouling.

U.S. EPR FSAR Tier 2, Table 9.2.5-5, "Ultimate Heat Sink - Initial Chemistry to be maintained at the Start of a DBA," described the limits of the UHS water. COL FSAR Section 9.2.5.2 states that a COL applicant that references the U.S. EPR design certification will compare site specific chemistry data for normal and emergency makeup water to the parameters in U.S. EPR FSAR Tier 2, Table 9.2.5-5. If the specific data for the site fall within the assumed design parameters in U.S. EPR Tier 2, Table 9.2.5-5, then the U.S. EPR standard design is bounding for the site. For site specific normal and emergency makeup water data or characteristics that are outside the bounds of the assumptions presented in U.S. EPR FSAR Tier 2, Table 9.2.5-5, the COL applicant will provide an analysis to confirm that the U.S. EPR UHS cooling towers are capable of removing the design-basis heat load for a minimum of 30 days without exceeding the maximum specified temperature limit of the ESWS and minimum required basin water level.

COL Information Item 9.2-9 states that a COL applicant that references the U.S. EPR design certification will compare site specific chemistry data for normal and emergency makeup water to the parameters in U.S. EPR FSAR Tier 2, Table 9.2.5-5. If the specific data for the site fall within the assumed design parameters in U.S. EPR FSAR Tier 2, Table 9.2.5-5, then the U.S. EPR standard design is bounding for the site. For site specific normal and emergency makeup water data or characteristics that are outside the bounds of the assumptions presented in U.S. EPR FSAR Tier 2, Table 9.2.5-5. The COL applicant will provide an analysis to confirm that the U.S. EPR UHS Cooling Towers are capable of removing the design-basis heat load for a minimum of 30 days without exceeding the maximum specified temperature limit for ESWS and minimum required basin water level.

Since the earlier revisions of the COL FSAR Section 9.2.5 did not adequately address this COL information item, in RAI 287, Question 09.02.05-19, the staff requested that the COL applicant address design conditions related to site specific chemistry.

In an April 30, 2013, response to RAI 287, Question 09.02.05-19, the COL applicant stated:

> U.S. EPR FSAR Table 9.2.5-5, it was determined that the site specific data for both ESWS normal (desalinated) makeup water and UHS emergency (Chesapeake Bay) makeup water do not fall within the assumed design parameters of U.S. EPR FSAR Table 9.2.5-5 for both normal makeup water and UHS emergency makeup water. Therefore, the site specific UHS Cooling Tower normal and emergency makeup water chemical constituents are not bounded by the values presented in U.S. EPR FSAR Table 9.2.5-5.
>
> The CCNPP Unit 3 UHS Cooling Tower is designed for an initial Total Dissolved Solids (TDS) value of 5,000 ppm, cooling water flow rate of 19,200 gpm, and inlet wet bulb temperature of 81°F. An analysis of the UHS Cooling Tower Basin Chemistry indicated that, for the first 72 hours post DBA, considering no makeup water to the basin, the TDS of the cooling water in the basin will increase from 5,000 ppm to 8,134 ppm. An analysis of the U.S. EPR Ultimate Heat Sink, which is also applicable to Calvert Cliffs Unit 3, indicated that the UHS Cooling Tower basin maximum water temperature for the first 72 hours post DBA does not exceed the 95 °F design cooling water temperature. This analysis considered basin cooling water initial TDS of 5,000 ppm of desalinated water and the worst environmental conditions from the 30-year hourly regional climatological data coincident with maximum heat load to the cooling tower. During this period, makeup water is not provided to the cooling tower. For the CCNPP Unit 3 UHS

Cooling Tower, makeup water will be introduced to the cooling tower basin from the Chesapeake Bay after 72 hours post DBA. An analysis of the UHS Cooling Tower Basin Chemistry indicated that at the end of the thirty days, the TDS concentration of the cooling water in the basin may reach up to 72,460 ppm. This concentration in the cooling water could potentially reduce the thermal performance of the cooling tower. However, an analysis of the U.S. EPR UHS Sizing Criteria indicated that the cooling tower heat load decreases significantly, with no anticipation of increase after the first 6 hours of DBA, and is approximately 33.62% of the maximum heat load after 72 hours post DBA. Based on the analysis performed by the prospective cooling tower vendor, at the end of the thirty days, the cooling tower basin water temperature will remain below 95°F and any impact of the reduced cooling tower thermal performance due to the concentrated TDS levels will be off-set by the reduced heat load on the cooling tower.

An analysis of the UHS Basin Height indicated the minimum water level required for ESW pump NPSH and Vortex Suppression, or minimum pump submergence from the bottom of the cooling tower basin, is 119 inches plus 6 inches for instrumentation uncertainty for the total of 125 inches. Considering the foot print of the UHS Cooling Tower basin is 12,426 ft^2, the available mass of water at this level for ESW pump NPSH and Vortex Suppression is approximately 8,068,000 lbm. An analysis of the UHS Cooling Tower Basin Chemistry during Design Basis Accident (DBA) post 72 hour to 30 days, evaluated the amount of water available in the cooling tower basin every 24 hours after DBA. The mass of water available in the cooling tower at the end of the 72 hours after DBA, without any makeup water from the normal or emergency makeup water system, is 9,111,035 lbm. This mass results in a basin height that is 16 inches higher than the height of water required for ESW pump NPSH and Vortex Suppression. After 72 hours post DBA, makeup water will be provided to the cooling tower basin from the UHS (emergency) Makeup Water System at a flow rate of greater than or equal to 300 gpm. This will increase the cooling tower basin water level due to lower evaporation from the cooling tower.

Therefore, the UHS Cooling Tower Basin water level will not decrease below the minimum required basin water level for the ESW pump NPSH and Vortex suppression. In conclusion, the U.S. EPR UHS Cooling Towers are capable of removing the design basis heat load for a minimum of 30 days without exceeding the maximum specified temperature limit for ESWS and minimum required basin water level.

The staff reviewed the COL applicant's April 30, 2013, response to RAI 287, Question 09.02.05-19, related to COL Information Item 9.2-9, and finds that the response and proposed COL FSAR changes partly acceptable. The COL applicant considered water chemistry as a function of time from the start of the DBA out to 30 days and determined a significant change in total dissolved solids, from 5,000 ppm TDS to 72,460 ppm TDS (or 14.4 times the original allowed ppm value). Thermal performance of the cooling tower was performed by the prospective cooling tower vendor as a function of time, decreasing heat load. It was determined that the cooling tower basin water temperature remains below 35 °C (95 °F) for the 30-day period post-DBA. The impact of the reduced cooling tower thermal performance due to the concentrated TDS levels will be off-set by the reduced heat load on the cooling tower.

However, the staff determined that the COL applicant did not adequately address the cooling tower analysis if a different cooling tower vendor was selected (other than the prospective cooling tower vendor). Therefore, in RAI 393, Question 09.02.05-31, the staff requested that the COL applicant address this issue. Specifically, the staff requested that the COL applicant add an ITAAC (COLA Part 10) to address the final analysis of the cooling tower performance (a report exists) due to degraded water chemistry over a 30-day period and that the cooling tower will be able to remove the required heat load and maintain cooling tower basins temperature below 35 °C (95 °F).

The staff considers the response related to COL Information Item 9.2-9 acceptable. **RAI 287, Question 09.02.05-19 is being tracked as a confirmatory item** to ensure it is incorporated into the next COL FSAR revision. **RAI 393, Question 09.02.05-31 is being tracked as an open item**.

9.2.5.4.4 Climate Data for UHS Cooling Towers; COL Information Items 9.2-6 and 9.2-7

COL Information Item 9.2.6 states that a COL applicant that references the U.S. EPR design certification will confirm by analysis of the highest average site specific wet bulb and dry bulb temperatures over a 72-hour period from a 30-year hourly regional climatological data set that the site specific evaporative and drift losses for the UHS are bounded by the values presented in U.S. EPR FSAR Tier 2, Table 9.2.5-3.

Since the earlier revisions of COL FSAR Section 9.2.5 did not adequately address this COL information item, in RAI 287, Question 09.02.05-19, the staff requested that the COL applicant address design conditions related to evaporative losses (which is dependent on wet bulb and dry bulb conditions) and drift losses.

In an April 30, 2013, response to RAI 287, Question 09.02.05-19, the COL applicant stated:

> The evaporation losses of the CCNPP Unit 3 UHS Cooling Tower are based on meteorological conditions that exist considering the highest average site specific wet bulb and dry bulb temperatures over a 72 hours period from a 30 years hourly regional climatological data set. For the CCNPP Unit 3 UHS Cooling Tower, the worst meteorological conditions resulting in maximum evaporation loss over a 72 hour period are shown in COLA FSAR Subsection 9.2.5.3.3, as a comparison table of U.S. EPR Table 9.2.5-3 and the Calvert Cliffs site specific values of wet bulb and dry bulb temperatures. The U.S. EPR and CCNPP Unit 3 use the same 72 hour period of temperature data to determine maximum evaporation of water from the UHS. Therefore, the worst CCNPP Unit 3 meteorological conditions resulting in maximum evaporation loss of water for the UHS over a 72 hour period are bounded by U.S. EPR FSAR Table 9.2.5-3.
>
> As a result of changes made to the U.S. EPR UHS heat load, drift and evaporation losses were re-calculated using the meteorological conditions in U.S. EPR Table 9.2.5-3. This analysis is the same analysis used for CCNPP Unit 3. Therefore, CCNPP Unit 3 is bounded by the U.S. EPR analysis. The drift loss value is independent of ambient environmental conditions. The analysis of the Ultimate Heat Sink indicates that drift loss from UHS Cooling Tower is 0.005% of the cooling water flow rate. However, consistent with the U.S. EPR FSAR, a conservative number of 0.010% is used to determine the drift loss in the

> CCNPP Unit 3 UHS cooling tower for the first 72 hours post DBA. Therefore, the CCNPP Unit 3 UHS Cooling Tower drift loss over a 72 hours period is bounded by the value presented in U.S. EPR FSAR Table 9.2.5-3.

The staff reviewed the COL applicant's April 30, 2013, response to RAI 287, Question 09.02.05-19, related to COL Information Item 9.2-6, and finds the response and proposed COL FSAR changes acceptable. The COL applicant has considered evaporative losses based on guidance in RG 1.27 related to meteorological conditions for 30 years. In addition, the analyzed drift losses are conservative and are bounding by the value in U.S. EPR FSAR Tier 2, Table 9.2.5-3. The staff calculated drift losses for the first 72 hours of a DBA (ESWS pump flow of 19,340 gpm x 0.0001 ~ 2.0 gpm), which is reasonable with industry practice of 0.000005 drift losses for other similar cooling towers. The staff considers the COL applicant's response to RAI 287, Question 09.02.05-19 related to COL Information Item 9.2-6 acceptable. **RAI 287, Question 09.02.05-19 is being tracked as a confirmatory item** to ensure it is incorporated into the next COL FSAR revision.

COL Information Item 9.2.7 states that a COL applicant that references the U.S. EPR design certification will confirm that the site characteristic sum of zero percent exceedance maximum non-coincident wet bulb temperature and the sites specific wet bulb correction factor does not exceed the value provided in U.S. EPR FSAR Tier 2, Table 9.2.5-2. If the value in U.S. EPR FSAR Tier 2, Table 9.2.5-2 is exceeded, the maximum UHS cold-water return temperature of 35 °C (95 °F) is to be confirmed by analysis (see Section 9.2.5.3.3 of this report).

Since the earlier revisions of COL FSAR Section 9.2.5 did not adequately address this COL information item, in RAI 365, Question 09.02.05-30, the staff requested that the COL applicant address wet bulb conditions.

In an April 30, 2013, response to RAI 365, Question 09.02.05-30, the COL applicant stated:

> The Calvert Cliffs Nuclear Power Project (CCNPP) Unit 3 site specific 0% exceedance maximum non-coincident wet bulb temperature is determined to be 85.3 °F using the guidance of Regulatory Guide 1.27 and 30 years of climatology data from the Patuxent River Naval Air Station.
>
> The maximum site specific wet bulb correction factor due to Ultimate Heat Sink (UHS) cooling tower interference and recirculation was determined by analysis to be 2.2 °F (2.1 °F ±0.1 °F) as described below. Therefore, the sum of 0% exceedance non-coincident wet bulb temperature and wet bulb correction factor is 87.5 °F. The U.S. EPR FSAR Table 9.2.5-2, Ultimate Heat Sink Cooling Tower Design Inlet Wet Bulb Temperature of 81 °F (non-coincident, 0% exceedance value) is less than the maximum site specific wet bulb temperature of 87.5 °F. Therefore an analysis is required.
>
> An analysis of the CCNPP Unit 3 UHS Cooling Towers was performed to determine the maximum UHS cold-water return temperature, considering a 24 hour meteorological data set from 30 years of hourly regional climatological data that maximizes the UHS cooling tower basin water temperature. This CCNPP Unit 3 UHS Cooling Tower analysis included a recirculation and interference correction factor of 2.5 ° F, the value assumed in the U.S. EPR FSAR that resulted in a maximum 0% exceedance non-coincident wet bulb temperature of 87.8 °F. The Large Break Loss of Coolant Accident (LB-LOCA)

heat load was evaluated to have the most bounding integrated heat loads to determine the maximum UHS cold-water return temperature.

Based on the UHS Cooling Tower analysis, the maximum UHS cooling tower basin water temperature was determined to be lower than 35 °C (95 °F). Therefore, the sum of the site specific wet bulb correction factor of -16.6 °C (2.2 °F) and the site specific non-coincident wet bulb temperature of 29.6 °C (85.3 °F) is bounded by the analysis, considering a -16.4 °C (2.5 °F) recirculation and interference correction factor that resulted in a UHS cold-water return temperature less than 35 °C (95 °F).

To determine the correction factor for tower recirculation and interference, a computational fluid dynamics (CFD) analysis of the CCNPP Unit 3 UHS Cooling Towers was completed using the software CD-adapco Star-CCM+, to determine the increase in ambient wet bulb temperature of cooling tower intake air for cooling towers due to recirculation and interference effects. The CFD analysis considered both cells of two adjacent UHS Cooling Towers, or one each from either side of the power block, operating at a maximum wet bulb temperature (85.3 °F) and heat duty based on a Design Basis Accident. Meteorological data with regard to wind speeds is considered from six years of measurements of wind speed at directions from the meteorological tower at CCNPP Unit 1 & 2. Isothermal CFD simulations were run for 16 individual and equally spaced wind directions (each at 22.5 degrees apart), using no heat load (neutrally buoyant) discharge from the UHS Cooling Tower, to determine the worst case wind directions. The recirculation effect is determined by using an iterative approach, where the discharge condition calculations are updated using intermediate CFD results at the UHS Cooling Tower air intakes, which iterate until convergence of the discharge parameters is obtained. The worst case condition of wind direction and UHS Cooling Tower operations was evaluated at various wind speeds to determine what conditions produced the highest ingestion of UHS Cooling Tower discharge. It was concluded that for low wind speeds (below 2.5 m/s [5.6 mph]), the cooling tower discharge rose high vertically, and the recirculation and interference are negligible. Wind speeds between the range of 5.0 m/s (11.2 mph) and 10 m/s (22.4 mph) at various wind directions yielded results with the highest associated increase in UHS Cooling Tower intake wet bulb temperature.

These CFD analyses result in a dry bulb temperature and water vapor mass fraction at the cooling tower intake that are converted into an increase in wet bulb temperature at the UHS cooling tower over the ambient value. The worst case increase of wet bulb temperature over the ambient value is the UHS Cooling Tower intake wet bulb correction for interference and recirculation, and was calculated to be 2.2 °F. This value is below the 2.5 °F allowance for impact of interference presented in the U.S. EPR Design Certification RAI 351/4112 Question 09.02.05-27.

CCNPP Unit 3 FSAR Section 9.2.5.3.3 proposed changes reflect the above discussions related to the analysis and the resultant ESWS cold water return temperature.

The staff reviewed the COL applicant's April 30, 2013, response RAI 365, Question 09.02.05-30, and proposed changes to the COL FSAR for RAI 365, Question 09.02.05-30 and finds them partly acceptable for the following reason. The COL applicant has performed a computational fluid dynamics (CFD) model of the complex interactions of the wind speed, wind direction, wet bulb temperatures, cooling tower locations, and proximity to each of the four cooling towers intakes. Given the worst set of conditions, the COL applicant confirmed that the U.S.EPR wet bulb correction factor of 2.5 °F was bounding since the calculated CCNPP Unit 3 correction factor was 2.2 °F wet bulb. The 2.5 °F UHS cooling tower wet bulb adjustment for recirculation is within the range of expected industry standards of 0.5 °F to 4 °F. Peak site wet bulb temperatures are generally expected during the months of June through July and occur between 3:00 P.M. and 5:00 P.M.; therefore, high wet bulb condition related to the UHS cooling tower is seasonal.

However, additional clarification is required related to CFD computer model uncertainties, meteorological conditions, and bounding scenarios. Therefore, in RAI 398, Question 09.02.05-32, the staff requested that the COL applicant provide this clarification. **RAI 398, Question 09.02.05-32 is being tracked as an open item.**

9.2.5.4.5 UHS Cooling Tower Interactions on Safety related Air Intakes; COL Information Item 9.2-10

COL Information Item 9.2-10 states that a COL applicant that references the U.S. EPR design certification will perform an evaluation of the interference effects of the UHS cooling tower on nearby safety related air intakes. This evaluation will confirm that potential UHS cooling tower interference effects on the safety related air intakes does not result in air intake inlet conditions that exceed the U.S. EPR Site Design Parameters for Air Temperature as specified in U.S. EPR FSAR Tier 2, Table 2.1-1. This will be address under Section 9.2.5.3.1 of this report.

Since the earlier revisions of COL FSAR Section 9.2.5 did not adequately address this COL information item, in RAI 331, Question 09.02.05-21, the staff requested that the COL applicant confirm that the safety related HVAC intakes are not negatively affected by the cooling tower plume.

In a July 2, 2013, response to RAI 331, Question 09.02.05-21, the COL applicant stated:

> A computational fluid dynamic (CFD) analysis of the Calvert Cliffs Nuclear Power Project (CCNPP) Unit 3 Ultimate Heat Sink (UHS) Cooling Towers and surrounding structures was completed to determine the increase in ambient wet bulb temperature of intake air for the main control room (MCR) and Safeguard Building Division 1 & 2 Ventilation systems. The increase in wet bulb temperature was calculated to be approximately 2.2°F.
>
> The effect of an increase in wet bulb temperature of 2.5°F was evaluated relative to the 0% exceedance site conditions (102°F dry bulb and 80°F wet bulbs temperatures) in CCNPP Unit 3 COLA Table 2.0-1. The conclusion of the evaluation is that the functions performed by safety related ventilation systems are not adversely affected.
>
> COL Information Item 9.2-10 is addressed in COLFSAR Sections 9.2.5.3.1 and 9.2.5.3.3.

UniStar Nuclear Energy (UNE) additionally has performed an evaluation of the interference effects of the UHS cooling tower plumes on nearby safety related air intakes. The evaluation concluded that there is no effect due to insensitivity to higher wet bulb temperatures and design features that isolate the fresh air intake of the system, and that there is sufficient margin in the system to accommodate the minor effects of a small wet bulb temperature increase. The conclusion of the evaluation is that the functions performed by safety related ventilation systems are not adversely affected.

The following safety related air intakes have been evaluated for potential adverse effects from the UHS cooling tower plumes:

1. Main Control Room (MCR) Air Conditioning System
2. Safeguards Building Ventilation, including Controlled Area and Electrical Division
3. Emergency Power Generating Ventilation, including Diesel Hall, Electric Room, Main Tank Room, and Combustion Air
4. Essential Service Water Pump Building Ventilation

Given the significant distance from the UHS Cooling Towers to the UHS Makeup Water Intake Structure (MWIS) – approximately 2000 ft, and the lower elevation of the UHS MWIS – ventilation intake for MWIS lower by approximately 130 ft from the UHS Cooling Tower plume discharge point, any effect on the UHS Makeup Water Intake Structure Ventilation system will be negligible.

Main Control Room Air Conditioning and Safeguard Building Ventilation

These safety related systems draw outside fresh air and their HVAC systems are affected by the moisture content of the drawn in fresh air. The percentage of drawn in fresh air is small in relation to recirculation air flow rate for both systems. It is also unlikely that worst case wind and UHS cooling tower plume conditions would occur simultaneously with design ambient conditions for the systems. Additionally, the duration of such worst case conditions would be short (on the order of a few hours), during which time any effect on the thermal inertia of the systems would be negligible. For these reasons, the current design ambient conditions for these systems at the Calvert Cliffs Unit 3 site, as shown in COL FSAR Table 2.0-1, are not adversely affected. Nevertheless, a quantitative evaluation of the interference effect of the UHS cooling tower plume on the operation of these safety related air intake systems was performed.

Calculation of Wet Bulb Temperature Increase at MCR and Safeguard Building Ventilation Air Intakes

A CFD analysis of the CCNPP Unit 3 UHS Cooling Towers and surrounding structures was performed to determine the increase in ambient wet bulb temperature of intake air for MCR and Safeguard Building Division 1 and 2 ventilation systems. The CFD analysis considered both cells of two adjacent UHS Cooling Towers operating at the design ambient conditions for the HVAC

systems (102 °F) dry bulb and 80°F wet bulb). The UHS Cooling Tower heat load considered for the analysis (194.2 MBtu/hr) is an approximate 1-hour average of the heat load from a design basis accident (Large Break LOCA) during its peak input to the UHS Cooling Tower. This is the worst case UHS Cooling Tower heat load. Meteorological data with regard to wind speeds were considered from six years of measurements of wind speed, at directions from a meteorological tower at CCNPP Units 1 and 2.

Isothermal CFD simulations were run for 16 individual and equally spaced wind directions (each at 22.5 degrees apart), using no heat load (neutrally buoyant) discharge from the UHS Cooling Tower discharge. The dry bulb and wet bulb temperatures for MCR and Safeguard Building Division 1 & 2 HVAC air intake are based on the worst case conditions of wind direction and cooling tower operations, as determined by analysis. This worst case condition of wind direction and UHS Cooling Tower operations was then evaluated at various wind speeds to determine what conditions produced the greatest wet bulb temperature increase at the MCR HVAC air intakes. It was concluded that for low wind speeds (below 2.5 m/s [5.6 mph]) the cooling tower discharge plume rose high vertically, therefore recirculation and interference effects are negligible. Wind speeds between the range of 5.0 m/s (11.2 mph) and 10 m/s (22.4 mph) at various wind directions yielded results with the highest associated increase in safety related HVAC ventilation intake wet bulb temperature. Based on wind data, wind speeds considered in the analysis wind speeds considered in the analysis were limited to 10 m/s (22.4 mph). The UHS Cooling Tower discharge conditions were determined using an iterative approach, where the discharge condition calculations were updated using intermediate CFD results for humidity and dry bulb temperature at the UHS Cooling Tower air intakes. Recirculation and interference cause these parameters to differ from ambient field values.

CFD analyses were then performed on these worst case conditions of wind speed, wind direction, and operating scenario determined from the neutrally buoyant studies, as described above, incorporating buoyancy and iteratively updating the UHS Cooling Tower discharge and its effect on the MCR HVAC intake conditions. These CFD analyses result in a dry bulb temperature and water vapor mass fraction at the MCR ventilation intake that are converted into an increase in wet bulb temperature over the ambient value. A CFD analysis was performed for the Safeguard Building Division 1 and 2 HVAC intakes considering the worst case conditions determined from the analysis of the UHS Cooling Tower effect on the MCR HVAC intakes.

Considering the worst case wind direction, wind speed, and divisional combination, the results of the CFD analysis showed a negligible dry bulb temperature increase and a small (approximately 2.2°F) wet bulb temperature increase above ambient temperatures at the most affected safety related MCR and Safeguard Building HVAC intake.

Main Control Room and Safeguard Building Ventilation Impact

A small wet bulb temperature increase, due to UHS Cooling Tower plume interference, for the safety related HVAC fresh air intake systems has no adverse impact on system performance due to the following factors:

1. For the Main Control Room HVAC system:

   There is (13 °F) margin between zero percent exceedance dry bulb temperature for the CCNPP Unit 3 site 38.9 °C (102 °F) and the zero percent exceedance dry bulb temperature used in the design of the system (46.1 C, 115°F). This results in a smaller heat transfer rate from the outside to the Main Control Room to be removed by the ventilation system. This margin more than offsets the small increase in latent heat resulting from the worst case increase in wet bulb temperature (-16.6 °C) (2.2 °F)) caused by the UHS Cooling Tower plume.

2. For the Safeguard Buildings HVAC systems:

   There is -10.6 °C (13 °F) margin between zero percent exceedance dry bulb temperature for the CCNPP Unit 3 site (38.9 °C) (102 °F)) and the zero percent exceedance dry bulb temperature used in the design of the system (46.1 C, 115 °F). This results in a smaller heat transfer rate from the outside to the Safeguard Buildings to be removed by the ventilation system. This margin, combined with the margin in the Safety Chilled Water system cooling capacity, more than offsets the increase in latent heat resulting from the worst case small increase in wet bulb temperature (-16.6 C ° (2.2 °F)) caused by the UHS Cooling Tower plume.

speeds between the range of 5.0 m/s (11.2 mph) and 10 m/s (22.4 mph) at various wind directions yielded results with the highest associated increase in safety related HVAC ventilation intake wet bulb temperature. Based on wind data, wind speeds considered in the analysis wind speeds considered in the analysis were limited to 10 m/s (22.4 mph). The UHS Cooling Tower discharge conditions were determined using an iterative approach, where the discharge condition calculations were updated using intermediate CFD results for humidity and dry bulb temperature at the UHS Cooling Tower air intakes. Recirculation and interference cause these parameters to differ from ambient field values.

Emergency Power Generating Building Ventilation Impact

Each emergency diesel division has its own building. Each of the four buildings has one safety related air intake, which supplies fresh air for diesel combustion as well as building ventilation.

Diesel Combustion Air

Any fresh air wet bulb temperature increase has no effect on the Emergency Diesel Generator combustion air intake, since diesel combustion is not adversely affected by wet bulb temperature. This conclusion has been confirmed with the Emergency Diesel Generator vendor.

Diesel Hall and Main Tank Room

For the Diesel Hall and Main Tank rooms, any fresh air wet bulb temperature increase has no effect, since this is an once-through ventilation system with no cooling coil to be impacted by an additional latent heat load from the cooling tower. Once through cooling systems are affected by increases in dry bulb temperature, but not wet bulb temperature increases. Therefore the maximum design temperature for the components of the Diesel Hall and Main Tank rooms is not challenged.

Electrical Room

Any fresh air wet bulb temperature increase has no effect on the components in the Emergency Power Generating Building electrical room. The safety related isolation damper at the air intake to the nonsafety related cooling system will close when the outside air exceeds 100°F. The safety related cooling system operates in recirculation mode, cooling the electrical components in the Emergency Power Generating Building electrical room with divisional cooling coils supplied by the Essential Service Water System.

Essential Service Water Pump Building (ESWB) Ventilation Impact

Any fresh air wet bulb temperature increase has no effect on the components in the four ESWB. The safety related isolation damper at the air intake to the non-safety related cooling system will close when the outside air exceeds 100°F. The safety related cooling system operates in recirculation mode with no drawn in fresh air.

CCNPP Unit 3 COLA Part 2, FSAR, Section 9.2.5.3.3, has been updated to address the above noted discussions.

The staff reviewed the COL applicant's July 2, 2013, response to RAI 331, Question 09.02.05-21 and finds the response is partly acceptable. The sections of the response that the staff determined was unacceptable are addressed in a follow-up RAI described below.

CFD analysis

CFD analysis assumed a series of 16 individual spaced wind directions. A wind speeds of 10 m/s resulted in the highest increase in safety related HVAC intake wet bulb. Considering the worst case meteorological data from the CCNPP Unit 1 and 2 site for a 6 year duration, wind direction, wind speed, and divisional combination, the results of the CFD analysis showed a negligible dry bulb temperature increase and a small (approximately (2.2 °F)) wet bulb temperature increase above ambient temperatures at the most affected safety related MCR and Safeguard Building HVAC intake.

Peak site wet bulb temperatures are generally expected during the months of June through July and occur between 3:00 P.M. and 5:00 P.M.; therefore, high wet bulb condition related to the UHS cooling tower is seasonal. The staff finds this approach reasonable; however, a several items are identified below that warrants a new RAI.

Safety related HVAC

For both the main control room HVAC and safeguards building HVAC, the COL applicant noted that there was a 13 °F dry bulb temperature margin between dry bulb temperature used in the design of the two systems and the dry bulb temperature of the CCNPP Unit 3 site. The staff finds that the 13 °F dry bulb temperature offsets the small increase in the worst case increase in wet bulb caused by the UHS cooling tower plume.

Diesel Combustion Air

Any fresh air wet bulb temperature increase has no effect on the Emergency Diesel Generator combustion air intake, since diesel combustion is not adversely affected by wet bulb temperature. The staff finds this approach acceptable.

Diesel Hall and Tank Room

Once through cooling systems are affected by increases in dry bulb temperature, but not wet bulb temperature increases. Therefore, the maximum design temperature for the components of the Diesel Hall and Main Tank rooms is not challenged. The staff finds this approach acceptable.

Emergency Power Generating Building Electrical Room

Any fresh air wet bulb temperature increase has no effect on the components in the four ESWB. The safety related isolation damper at the air intake to the non-safety related cooling system will close when the outside air exceeds 37.8 °C (100°F). The safety related cooling system operates in recirculation mode with no drawn in fresh air. The staff finds this approach acceptable since Emergency Power Generating Building Electrical Room cooling credit is taken for the safety related HVAC which isolate the non-safety related air intake on high outside air temperature.

ESWS Pumphouse

Any fresh air wet bulb temperature increase has no effect on the components in the four ESWB. The safety related isolation damper at the air intake to the non-safety related cooling system will close when the outside air exceeds 37.8 °C (100°F). The safety related cooling system operates in recirculation mode with no drawn in fresh air. The staff finds this approach acceptable since ESWS pumphouse cooling credit is taken for the safety related HVAC which isolate the non-safety related air intake on high outside air temperature.

However, additional clarification is required related to CFD computer model uncertainties, meteorological conditions, and bounding scenarios. Therefore, In RAI 398, Question 09.02.05-32, the staff requested that the COL applicant provide this clarification. **RAI 398, Question 09.02.05-32 is being tracked as an open item.**

9.2.5.4.6 Safety related UHS Makeup Water and Evaporative/Drift Losses; COL Interface 9-2, COL Information Item 9.2-8

COL Information Item 9.2.8 states that a COL applicant that references the U.S. EPR design certification will confirm that the site specific UHS makeup capacity is sufficient to meet the

maximum evaporative and drift water loss after 72 hours through the remainder of the 30-day period consistent with RG 1.27.

Since the earlier revisions of COL FSAR Section 9.2.5 did not adequately address this COL information item, in RAI 287, Question 09.02.05-19, the staff requested that the COL applicant confirm makeup capacity from 72 hours post-DBA up to 30 days.

In an April 30, 2013, response to RAI 287, Question 09.02.05-19, the COL applicant stated:

> The CCNPP Unit 3 UHS Makeup Water System provides ≥ 300 gpm of makeup water to the UHS Cooling Tower basin starting 72 hours post DBA. The CCNPP Unit 3 UHS Makeup Water pumps are sized to provide a maximum of approximately 750 gpm to the UHS Cooling Tower basin. This flow is sufficient to provide the minimum required flow even when the intermittent traveling screen wash and the intermittent strainer wash systems are operating. Therefore, even during the screen wash process, makeup water provided post DBA is adequate to maintain the water level in the basin above the required minimum water level for the ESW pump Net Positive Suction Head (NPSH) and Vortex Suppression, considering the maximum evaporation and drift loss after 72 hours and up to 30 days post DBA. U.S. EPR FSAR Table 9.2.5-2, Ultimate Heat Sink Design Parameters, states the required cooling tower emergency makeup flow, post DBA (72 hours through 30 days) as ≥ 300 gpm. The U.S. EPR design 72-hour meteorological conditions resulting in maximum evaporation and drift from the UHS Cooling Tower, as depicted in U.S. EPR FSAR Table 9.2.5-3, are identical to the CCNPP Unit 3 values for the 72-hour meteorological conditions, resulting in maximum evaporation and drift loss, as shown in the comparison table in COLA FSAR Subsection 9.2.5.3.3. Therefore, the CCNPP Unit 3 UHS Makeup water capacity is bounded by U.S. EPR Makeup Water capacity, to meet the maximum evaporation and drift loss starting 72 hours post DBA through the remainder of the 30 day period.

The staff reviewed the COL applicant's April 30, 2013, response to RAI 287, Question 09.02.05-19 and proposed COL FSAR changes and finds them acceptable. The COL applicant has verified that starting at 72 hours post-DBA, the UHS makeup water pumps (designed for 2839 Lpm (750 gpm)) have adequate flow margins to supply the required 1136 Lpm (300 gpm) flow to the ESWS cooling tower basin and still provide intermittent strainer wash and travelling screens. The staff notes that the UHS makeup water pumps are adequate to maintain the water level in the basin above the required minimum water level for the ESW pump NPSH) and vortex suppression. As previously stated, when the intermittent traveling screen wash system is operating the makeup flow rate to the basin is reduced to approximately 1,930 Lpm (510 gpm), which calculates to be a 795 Lpm (210 gpm) margin to the required 1135 Lpm(300 gpm) basin makeup flow rate. The staff considers RAI 287, Question 09.02.05-19 related to COL Information Item 9.2-8 resolved.

9.2.5.4.7 Maximum UHS Cold-Water Return Temperature; COL Information Item 9.2-11

COL Information Item 9.2-11 states the a COL applicant that references the U.S. EPR design certification will confirm that the maximum UHS cold-water return temperature of 35 °C (95 °F) is met by an analysis that confirms that the worst combination of site specific wet bulb and dry bulb temperatures over a 24-hour period, from a 30-year hourly regional climatological data set,

is bounded by the values presented in COL FSAR Table 9.2.5-4. This is further addressed under Section 9.2.5.3.3 of this report.

In RAI 287, Question 09.02.05-19, the staff requested that the COL applicant confirm the ESWS cold water return temperature.

In an April 30, 2013, response to RAI 287, Question 09.02.05-19, the COL applicant stated:

> An analysis of the UHS evaluated the 30 years of meteorological data for Patuxent River Naval Air Station [Data location PAX NAS] (11 miles from CCNPP Unit 3) and determined the worst 24-hour meteorological conditions for minimum water cooling to be used in determining the maximum UHS Cooling Tower basin water temperature. The worst 24-hour meteorological conditions considered for the U.S. EPR design are presented in U.S. EPR FSAR Table 9.2.5-4. A comparison of the CCNPP Unit 3 worst 24-hour meteorological conditions from 30 years meteorological data set is provided in COLA Section 9.2.5.3.3. This comparison table shows that the CCNPP Unit 3 conditions in CCNPP COLA Revision 9 were identical to those in the U.S. EPR FSAR Revision 4 Table 9.2.5-4.
>
> As a result of the revision of the UHS heat load, the UHS cooling tower basin peak temperatures and drift and evaporation losses were re-calculated using the worst case meteorology. The revised peak heat load occurs sooner (approximately seven hours earlier) than in the previous analysis and no longer corresponds to the peak wet bulb temperature as presented in U.S. EPR FSAR Table 9.2.5-4. Therefore, the 24-hour temperature sequence in U.S. EPR FSAR Table 9.2.5-4 is no longer conservative. In the CCNPP Unit 3 COLA markups, the same 24-hour profile is used but the values are shifted so that the peak wet bulb temperature is aligned to the time of the peak heat load. This results in a difference between the U.S. EPR FSAR Table 9.2.5-4 and CCNPP Unit 3 data listed in COLA Section 9.2.5.3.3 temperature tables. Therefore, this results in a departure from the U.S. EPR FSAR.
>
> The CCNPP Unit 3 analysis methodology is the same as is used for the U.S. EPR FSAR. As a result of the revision of the UHS heat load, the U.S. EPR FSAR Table 9.2.5-4 requires revision to be consistent with the analysis. However, until the U.S. EPR FSAR is revised, there will be a discrepancy between the temperature tables. However, this departure is expected to be eliminated when U.S. EPR FSAR Table 9.2.5-4 is updated in a future revision. The departure will be maintained in the CCNPP COLA until the discrepancy is eliminated.
>
> The revised Section 9.2.5.3.3 temperature table is included in the COLA Impact section of this response. This temperature data provides the worst combination of site specific wet bulb and dry bulb temperatures over a 24-hour period from a 30-year hourly regional climatological data. This analysis concluded that for the duration of the DBA, the maximum UHS Cooling Tower basin cold-water return temperature does not exceed the UHS cooling tower basin design of 95 °F.

Summary of Departure:

> The U.S. EPR FSAR Tier 2, Table 9.2.5-4, Design Values for Minimum Water Cooling in the UHS, contains the worst 24 hours meteorological conditions considered for the design of the UHS Cooling Tower to maintain maximum ESWS tower basin water temperature less than the 95 °F (35 °C). To maximize the basin cooling water temperature, the site specific 24 hour meteorological data set has been shifted so that the peak ambient wet bulb temperatures coincide with the peak cooling tower heat loads. These ambient temperature conditions are imposed on the cooling tower model with the highest average wet bulb temperature coincident with the peak cooling tower heat load for the first 24 hours of the DBA. Due to the shifting of the worst 24 hours meteorological conditions, Calvert Cliffs Unit 3 is not bounded by U.S. EPR FSAR Tier 2, Table 9.2.5-4.

The staff reviewed the COL applicant's April 30, 2013, response to RAI 287, Question 09.02.05-19 and proposed COL FSAR changes and finds them acceptable. The COL applicant has verified that with the revised peak heat loads and peak wet bulb temperatures, the ESWS cold water return temperature does not exceed the cooling tower basin design of 35 °C (95 °F). In addition, U.S. EPR FSAR Tier 1, Revision 4, Table 2.7.11-2, Item 7.9 ITAAC Acceptance Criteria states that a report concludes that the UHS cooling towers are capable of removing the design heat load for a minimum of 30 days following a design-basis accident, assuming the most limiting design conditions of heat removal and assuming worst-case (or most limiting) site specific meteorological conditions (including the effects of concentrating impurities on the ESWS), without exceeding the maximum design temperature limit for ESWS. **RAI 287, Question 09.02.05-19 is being tracked as a confirmatory item** to ensure the proposed changes are incorporated into the next COL FSAR revision.

The staff reviewed the associated departure and COL application, Part 7 proposed changes and finds them acceptable. The staff finds that the adjustment made to the worst 24 hours meteorological conditions is conservative and maximizes the basin cooling water temperature, so that the peak ambient wet bulb temperatures coincide with the peak cooling tower heat loads. The staff notes that the analysis has determined that the ESWS tower basin water temperature cold water return is less than the 35 °C (95 °F). The staff finds the COL FSAR Table 9.2.5-3, "Design Values for Maximum Evaporation and Drift Loss of Water from the UHS," and COL FSAR Table 9.2.5-4, "Design Values for Minimum Water Cooling in the UHS," revisions acceptable since the wet and dry bulb temperatures have been corrected with the revised heat loads. **RAI 287, Question 09.02.05-19 is being tracked as a confirmatory item** to ensure the associated departure and proposed changes are incorporated into the next COL FSAR revision**.**

9.2.5.4.8 UHS Makeup Water Support for the Dedicated ESW

COL FSAR Section 9.2.1.3.2 states there are no departures or supplements are included for the dedicated essential service water pumps. The staff notes there is no discussion in COL FSAR Section 9.2.5 in support of UHS makeup water for severe accidents.

U.S. EPR FSAR Tier 2, Table 9.2.1-1, "Essential Service Water Design Parameters," and U.S. EPR FSAR Tier 2, Table 9.2.1-2, "Dedicated Essential Service Water Design Parameters," states that the required UHS basin water level in the UHS basin to support the ESWS pump is 2.41 m (95 in.) and the required UHS basin water level for the dedicated ESWS is 1.17 m

(46 in.). The water requirements for the dedicated ESW pumps is 1.24 m (49 in.) lower than the ESWS pump requirements, thus UHS basin water makeup are less critical for the severe accident, therefore additional time is allowed for any markup source, including Train 4 of the UHS makeup water system to be aligned.

The staff finds that the dedicated ESW Train 4 provides an independent means of cooling critical severe accident heat loads from the CCW heat exchanger by circulating ESW between the UHS and the dedicated train CCW components. As such, the dedicated train is available immediately after the start of a severe accident. Makeup water to the Train 4 UHS tower would not be necessary for well beyond 72 hours as the heat load during this event is low compared to a DBA. The desalination plant provides the required makeup water for the cooling tower and would also do so during the severe accident. In addition, the cooling tower makeup requirement is relatively low compared to the DBA. Furthermore, the Train 4 safety related UHS makeup water train is available and could be supplemented by other means if not available for the long-term support of severe accident response. The staff finds that the dedicated Train 4 does not require dedicated equipment to provide UHS makeup water.

9.2.5.4.9 Preoperational Testing

Section 14.2 of this report addresses the staff's evaluation of the initial test program for the UHS makeup water system.

9.2.5.4.9.1 *Preoperational Testing UHS Makeup Water System*

COL FSAR Section 14.2.14.2, "UHS Makeup Water System," describes the preoperational testing to demonstrate the ability of the UHS makeup water system to supply makeup water as designed. Testing includes automatic valve performance, strainer performance, pump performance, heat tracing, alarms and controls, and electrical independency. In addition, UHS makeup water pump NPSH available is verified greater than or equal to the NPSH required by the pump manufacturer.

The staff reviewed this section of the COL FSAR and determined it was incomplete. Therefore, in RAI 337, Question 14.02-58, the staff requested that the COL applicant address several issues. These issues include; testing for adequate pump NPSH, testing of travelling screens and screen wash, testing for absence of waterhammer, testing of the mini-flow valve, and testing of heat tracing.

In a December 20, 2012, response to RAI 337, Question 14.02-58, the COL applicant stated that the changes have been incorporated in to COL FSAR Revision 9. The staff finds the COL applicant's response acceptable because, except for testing for the absence of waterhammer, the changes have been incorporated into COL FSAR Revision 9.

In an April 30, 2013, response to RAI 337, Question 14.02-58, the COL applicant added waterhammer testing. Specifically, COL FSAR Section 14.2.14.2 was modified with the following information:

> Verify that there is no water hammer indication effects, such as noise, pipe movement, pipe support or restraint damage, leakage, damaged valves or equipment, present during manual startup, manual system testing and auto keep-fill of the UHS Makeup Water system.

The staff reviewed the COL applicant's responses to RAI 337, Question 14.02-58 and finds the response and COL FSAR proposed changes acceptable since testing for the lack of waterhammer during manual startup, testing, or automatic keep fill operations was added to the COL FSAR. **RAI 337, Question 14.02-58 is being tracked as a confirmatory item** to ensure the proposed revisions are incorporated into the next COL FSAR revision.

The staff reviewed COL Preoperational Testing Essential Service Water Blowdown System FSAR Section 14.2.14.2 and finds the preoperational testing associated with the UHS makeup water system acceptable. Key functional testing will include UHS makeup water pump NPSH, flows, and pump head. In addition, other key features are tested such as valves, air release valves, alarms, interlocks, electrical power, controls, keep fill, screen wash, and heat tracing.

9.2.5.4.9.2 *Preoperational Testing Essential Service Water Blowdown System*

COL FSAR Section 14.2.14.3, "Essential Service Water Blowdown System," describes the preoperational testing to demonstrate the ability of the ESW blowdown system, including the alternate blowdown path, to provide blowdown flow for control of ESW chemistry. Testing includes blowdown flow rates, alarms and interlocks, and valve performance.

The staff reviewed this section of the COL FSAR and finds it acceptable. Acceptable testing for ESW blowdown system normal operations and accident conditions has been adequately addressed.

9.2.5.4.9.3 *Preoperational Testing Essential Service Water Chemical Treatment System*

COL FSAR Section 14.2.14.4, "Essential Service Water Chemical Treatment System," describes the preoperational testing to demonstrate the ability of the ESW chemical treatment system which provides chemical treatment of ESW/UHS cooling tower basin as designed. Testing includes chemical treatment operations, alarms and interlocks, and valve performance.

The staff reviewed this section of the COL FSAR and finds it acceptable. Acceptable testing for ESW/UHS chemical treatment for normal operations including alarms, and controls has been adequately addressed. As previously described in Section 9.2.5.4.3 above, the UHS makeup water system does not required chemical treatment; therefore, there is no chemical treatment testing required for this subsystem.

9.2.5.4.10 Essential Service Water System U.S. EPR Tier 1 Interfaces and Site specific ITAAC

U.S. EPR FSAR Tier 1, Section 4.7 states that the Interface Requirements for the ESWS and UHS, including the emergency makeup water system, are provided in U.S. EPR FSAR Tier 1, Section 2.7.11 and U.S. EPR FSAR Tier 1, Section 4.6 for buried conduit and duct banks, and pipe and pipe ducts. The CCNPP Unit 3 site specific U.S. EPR Interface Requirements related to U.S. EPR FSAR Tier 1, Section 2.7.11 are addressed address below. The CCNPP Unit 3 site specific U.S. EPR Interface Requirements related to U.S. EPR FSAR Tier 1, Section 4.6 are addressed under COL application Part 10, Table 2.4-8, "Buried Conduit and Duct Banks, and Pipe and Pipe Ducts Inspections, Tests, Analyses, and Acceptance Criteria, and is addressed in Section 3.8.4 of this report.

COL application, Part 10, Revision 9, ITAAC Table 2.4-22, “Ultimate Heat Sink Makeup Water System Inspection, Tests, Analysis, and Acceptance Criteria,” Figure 2.4-1, “Ultimate Heat Sink Makeup Water System Functional Arrangement,” and Table 2.4-29, “Ultimate Heat Sink (UHS) Makeup Water System Component Mechanical Design,” provides system functional arrangement, component physical locations, functions, ASME Code Class applicability, and seismic category for the UHS makeup water system and are discussed below in this report.

COL application, Part 10, Revision 9, ITAAC Table 2.4-7, “Ultimate Heat Sink Makeup Water Intake Structure Inspection, Tests, Analysis, and Acceptance Criteria,” Table 2.4-28, “Class 1E Emergency Power Supply Components for Site specific Systems System Inspection, Tests, Analysis, and Acceptance Criteria,” also describe the ITAAC associated with the UHS makeup water system.

ITAAC associated with Tables 2.4-7 (UHS structure) and 2.4-8 (buried piping) are discussed in Section 3.8.4 of this report.

Four U.S. EPR FSAR Tier 1, Section 2.7.11, interface requirements are applicable to the site specific UHS. These interface requirements include:

1. Item 8.1 states that the site specific emergency makeup water system provides ≥ 1135 Lpm (300 gpm) makeup water to each ESW cooling tower basin to maintain the minimum basin water level.

2. Item 8.2 states that the site specific emergency makeup water system provides water to each ESW cooling tower basin at a temperature below the maximum ESWS supply temperature of 35 °C (95 °F).

3. Item 8.3 states that the site specific emergency makeup water system is designed in accordance with ASME Section III, Class 3 safety related SSC and Seismic Category I requirements.

4. Item 8.4 states that the site specific emergency makeup water system provides a means to limit corrosion, scaling, and biological contaminants in order to minimize component fouling for a minimum of 30 days post-DBA.

The staff finds that COL application, Part 10, ITAAC Table 2.4-22, address some of the site specific ITAAC for the above noted U.S. EPR FSAR Tier 1 Interfaces.

For item 8.1 above, Items 16 and 21 of Table 24-22, the staff finds that this ITAAC adequately addresses the minimum flow rate requirements of ≥ 1135 Lpm (300 gpm).

For Item 8.2 above, Item 24 of Table 24-22, the staff finds that this ITAAC adequately addresses the ESWS design water temperature of < 35 °C (95 °F).

For Item 8.3 above, Items 4, 5, 6, 7, 8, 9, 10 and 11 of Table 2.4-22, the staff finds that these ITAAC adequately addresses the safety related (ASME) and seismic requirements for the UHS makeup water system.

For Item 8.4 above, the staff finds that there is no existing ITAAC that addressed this interface requirement for fouling. The UHS makeup water piping, valves, fittings, and that components are made from super austenitic stainless steel, an anti-corrosion piping material is capable of

withstanding the effects of silting, erosion, corrosion, and the presence of organisms that subject the system to microbiological influenced corrosion as well as well as macro fouling. UHS makeup water system piping is compatible with the Chesapeake Bay water chemistry. These features eliminate the need for a UHS makeup water chemical treatment system during standby conditions. During the quarterly functional pump testing for flow and pressure, the entire UHS makeup water system piping system will be flushed through the test bypass line located in the ESW pump room. Quarterly functional testing is described under CCNPP Unit 3 TS SR 3.7.22.2 which also references U.S.EPR TS SR 3.7.19.6 (supply makeup to the cooling tower). For the reasons noted above, the staff finds that no specific ITAAC is needed to address Item 8.4.

COL application, Part 10 - ITAAC Table 2.4-22, Revision 9 also includes (in addition to the 4 interface requirements and 11 ITAAC previously noted) additional ITAAC verification for the following:

- Four divisions of UHS makeup water system (Item 1)
- Electrical independence, isolation devices, and Class 1E valves (Items 2, 3, and 14)
- Compatible materials (Item 12)
- Bar screens (Item 13)
- Manually initiated (Item 15)
- Pump NPSH (Item 17)
- Valve functions (Items 18 and 19)
- Testing of the bypass line (Item 20)
- Keep-fill testing (Items 22 and 23)

The staff finds that for the CCNPP Unit 3 UHS and UHS makeup water system, the requirements of 10 CFR 52.80, ITAAC have been met. Specifically, there are 24 individual ITAAC for the UHS water makeup system. The COL applicant has included inspections, tests, and analyses that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act of 1954, and NRC regulations.

9.2.5.4.11 Technical Specifications

10 CFR 50.36(c)(2)(ii) states that a technical specification limiting condition for operation (LCO) of a nuclear reactor must be established for each item meeting one or more of four listed criteria:

1. Criterion 1

   Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.

2. Criterion 2

   A process variable, design feature, or operating restriction that is an initial condition of a design-basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

3. Criterion 3

   A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design-basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.

4. Criterion 4

   A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.

U.S. EPR Technical Specifications 3.7.19, "Ultimate Heat Sink," describes the UHS Limiting Conditions of Operations and Surveillance Requirements. Four UHS trains are required to be Operable in Modes 1, 2, 3, and 4. SRs for the UHS include; cooling tower basin water level (> 7.24 m (23.75 ft)) - SR 3.7.19.1), cooling tower basin water temperature (< 32.2 °C (90 °F)) – SR 3.7.19.2), UHS fans (operate for >15 minutes - SR 3.7.19.3), UHS fan automatic start (SR 3.7.19.4), UHS makeup water flow (> 1136 Lpm ((300 gpm)) - SR 3.7.19.6) and automatic valves verification based on actuation signal (SR 3.7.19.5).

COL application Part 4, TS and Bases incorporated by reference the U.S. EPR Technical Specifications. The U.S. EPR design certification application was modified for CCNPP Unit 3 TS Section 3.7.19 and the bracket text of the U.S.EPR FSAR was removed and the following SR was added:

> SR 3.7.19.6, Verify the ability to supply emergency makeup water to each UHS cooling tower basin at ≥ 300 gpm. The frequency is in accordance with the inservice testing program.

CCNPP Unit 3 TS 3.7.19 Bases was added as described below to address the bracketed text in the U.S. EPR design certification application.

> The seismic Category 1 emergency makeup water supply, to the ESWS cooling tower basins, necessary to support 30 days of post accident mitigation is provided by the safety related Ultimate Heat Sink (UHS) makeup water system that draws water from the Chesapeake Bay. Chesapeake Bay water enters the UHS makeup water intake structure through an intake channel shared with the circulating water system makeup intake structure. The UHS makeup water intake structure houses four independent UHS makeup water system trains, one for each ESWS division. Each train has one pump, a discharge check valve, and a pump discharge isolation motor operated valve, all housed in the UHS makeup

water intake structure, plus the buried piping running up to and into the ESWS pumphouse at the ESWS cooling tower basin. Each UHS makeup water system pump is rated at 2839 Lpm (750 gpm).

An operable emergency makeup water source consists of one operable train of the UHS makeup water system capable of providing makeup water to its associated ESWS cooling tower basin. Each UHS makeup water system train includes a pump, valves, piping, instruments and controls to ensure the transfer of the required supply of water from the Chesapeake Bay to its associated ESWS cooling tower basin.

The staff finds this modified TS SR and TS Bases text acceptable since it provides clarification to the bracket text of the U.S. EPR design certification application. The key requirement of the UHS makeup system is to supply the desired water flow to the UHS cooling towers post accident plus 72 hours.

COL application Part 4 TS and Bases Section 3.7.22 describes the UHS makeup water system. Four UHS makeup water system train shall be operable in Modes 1, 2, 3, and 4. Any UHS makeup water system train is inoperable; a 72 hour completion time is required for restoration of that train. If the completion time is not met, the associated UHS train is declared inoperable.

There are two SR associated with the UHS makeup water system. SR 3.7.22.1 verifies the water level in the UHS makeup water system is >-3.57 m (-11.7 ft) – NGVD 29 (24 hour frequency). SR 3.7.22.2 verifies the traveling screen rotates and screen wash system that provides the necessary design flow rate to wash the screens, coincident with the SR 3.7.19.6 UHS emergency makeup water flow rate to the cooling tower basin, on an actual or simulated actuation signal to verify proper operation to perform their associated safety function (frequency is quarterly).

The staff determined that there is a missing TS related to the UHS emergency makeup water sources. Specifically, the COL applicant should describe in the COL application those TS LCO and SR related to the UHS emergency makeup system water temperature. Therefore, in RAI 336, Question 09.02.05-23, the staff requested that the COL applicant address this item.

In a December 20, 2012, response to RAI 336, Question 09.02.05-23, the COL applicant stated:

UHS Makeup Water Supply Temperature:

The UHS makeup water system draws water from the Chesapeake Bay, starting 72 hours post-DBA, to provide makeup water to the UHS cooling tower basin to ensure adequate basin volume for the required net positive suction head (NPSH) for the associated Essential Service Water (ESW) pump. The UHS makeup water system provides a minimum of 300 gpm to the basin to make-up for losses due to evaporation, drift, seepage, and boundary isolation valve seat leakage, starting 72 hours post-DBA. The UHS cooling tower basin has a U.S. EPR FSAR TS SR to verify the basin water temperature of each UHS cooling tower to be less than or equal to 90 °F (32.2 °C). Based on CCNPP Unit 1 and 2 intake channel surface water temperature for the past 17 years, the highest experienced inlet water temperature recorded was 88.13 °F (31.2 °C). The CWS and UHS common forebay draws water from the Unit 3 inlet area at an elevation well below the extreme low water level of the bay, where the drawn water

temperature is lower than the measured surface water temperature of the Chesapeake Bay. Since the maximum UHS makeup water system flow of 750 GPM is a minor contributor to the total UHS Cooling Tower post-DBA minimum basin volume of approximately two million gallons before starting 72 hours post-DBA, the temperature impacts from the UHS makeup water system to the total basin volume are considered negligible. The UHS cooling tower basin U.S. EPR TS SR temperature limit of less than or equal to 90 °F (32.2 °C), and the critical temperature of the ESW to CCWS heat exchanger of 95 °F (35 °C), as described in the U.S. EPR Technical Specification, will ensure the UHS cooling tower basin can perform its safety function to mitigate a design basis accident. Therefore, a site specific TS LCO or SR for the UHS Makeup Water forebay temperature is not required, since the current SR or TS ensures the ability of the UHS makeup water system to support the long term heat removal post-DBA.

UHS Makeup Water (forebay) Level (required to support proper operations of the makeup water pumps):

The UHS Makeup Water forebay level is currently measured upstream and downstream of UHS Makeup Water traveling screens, to determine the differential level across the screens for operation of the screen wash system. The downstream level location measures the water level at the UHS Makeup Water pump bay, which can be used to ensure proper water level is available for NPSH of the UHS Makeup Water pump. Therefore, this downstream UHS Makeup Water pump bay water level will be added to the CCNPP Unit 3 Technical Specification Surveillance Requirement, to ensure adequate NPSH is available to maintain proper operation of the UHS Makeup Water pump and that the pump can perform its safety function of providing makeup water to the UHS cooling tower basin starting 72 hours post-DBA. CCNPP Unit 3 FSAR Subsection 9.2.5.3.2, "UHS Makeup Water System Pumps" describe the excess margin (33.3 ft) between the NPSH-available and NPSH-required. CCNPP Unit 3 COLA Part 4 Technical Specifications and Bases are being updated to include the new surveillance requirement for UHS Makeup Water pump bay level.

In addition, CCNPP Unit 3 FSAR Table 9.2-2, Alarm Summary, is updated to include the UHS makeup water pump forebay level alarm, low forebay water level and forebay water level at or near TS low water level.

The staff reviewed the COL applicant’s December 20, 2012, response to RAI 336, Question 09.02.05 23, and finds the response acceptable for the following reasons. Based on historical data for 17 years, the highest experienced Chesapeake Bay water temperature at the common area (Unit 1 and 2) was < 31.4 °C (88.5 °F), which is below the 32.2 °C (90 °F)TS water temperature for the CCNPP Unit 3 UHS basins. TS SR 3.7.19.2 (U.S. EPR design certification) will verify that each cooling tower basin is < 32.2 °C (90 °F). **RAI 336, Question 09.02.05-23 is being tracked as a confirmatory item** to ensure that the approved markup is properly incorporated in the next COL FSAR.

The staff finds that for the UHS and UHS makeup water system that the requirements of 10 CFR 50.36(c)(2)(ii) have been adequately addressed.

Chapter 16 of this report further addressed the CCNPP Unit 3 TS and TS Bases.

9.2.5.4.12 UHS Basin External Access Piping to Address Loss of Large Area of the Plant Due to Explosions and Fires (LOLA)

In a June 6, 2013, response to RAI 335, Question 19.03-35, the COL applicant provided changes that affect COL FSAR Sections 9.2.1 and 9.2.5 and COL application Part 10, ITAAC related to the UHS basin external access piping and beyond design basis events. The COL applicant stated that the access piping at each of the four cooling towers will be designed to safety classification NS-AQ, Quality Group D and Seismic Category ‘Carbon Steel.” Conventional Seismic (CS) designed and built in accordance with ASME B31.1, “Power Piping.” A normally closed valve outside the UHS allows access to the water in the UHS basin when needed.

The staff reviewed the COL applicant’s June 6, 2013, response to RAI 335, Question 19.03-35 and COL FSAR changes and finds them acceptable. The access piping at each of the four cooling towers will be designed to safety classification NS-AQ, Quality Group D and Seismic Category ‘CS.” The new piping configuration is shown in the proposed changes to COL FSAR Figure 9.2-10. The ESW basin external access piping isolation valve is closed during normal operations. This valve is opened manually to allow water to be drawn from an ESW basin that is not performing its safety related function. A normally open vent valve is provided at the high point of the ESW basin external access piping to ensure that water cannot be inadvertently siphoned from the basin. The piping and valves associated with the ESW basin external access piping are constructed of stainless steel. In the event of a pipe break outside the UHS, there would be no loss of UHS water due to the piping configuration and normally open high point vent. Failure of the piping will not result in draining the UHS cooling tower basin. **RAI 335, Question 19.03-35 is being tracked as a confirmatory item** to ensure that the approved markup is properly incorporated in the next COL FSAR revision.

The UHS basin external piping is further described in the staffs SER related to the CCNPP Unit 3 Mitigative Strategies Report Loss of Large Area of the Plant Due to Explosions or Fire.

9.2.5.5 *Post Combined License Activities*

There are no post Col activities related to this section.

9.2.5.6 *Conclusion*

The staff evaluated the UHS for the COL FSAR Revision 9 in accordance with the guidance that is referred to in the Regulatory Evaluation Section. This section of the report includes compliance with GDC 2, GDC 4, GDC 5, GDC 44, GDC 45, and GDC 46 and the guidance established in SRP Section 9.2.5 and RG 1.27. The staff finds that the requirements of 10 CFR 20.1406 and 10 CFR 52.80 are acceptable, with the exception of the three remaining open items previously noted.

The staff concludes the CCNPP Unit 3 COL application as described under COL FSAR Section 9.2.5 acceptable and that all the applicable COL Information Items and Interface Requirements have been adequately addressed.

9.2.6 Condensate Storage Facilities

COL FSAR Section 9.2.6 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.2.6. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in the U.S EPR FSAR Tier 2, Section 9.2.6 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the condensate storage tank incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.2.6 of this report to reflect the final disposition of the design certification application.

9.2.7 Seal Water Supply System

The seal water supply system (SEWSS) is a non-safety related system which supplies seal water to equipment and components in systems carrying radioactive fluids to prevent the escape of radioactive fluids from the shaft seals of pumps and agitators (e.g., chemical and volume control system (CVCS) pump seals, liquid and solid waste processing pump seals, liquid waste storage agitators, severe accident heat removal pump seals). The SEWSS also feeds the sealing liquid tanks of the gaseous waste processing system and the piping of the operational chilled water system.

Operation of the SEWSS is not required for the safe-shutdown of the plant or for mitigating the consequences of a design-basis accident. Therefore, the SEWSS does not require a safety evaluation.

COL FSAR Section 9.2.7 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.2.7. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in the U.S EPR FSAR Tier 2, Section 9.2.7 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the component cooling water system incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section9.2.7 of this report to reflect the final disposition of the design certification application.

9.2.8 Safety Chilled Water System

The safety chilled water system (SCWS) supplies refrigerated chilled water to the safety related heating, ventilation and air conditioning (HVAC) systems and to the low head safety injection system (LHSI) pump motors. The SCWS consists of four separate and independent trains or divisions. Each SCWS division is a separate closed-loop chilled water production system.

COL FSAR Section 9.2.8 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.2.8. The staff reviewed the COL application and checked the

referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in the U.S EPR FSAR Tier 2, Section 9.2.8 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the component cooling water system incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.2.8 of this report to reflect the final disposition of the design certification application.

9.2.9 Raw Water Supply System

9.2.9.1 *Introduction*

COL FSAR Section 9.2.9, "Raw Water Supp[y System," describes the non-safety related raw water supply system (RWSS) for CCNPP Unit 3. The RWSS is non-safety related and does not provide any safety related function. There is no connection between raw water and the components of other systems that have the potential to contain radiological contamination.

Raw water, also referred to as untreated water, is supplied from the Chesapeake Bay by the circulating water system (CWS) makeup system, which pumps water to the circulating water basin and to the desalinization plant. The desalinization plant processes raw brackish water through filtration and reverse osmosis, with auxiliary chemical treatment, to deliver clean water to the desalinated storage tank. From the desalinated storage tank, the desalinated water is distributed to the ESWS for normal operations, to the desalinized water system, to the fire protection system, and to the potable water system. This encompasses all of the plant water demands, with the exception of circulating water system makeup and UHS makeup during emergency conditions. The CWS is described in Section 10.4.5 and the UHS safety related makeup is discussed in Section 9.2.5 of this report.

On receipt of an accident signal, the normal RWSS is isolated with motor operated valves (MOVs) associated with the UHS. The UHS safety related makeup water system, which is described in COL FSAR Section 9.2.5, functions to provide reliable makeup to the ESWS cooling tower basins, starting no later than 72 hours after receipt of an accident signal, to ensure that sufficient makeup flow is provided so the ESWS can fulfill its design requirement of shutdown decal heat removal for a minimum of 30 days following a DBA.

9.2.9.2 *Summary of Application*

COL FSAR, Revision 9, Section 9.2.8 addresses the following COL information items in the U.S. EPR FSAR, Tier 2, Section 9.2.9:

COL Information Items

- COL Information Item 9.2-3

The RWSS and the design requirements of the EWSS are site specific and will be addressed by the COL applicant.

- COL Information Item 14.2-8

  A COL applicant that references the U.S. EPR design certification will provide site specific test abstract information for the RWSS.

The conceptual design of the RWSS is described in U.S. EPR FSAR Tier 2, Revision 4, Section 9.2.9, Table 9.2.9-1, “Conceptual Site Specific Raw Water Supply System.”

9.2.9.3 *Regulatory Basis*

The relevant NRC requirements provided for this area of review, and the associated acceptance criteria are given in NUREG-0800, Revision 3, Section 10.4.5, “Circulating Water System,: because the RWSS typically provides the makeup water to the CWS cooling towers. However for CCNPP Unit 3, the CWS makeup is a separate system from the RWSS and is included in NUREG-0800, Revision 3, Section 10.4.5. The CCNPP Unit 3 RWSS will be reviewed based on guidance founded in SRP Section 10.4.5, SRP Section 9.2.1, “Station Service Water System,” Revision 6, March 2007, SRP Section 9.2.5, “Ultimate Heat Sink,” March 2007, and SRP Section 9.2.4, “Potable and Sanitary Water System,” Revision 3, March 2007. Review interfaces with other NUREG-0800 sections can also be found in NUREG-0800, Section 10.4.5. Based on SRP Section 10.4.5, staff acceptance of the design is based on compliance with the requirements of GDC 4. Based on SRP Section 9.2.4, staff acceptance of the design is based on compliance with the requirements of GDC 60, ‘Control of Release of Radioactive Material to the Environment.”

Additional requirements not described in the above noted SRPs:

> 10 CFR 20.1406, “Minimization of contamination,” as it relates to the design features that will facilitate eventual decommissioning and minimize, to the extent practicable, the contamination of the facility and the environment and the generation of radioactive waste.

9.2.9.4 *Technical Evaluation*

The staff reviewed COL FSAR, Revision 9, Section 9.2.9 and checked the referenced design certification FSAR. The staff confirmed that the information contained in the COL application addresses the relevant information related to the RWSS. U.S. EPR FSAR Tier 2, Section 9.2.9 is being reviewed by the staff under Docket No. 052-020. The staff’s technical evaluation of the information incorporated by reference related to the RWSS will be documented in the corresponding safety evaluation report.

As discussed above, the CCNPP Unit 3, RWSS is non-safety related and processes raw water drawn from the Chesapeake Bay. Untreated water is pumped by the CWS makeup system to the desalinization plant, which supplies all of the plant water demands, with the exception of the ESW emergency makeup. The desalinization plant processes the water through filtration and reverse osmosis, with auxiliary chemical treatment, to deliver clean water to the desalinated water storage tank. From the two 1.14 million liter (l) (300,000 gallon (gal)) desalinated water storage tanks, the desalinated water is distributed to the four ESWS cooling tower basins for normal operations, to the demineralized water system, to the fire protection system, and to the potable water system.

Normal desalinated water demand is approximately 3,073 liter per minute (Lpm) (812 gallons per minute (gpm)) and peak demand is approximately 9.145 Lpm (2.416 gpm). The desalinated water storage tanks are sized for 8 hours with a flow rate of 4637 Lpm (1225 gpm).

The RWSS is a non-safety related and non-seismic class system as described in COL FSAR Table 3.2-1, "Classification Summary for Site specific SSCs." The RWSS provides no safety functions and no accident mitigation functions. While the RWSS provide makeup to the ESWS cooling tower basins during normal operations, these functions are not relied upon under post-accident conditions. The desalinization plant supply to the basins is automatically isolated from the UHS safety related makeup system at the start of an accident safety injection signal) by isolation valves, which are addressed in Section 9.2.5 of this report. The CCNPP Unit 3 RWSS is not relied upon for post-accident emergency makeup and is not credited for any heat removal or other UHS-related functions. Therefore, the staff agrees with the COL applicant that non-safety and non-seismic classification for the RWSS is appropriate and the requirements of SRP Section 9.2.1 and SRP Section 9.2.5, including GDC 2. GDC 5, GDC 44, GDC 45, and GDC 46 do not apply to the CCNPP Unit 2 RWSS. Since these requirements do not apply, they are not discussed further in this report.

As discussed above, U.S. EPR COL Information Item 9.2-3 (RWSS completed design) is evaluated in various sections of this report.

The staff reviewed the relevant information in the COL FSAR:

System Descriptive Information

The staff reviewed the RWSS description in COL FSAR Section 9.2.9, COL FSAR Figure 9.2-7, "Raw Water and Desalinated Water Supply," and FSAR Figure 10.4-3, "Circulating Water System Makeup System (P&ID)," to confirm that the flow paths and components have been identified and described in sufficient detail enable a full understanding of the system design and operation. For this reason, the staff notes that the system description and drawings are incomplete, inaccurate, or that clarification is needed. Therefore, in RAI 171, Question 09.02.05-2, the staff requested that the COL applicant address the following 11 items:

1. COL FSAR Table 3.2-1, "Classification Summary for Site specific SSC" does not have a code explanation for "UPQ," desalination/water treatment building.

2. COL FSAR Figure 10.4-3, "Circulating Water System Makeup System (P&ID," does not indicate the RWSS connection that is referenced in COL FSAR Figure 9.2-3.

3. RWSS design and operating pressure and temperature are not indicated in the COL application.

4. RWSS design flow rates and head of the pumps is not specified.

5. RWSS normal and peak loads for each major user of the RWSS are not specified (i.e., potable water, fire protection, demineralized water ESWS cooling tower basis. The staff noted that in U.S. EPR FSAR Tier 2, Section 9.2.1.4.1, "Normal Operating Conditions," four ESWS divisions are normally running to achieve cold shutdown conditions. COL FSAR Section 8.2.5.1, "Design Basis," is 3,560 Lpm (940 gpm) per train and is supplied from the RWSS.

6. RWSS piping materials are not specified, including buried materials.

7. COL FSAR Figure 9.2-7 is not clear by providing specific locations of the RWSS equipment and major isolative valves to interfacing system, or if the system components are in the yard or buried.

8. RWSS chemical treatment and relevant chemicals are not defined and have not been evaluated as a non-toxic to the control room boundary.

9. The COL applicant did not provide information regarding the electrical power for the RWSS and desalinated water pumps and equipment.

10. RWSS components, such as RWSS pump starts, based on instrumentation and controls logic are not discussed. U.S. EPR FSAR Tier 2, Section 14.2.12.5.1, "Raw Water Supply System," (Test#043), Item 3.2 verified the standby RWSS pump starts on low discharge pressure or a trip of the running pump.

11. COL FSAR Table 2.3-25, "Raw Water Supply System Inspection, Tests, Analysis, and Acceptance Criteria," does not have meter numbers.

In a February 5, 2010, response to RAI 191, Question 09.02.05-2, the COL applicant provided the following for each of the 11 items:

1. As previously provided in the response to RAI 109, Question 3.2.1-31, FSAR Table 3.2-1, Note 3 will be updated to include UPQ, water treatment building.

2. FSAR Figure 10.4-3 indicates the RWSS connection as "Desal Plant.: FSAR Section 9.2.9 describes 'raw water' as the term usually applied to untreated water. At CCNPP Unit 3, 'raw water' is supplied from the circulating water system makeup water system (which draws water from the Chesapeake Bay) and is directed to the desalinization plant.

3. The design pressure and temperature for the RWSS is 8.97 bars (130 psig) and 37.80° C (100° F), respectively. Operating pressure(s) and temperature(s) are enveloped by the design pressure and temperature. FSAR Section 9.2.9.2 will be revised to include this information.

4. FSAR Section 9.2.9.2 states that the circulating water makeup system is the source of water to the desalination plant for processing. FSAR Section 9.2.9.3 states that the desalinated water flowrate (called production rate) is a nominal 4637 lpm (1225 gpm). This is based upon the water being desalinated, resulting in a 40% nominal recovery rate of desalinated water. FSAR section 9.2.9.3 will be revised to include the following information.

   The two 100% capacity desalinated water transfer pumps have been sized based upon a total developed head (TDH) of a nominal 61 m (200 ft) at a nominal 2992 lpm (790 gpm) each. This includes consideration of the

normal demands of the desalinated water users and those simultaneous peak demands (i.e., 4 ESW cooling towers simultaneously in operation). Each of the desalinated users' headers have been sized to accommodate peak flowrates with the desalinated water transfer pumps' suction and discharge piping sized to accommodate peak flowrates for the required demands.

5. Normal and peak loads for major RWSS users are summarized below from COLA Part 3, Environmental Report Table 3.3-1, under the water stream heading "Chesapeake Bay Water Demand for Desalinization":

	Average Flow gpm/Lpm	**Maximum Flow gpm/Lpm**
Potable & Sanitary Water	93/352	216/818
Fire Water Distribution	5/19	625/2,365
Demineralized Water	80/303	80/303
ESW Water Basins	629/2,381	1,490/5,640

6. Materials such as fiberglass reinforced plastic (FRP) or high density polyethylene (HDPE) are being evaluated for the RWSS underground piping along with aboveground materials, such as glass fiber reinforced epoxy or steel. RWSS components will be fabricated from corrosion resistant materials (such as FRP, HDPE or equivalent for underground, and glass fiber reinforced epoxy, steel or equivalent for aboveground). Appropriate corrosion inhibitors will be specified for the system. FSAR Section 9.2.9.3 will be revised to include the following information:

   The RWSS piping, tanks, pumps and other system components' materials are compatible with the Chesapeake Bay water quality prior to treatment and desalinated water quality for the remainder of the system. As such, RWSS components will be fabricated from corrosion resistant materials (such as FRP, HDPE or equivalent for underground, and glass fiber reinforced epoxy, steel or equivalent for aboveground). Appropriate corrosion inhibitors will be specified for the system.

7. FSAR Figure 9.2-7 will be updated to indicate the RWSS equipment and major isolation valves to the interfacing systems and, where a building is not indicated, the components (i.e., piping) are outside in the yard area or buried. See updated Figure 9.2-7 in this Enclosure (COLA Impact page 41).

8. FSAR Section 9.2.9.2 will be updated to include the following chemical treatment and relevant chemicals for the desalination process.

- o Sodium Bisulfite for dechlorination upstream of the RO membranes

- o Sulfuric Acid: continuous feed to the pretreated water prior to desalination for pH adjustment

- o Scale inhibitor: proprietary (supplier-specific) - continuous feed to the pretreated water prior to desalination

The chemicals used in the circulating water, circulating water makeup, UHS cooling towers and RWSS chemical treatment have been defined and evaluated to determine minimum safe distances from the control room boundary (toxicity evaluation) and nearest safety related structure (explosions, flammable vapor cloud and flammable vapor cloud delayed ignition). A FSAR proposed change for Section 2.2 is provided with this information.

9. FSAR Section 9.2.9.2 will be updated to state that two separate normal power supplies are provided to the desalinization building to allow RWSS equipment supporting desalination to remain operational if one power supply is lost. The RWSS and desalinated water plant are not credited to be available during a Loss of Offsite Power or Station Blackout event.

10. FSAR Section 9.2.9 states that the supply of raw (brackish) water is supplied to the RWSS by the circulating water makeup pumps; there is no separate RWSS supply pump. Instrumentation and controls (I&C) logic for the circulating water makeup pumps is provided in FSAR Section 10.4.5.

    The raw (desalinated) water supply system pumps that transport water to various system users are the desalinated water transfer pumps. Their current I&C logic is one of the two 100% capacity desalinated water transfer pumps will be manually started if the system is not operational. As stated in FSAR Section 14.2.14.1, the standby pump will automatically start on low discharge pressure or the standby pump will automatically start if the running pump is tripped.

    FSAR Section 9.2.9.3 will be revised to remove "desalinated water transfer pumps – Potable Water," which are part of the Potable and Sanitary Water System, and not part of the RWSS.

11. The metric equivalents of the values contained in COLA Part 10, Appendix B, Table 2.4-25 will be provided as follows: 1.14 million liters (300,000 gallons) and 2366 liters (625 gallons) per minute.

The staff evaluated the COL applicant's response to Question 09.02.05-2. Each of the ten items is discussed below.

1. RAI 171, Question 09.02.05-2, Item 1: The staff concluded that RAI 171, Question 09.02.05-2, Item 1 is a COL FSAR editorial clarification, which the staff considers resolved since the COL applicant agreed to make the COL FSAR changes to

add the water treatment building. The staff confirmed this was corrected in COL FSAR Revision 6. Accordingly, the staff considers RAI 171, Question 09.02.05-2, Item 1 resolved.

2. RAI 171, Question 09.02.05-2, Item 2: The staff considers RAI 171, Question 09.02.05-2, Item 2 resolved since the COL applicant indicated that the RWSS and "Desal Plant" are considered the same system and COL FSAR Figure 10.4-3 does have the correct connection shown. No further actions are required. Accordingly, the staff considers RAI 171, Question 09.02.05-2, Item 2 resolved.

3. RAI 171, Question 09.02.05-2, Item 3: The staff considers RAI 171, Question 09.02.05-2 resolved since the pressure and temperature are reasonable for this system and the pressure/temperatures provided by the COL applicant. The staff confirmed that this system is not considered a high energy line and is below 93.3 °C (200 °F) and 19 bar (275 psig), which is evaluated against U.S. EPR FSAR Tier 2, Section 3.6.1.1.1, "Criteria and Assumptions." The COL applicant agreed to add this information to COL FSAR Revision 9. **RAI 171, Question 09.02.05-2, Item 3 is being tracked as a confirmatory item.**

4. RAI 171, Question 09.02.05-2, Items 4 and 5: The staff considers RAI 171, Question 09.02.05-2, Items 4 and 5 unresolved. Information provided by the COL applicant indicated there are two 100 percent capacity pumps and that the desalinated water flow rates is 4,637 Lpm (1,225 gpm); the nominal pump flow is 2,992 Lpm (790 gpm) for head determination, the average flow rates are 3,055 Lpm (807 gpm) up to maximum flow rates of 9,126 Lpm (2411 gpm). The maximum UHS evaporate water loss is indicated in Table 2.0-1, "U.S. ERP Site Design Envelope Comparison," of 5,163 Lpm (1,364 gpm). U.S.EPR FSAR Tier 2, Table 9.2.5-2, "Ultimate Heat Sink Design Parameters," states that the maximum evaporation loss at design conditions (total both cells) is 2,161 Lpm (571 gpm). The staff notes that ESWS/UHS normal loads should be clearly described in the COL FSAR, which includes the desalinated water pump design capacity and the margin available to maintain the UHS basin above its Technical Specification water level. Therefore, in RAI 286, Question 09.02.05-18, the staff requested that the COL applicant resolve these items.

   In an April 6, 2011, response to RAI 286, Question 09.02.05-18, Items 4 and 5, the COL applicant provided the following:

   > Each of the two 100% capacity desalinated water transfer pumps has been sized based upon a total developed head of a nominal 61 m (200 ft) at nominal 2992 lpm (790 gpm) flow. The desalination plant is designed for an average flow of 4,637 Lpm (1225 gpm).
   >
   > The comparison of maximum UHS cooling tower evaporative losses in FSAR Table 2.0-1 was removed in Revision 7 of the CCNPP Unit 3 COLA FSAR.
   >
   > The evaporation loss at design conditions (total both cells) of 2161 lpm (571 gpm) is the evaporation value that occurs during the design basis accident (DBA), at the design meteorological conditions and heat load. Since this evaporation value occurs during the DBA, the RWSS (no safety related system) is not credited for the replenishment of the basin.

During normal operation, only two UHS cooling towers are in operation. Based on the UHS analysis for normal operational heat load and worst case three-day temperature for evaporation, the average total makeup water required is approximately 1068 lpm (282 gpm) for each cooling tower.

The design of desalination capacity is based on the UHS cooling towers evaporation value of 1068 lpm (282 gpm) per tower and other associated losses such as drift, and blowdown. In addition, the design of the desalination plant also considers other user demands such as potable water, fire water, and demineralized water makeup concurrent with the requirements of the operating UHS cooling towers. The cooling tower evaporation value during normal operation used in the sizing of desalination capacity is conservative, since this is based on the worst case meteorological conditions using a 30-year period of meteorological data. As specified in FSAR Section 9.2.5.1, for two cooling towers the ESWS normal makeup provides 627 gpm (564 gpm for evaporation, 61 gpm for blowdown and 2 gpm for drift).

In an April 27, 2009, response to U.S. EPR RAI 119, Question 09.02.01-171, AREVA indicated that the cooling tower basin will be maintained at normal operating level (approximately 22 cm] (6 in.) above the low operating level). Each UHS cooling tower basin has a margin of 25.4 cm] (10 in.) below the low operating level to the Technical Specification limit, which provides additional margin for the UHS cooling tower water inventory during normal operation

The staff finds the COL applicant's April 6, 2011, response to RAI 286, Question 09.02.05-18, Items 4 and 5 acceptable since the COL applicant clarified that for normal operations flow requirements to account for evaporation is 1,068 lpm (282 gpm) for each UHS cooling tower (total of 2,136 Lpm (564 gpm)). Accounting for additional UHS blowdown and drift (238 Lpm (63 gpm)) plus normal fire protection 19 Lpm (5 gpm) and normal demineralized water usage 303 Lpm (80 gpm), this is well within the capacity of the RWSS pump rated at 2,992 Lpm (790 gpm) with an approximately 9 percent flow margin. Accordingly, the staff considers RAI 286, Question 09.02.05-18, Items 4 and 5 resolved.

5. RAI 171, Question 09.02.05-2, Item 6: The staff considers RAI 171, Question 09.02.05-2, Item 6 resolved since the COL applicant stated that the RWSS material to be utilized will be compatible with the Chesapeake Bay water quality which includes nonmetallic materials that will be designed and installed in accordance with the applicable Codes as stated in COL FSAR Revision 9Table 3.2-1. The COL applicant agreed to add this information to COL FSAR. **RAI 171, Question 09.02.05-2, Item 6 is being tracked as a confirmatory item**.

6. RAI 171, Question 09.02.05-2, Item 7: The staff considers RAI 171, Question09.02.05-2, Item 7ed unresolved. The COL applicant provided revised COL FSAR Figure 9.2-7, "Raw Water and Desalinated Water System," which indicates the specific location of RWSS equipment and major isolation valves; however, the staff notes that the flow path to the potable water system is no longer shown, which conflicts with COL FSAR Section 9.2.9.2. Also COL FSAR Section 9.2.9.3 states that a second

pair of 100 percent capacity pumps is provided for potable water demand. In RAI 286, Question 09.02.05-18, the staff requested that the COL applicant resolve this item.

In an April 6, 2011, response to RAI 286, Question 09.02.05-2, Item 7, the COL applicant provided the following:

> FSAR Figure 9.2-7 indicates a flow path to the Potable Water System from the desalination processing of the RWSS. The details of the Potable Water System, including two 100% capacity Potable Water Transfer Pumps, are shown in FSAR Figure 9.2-1.
>
> FSAR Section 9.2.9.3 (under the sub heading Desalinated Water Transfer Pumps), is being revised to remove the potable water transfer pump discussion. The potable water transfer pumps are described in FSAR Section 9.2.4.2.2.

The staff finds RAI 286, Question 09.02.05-18, Item 7 acceptable since the COL applicant clarified that the second pair of desalinated water transfer pumps for potable water demand was in error. The COL applicant agreed to remove this information from COL FSAR Section 9.2.9.3. The staff has confirmed that this change has been incorporated into COL FSAR Revision 8. Accordingly, the staff considers RAI 286, Question 09.02.05-7, Item 7 resolved.

7. RAI 171, Question 09.02.05-2, Item 8: The staff considers RAI 171, Question 09.02.05-2, Item 8 resolved since the COL applicant provided the information related to chemical treatment and relevant chemical for the desalination process. These chemicals will be evaluated under Chapter 2 of this report.

8. RAI 171, Question 09.02.05-2, Item 9: The staff considers the response to RAI 171, Question 09.02.05-2, Item 9 acceptable since the two separate normal power supplies are provided to the desalinization building with provided electrical redundancy. The COL applicant agreed to add this information to COL FSAR Revision 9, Section 9.2.9.2. **RAI 171, Question 09.02.05-2, Item 9 is being tracked as a confirmatory item.**

9. RAI 171, Question 09.02.05-2, Item 10: The staff considers RAI 171, Question 09.02.05-2, Item 10 unresolved. COL FSAR Section 14.2.14.1 does describe that the standby desalinated water transfer pump will automatically start on sensed low discharge pressure or if the running desalinated water transfer pump trips. The staff notes this was adequately described; however, the COL applicant was also requested to provide a COL FSAR proposed change to remove the reference to the “desalinated water transfer pumps- Potable Water.” This COL FSAR proposed change was not provided. In RAI 286, Question 09.02.05-18, Item 10, the staff requested that the COL applicant resolve this item.

   In an April 6, 2011, response to RAI 286, Question 09.02.05-18, Item 10, the COL applicant provided the following:

   > In the response to CCNPP Unit 3 RAI 171/2674, Question 09.02.05-2, bullet 10, the last paragraph is changed to read, "FSAR Figure 9.2-7 has also been revised to remove the 'desalinated water transfer pumps -

Potable water', which are part of Potable and Sanitary water system and not part of the RWSS."

The staff finds the COL applicant's April 6, 2011, response to RAI 286, Question 09.02.05-18, Item 10 acceptable since the COL applicant clarified that the second pair of desalinated water transfer pumps for potable water demand was in error. The staff has confirmed that the COL applicant has incorporated this change into COL FSAR, Revision 7, Figure 9.2-7. Accordingly, the staff considers RAI 286, Question 09.02.05-18, Item resolved.

10. RAI 286, Question 09.02.05-2, Item 11: The staff considers RAI 286, Question 09.02.05-2, Item 11 resolved since the COL applicant provided a COL FSAR proposed change of the metric equivalents for the ITAAC. The staff has confirmed that the COL applicant has added this information to the COL FSAR Revision 7. Accordingly, the staff considers RAI 286, Question 09.02.05-2, Item 11 resolved.

Based on the above, the staff finds the COL applicant's responses to RAI 171, Question 09.02.05-2 acceptable. **RAI 171, Question 09.02.05-2 is being tracked as a confirmatory item.**

<u>GDC 4, "Environmental and Dynamics Effects Design Bases"</u>

Functional arrangement of the RWSS is shown in COL FSAR Figure 9.2-3, "Normal Makeup, UHS Makeup, Blowdown & Chemical Treatment," and COL FSAR Figure 9.2-7, "Raw Water and Desalinated Water Supply." As described in COL FSAR Table 3.2-1, all the major RWSS components are housed in the desalinization structure that contains the desalinated water storage tank, pumps, and associated components located near the CWS cooling tower which is shown on COL FSAR Figure 1.1-3, "Site Area Map.

The desalinization building, desalinization plant, desalinated water transfer pumps, storage tanks, valves, miscellaneous components, and piping system were described as non-safety related, non-seismic, quality group "E" as addressed in COL FSAR Section 9.2.9.2, "System Description" and COL FSAR Table 3.2-1, "Classification Summary for Site specific SSCs." The staff finds that these RWSS SSCs have been properly classified and are built to appropriate industry codes and standards such as ASME B31.1, "Power Piping.

In COL FSAR Section 9.2.9.4, "Safety Evaluation," the COL applicant stated that, with respect to potential flooding caused by piping or component failures in the RWSS, there is no adverse impact on safety functions. The COL applicant stated that the RWSS and the desalinization plant are located at the CWS cooling tower (COL FSAR Figure 1.1-3) and are located remotely from any safety related systems and equipment. A piping or component failure at the connection to the ESWS tower basin represents the worst case failure for flooding. The COL applicant stated that intervening topography and plant storm water controls will divert surface water flow from piping failures from safety functions. The failure at the connection to the ESWS tower basin is mitigated by safety related motor operated isolation valves to ensure the integrity of the ESWS cooling tower basin and the UHS makeup water system by closing in the event of a design-basis accident. In addition, potential leakage from the desalinated water lines in the ESWS pump houses is controlled, collected and routed away by the floor drains in those structures. These floor drain lines include check valves where necessary to prevent possible backflow from causing flooding that could adversely affect the safety related equipment.

The staff noted the drawing information provided in COL FSAR Figures 1.1-3, 9.2-3, and 9.2-7 is of insufficient detail to ensure this flooding analysis. The COL applicant needs to describe the layout and provide adequate drawings of the RWSS, desalinated water storage tank, transfer pumps and their relationship to the four ESWS cooling towers and ESWS pump house including the location of the safety related motor operated valves between the desalinization plant and the normal makeup related to flooding consequences. In RAI 171, Question 09.02.05-3, the staff requested that the COL applicant provide information for the layout of the desalinated water storage tank and transfer pumps and their relationship to the four ESWS cooling towers.

In a December 11, 2009, response to RAI 171, Question 09.02.05-3, the COL applicant provided the following response:

> CCNPP Unit 3 FSAR Figure 1.1-3, Site Area Map, does not show grading details; however, it does show the desalination/water treatment building as "desalinization structure". FSAR Figures 2.1-1, Site Area Map, and 2.5-129, Site Grading Plan, show the unlabeled desalinization structure and the desalinated water storage tanks outside of the building, and the grading around the building, and the desalinated water storage tanks, to assess overall proximity. The intervening topography and the plant storm water controls are designed to divert surface water flow, including that which would result from catastrophic failure of the desalinated water storage tanks.
>
> FSAR Figure 9.2-3, Normal Makeup, Emergency Makeup, Blowdown & Chemical Treatment, shows that there is normal makeup to the Essential Service Water System (ESWS) from the Raw Water Supply System (RWSS) desalination process.
>
> The attached revised FSAR Figure 9.2-7, Raw Water and Desalinated Water Supply, includes the desalinated water storage tanks and two 100% capacity desalinated water transfer pumps in order to discern the relationship of the RWSS components to the four ESWS pump house/cooling towers. The figure shows that the desalinated water transfer pumps are located in the Desalination/Water Treatment Building. The automated isolation valves, including the safety related motor operated valves for the ESWS, are also shown in this figure. These safety related motor operated valves are located inside the respective ESWS pump house buildings.
>
> The internal flooding protective measures for Seismic Category I structures, including the ESWS Pump Buildings, are addressed in US EPR FSAR Section 3.4.1. The internal flooding event analysis for the E SWS pump house buildings is described in US EPR FSAR Section 3.4.3.9. External flooding protection design requirements are addressed in US EPR FSAR Section 3.4.2, as supplemented by CCNPP Unit 3 COLA FSAR Section 3.4.2. CCNPP Unit 3 COLA FSAR Section 9.2.9.4 will be revised.

The staff evaluated the COL applicant’s December 11, 2009, response to RAI 171, Question 09.02.05-3 and determined it to be unacceptable.

Based on the COL applicant’s December 11, 2009, response to RAI 171, Question 09.02.05-3, an evaluation of the impact of a failure of the non-safety related RWSS piping on the ESWS pump house buildings and ESWS cooling towers indicates that the RWSS piping has no impact

on the ability of the ESWS pump house buildings and ESWS cooling towers to meet their intended safety function. However, based on the COL applicant's February 5, 2010, response to RAI 171, Question 09.02.05-2, materials for the RWSS underground piping maybe include materials such as FRP or HDPE. During a seismic event, a piping breach is possible that all four non-safety related pipes could fail at the interface to the ESW pump house with the desalinated water transfer pumps remain running, thus feeding the break (worst case) at some high flow rate. The COL applicant should describe in the COL FSAR how this event may impact the ESWS pump house and how the UHS cooling towers and ESWS components continue to meet their intended safety function and provide detains of this evaluation. In RAI 286, Question 09.02.05-18, the staff requested that the COL applicant address this item.

In an April 6, 2011, response to RAI 286, Question 09.02.05-18, the COL applicant provided the following for RAI 171, Question 09.02.05-3.

> The nonsafety related RWSS piping supplying makeup water to the UHS cooling tower terminates at the interface with the Essential Service Water (ESW) Building.
>
> In the event of a break of RWSS piping at the interface with the ESW System at the building wall, with the discharge directly against the ESW Building wall, the wall will act as a dissipation baffle, reducing the force of the flow. The interface penetration anchor, designed and constructed in conformance to RG 1.29, Revision 4 regulatory position C.2, does not allow flow through the penetration anchor inside the building.
>
> The buried RWSS pipe enters the ESW Building approximately 6 ft (1.8 meters) below grade. For a complete RWSS pipe failure outside the building (at the interface), the least resistance flow path will be upward. Therefore, the flow will find its way toward the surface after eroding the top soil cover. In essence, the pipe failure will result in soil erosion of the pipe surrounding area at the break location creating a localized scour hole. The eroded soil will be entrained with water and will move with the flow in the upward direction creating a gully or localized scour hole. The scour hole will function as an energy dissipation pool, dissipating the forces associated with the high pressure flow. The bottom of the ESW structure is approximately 10 ft (3.1 m) lower than the buried RWSS pipe. Soil erosion towards the structure bottom is less likely, since the distance upward is shorter. This will result in a dissipation pool surrounding the failed pipe in the ground. The size of the scour holes are substantially less than the footprint of the ESW structure and hazard to the structure associated with the scouring is insignificant.
>
> The scope of the interface anchor and the normal makeup piping inside the building is part of the generic ESW design. As specified in the responses to U.S. EPR RAI 119, Question 09.02.01-12 and U.S. EPR RAI 175, Question 09.02.05-43, nonsafety related UHS piping, components, and associated pipe supports located near or forming an extension of safety related system piping and components are classified and designed as Seismic Category II or Non-Seismic, depending on pipe routing. As a minimum, the nonsafety related system piping is seismically analyzed up to the boundary anchor. A Seismic Category II classification ensures that loss of physical

integrity of a nonsafety related structure, system or component (SSC), as a result of natural phenomena, will not result in an adverse interaction with a safety related SSC that potentially compromises the capability of the safety related SSC to perform its safety function. Therefore, the design of the interface anchor to the seismic standards prevents leakage of water inside the ESW Building from a break of the RWSS piping. In the event of a break of the RWSS piping to the UHS cooling tower during a seismic event, the normal makeup supply to the UHS cooling tower basin will be terminated. Safe shutdown is achieved and maintained with the UHS tower basin 72-hour reserve and with the safety related UHS makeup supply after 72 hours

The staff determined that non-safety related and non-seismic UHS makeup piping system related to flooding in the yard is acceptable since the associated penetration anchor at the ESWS building does not allow flow through the penetration anchor inside the building. In the event of a break of the RWSS piping to the UHS cooling tower during a seismic event, the normal makeup supply to the UHS cooling tower basin will be terminated. Safe shutdown is achieved and maintained with the UHS tower basin reserve and with the safety related UHS makeup supply. The COL applicant agreed to add this information to COL FSAR, Revision 8, Section 9.2.9.2. The staff has confirmed that the COL applicant has added this information to COL FSAR Revision 8.

The staff finds the portion of the non-safety related desalinated water piping and components that interface with the safety related ESWS acceptable. Therefore, pending adequate resolution to, the confirmatory item in RAI 171, Question 09.02.05-2, the staff concludes that GDC 4 is met by ensuring that the non-safety related RWSS / desalinated water will not affect the performance of ESWS in its safety function following component or piping failure.

Based on the above, the staff considers RAI 171, Question 09.02.05-3 and RAI 286, Question 9.2.5-18 resolved.

GDC 60, “Control of Release of Radioactive Material to the Environment” and 10 CFR 20.1406, “Minimization of contamination”

The staff notes that means must be provided for the control of release of radioactive material to the environment in accordance with GDC 60 requirements. The staff review was based on comparison of guidance provided in SRP Section 9.2.4 with the system design of RWSS described in COL FSAR Section 9.2.9. The staff noted that design provisions identified by the COL applicant with regard to GDC 60 were included in the COL FSAR Section 9.2.9.4. The COL applicant concluded the raw water piping system supplied to the desalinated plant has no cross connection to systems with the potential for containing radioactive materials and the desalinization plant is separated from all other plant systems with the potential for containing radioactive materials. This prevents the RWSS from potentially being contaminated with radioactive material.

The staff notes that 10 CFR 20.1406, “Minimization of contamination,” does not apply to the RWSS since the RWSS has no cross connection to systems with the potential for containing radioactive materials. Therefore, no design features are needed that will facilitate eventual decommissioning and minimize, to the extent practicable, the contamination of the facility and the environment and the generation of radioactive waste.

Based on its review of COL FSAR design criteria and design bases for the RWSS, the staff finds the COL applicant's design provisions adequate for compliance with GDC 60 and 10 CFR 20.1406.

9.2.9.4.1 Inspections, Tests, Analyses, and Acceptance Criteria

CCNPP Unit 3 application, Part 10 Table 2.4-25, "Raw Water Supply System Inspection, Tests, Analysis, and Acceptance Criteria," provided information for the RWSS.

The staff reviewed the ITAAC information provided in COL FSAR Table 2.4-25 to confirm completeness and consistency with the plant design basis as described in COL FSAR Section 9.2.9. The ITAAC describes the RWSS requirements to support the fire protection system at 1.135 l (300,000 gal) within an 8-hour period in accordance with National Fire Protection Association (NFPA) Code 804, "Standard for Fire Protection for Advances Light Water Reactor Electric Generating Plants." The acceptance criterion of the RWSS is related to the fire protection system requiring flow to be equal to or greater than 2,365 Lpm (625 gpm) flow rate. The staff finds that the ITAAC information specific to the fire protection system acceptable since it meets the requirements stated in U.S. EPR FSAR Tier 2, Section 9.5.1.2.1, "General Description," for the fire protection system. The staff determined that the reference NFPA code is incorrectly referenced; therefore, in RAI 143, Question 09.02.05-1, the staff requested that the COL applicant address this discrepantly. In addition, the staff concluded that the RWSS other loads such as potable water, demineralized water, and cooling tower makeup do not require specific ITAAC due to the relevance of the systems.

In a January 19, 2010, response to RAI 143, Question 09.02.05-1, the COL applicant provided a COL application, Part 10, ITAAC Table 2.4-25 proposed change that corrected the NFPA Code to RG 1.189, "Fire Protection of Operating Nuclear Power Plants," Revision 1. The staff finds the proposed change acceptable since the correct reference was provided. The staff has confirmed that COL FSAR Revision 7 has incorporated the correct reference. Accordingly, the staff considers RAI 143, Question 09.02.05-1 resolved.

9.2.9.4.2 Initial Test Program

Prior to initial plant startup, a preoperational test is performed. The test is intended to demonstrate the ability of the RWSS to supply treated water as designed during normal plant operation. The RWSS water system is tested as described in the U.S. EPR FSAR Tier 2, Section 14.2, Test #043, "Raw Water Supply System." Additionally, the RWSS and desalinization plant, which is part of the RWSS, is addressed in the Initial Plant Test Program in COL FSAR Section 14.2.14.1, "Raw Water Supply System". The staff reviewed the tests and finds them acceptable. Due to the U.S.EPR RWSS being site specific, the U.S. EPR Test #043 as stated under COL FSAR Section 14.2 was reviewed in addition to the CCNPP Unit 3 preoperational test for the desalinization plant. The staff finds the described test adequate for the RWSS.

9.2.9.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.2.9.6 *Conclusion*

The staff evaluated the RWSS for COL FSAR Revision 9 in accordance with the guidance that is referred to in the Regulatory Basis Section of this report. The referenced guidance in this section includes compliance with GDC 4 and GDC 60 including 10 CFR 20.1406, and the guidance established in applicable SRPs. Except for the three confirmatory items previously noted, the staff finds the COL application as described under COL FSAR Section 9.2.9 acceptable.

9.3 Process Auxiliaries

COL FSAR Section 9.3 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.3. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in the U.S EPR FSAR Tier 2, Section 9.3 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the process auxiliaries incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.3 of this report to reflect the final disposition of the design certification application.

9.4 Air Conditioning, Heating, Cooling and Ventilation Systems

9.4.1 Main Control Room Air Conditioning System

COL FSAR 9.4.1 incorporates by reference, with no departures, supplements, U.S. EPR FSAR Tier 2, Section 9.4.1. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in U.S. EPR FSAR Tier 2, Section 9.4.1 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the Main Control Room Air Conditioning System incorporated by reference in the COL FSAR will be documented by the staff in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.4.1 of this report to reflect the final disposition of the design certification application.

9.4.2 Fuel Building Ventilation System

COL FSAR Section 9.4.2 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.4.2, "Fuel Building Ventilation System." The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issues relating to this section remained for review. The staff's review confirmed that there are no outstanding issues related to this section.

The staff reviewed the information in the U.S. EPR FSAR Tier 2, Section 9.4.2 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the fuel building ventilation system incorporated by reference in the COL FSAR have been documented in the staff SER on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.4.2 of this report to reflect the final disposition of the design certification application.

9.4.3 Nuclear Auxiliary Building Ventilation System

COL FSAR Section 9.4.3 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.4.3, "Nuclear Auxiliary Building Ventilation System." The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff's review confirmed that there are no outstanding issues related to this section.

The staff reviewed the information in the U.S. EPR FSAR Tier 2, Section 9.4.3 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the Nuclear Auxiliary Building Ventilation System incorporated by reference in the COL FSAR will be documented in the staff SER on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.4.3 of this report to reflect the final disposition of the design certification application.

9.4.4 Turbine Building Ventilation System

9.4.4.1 *Introduction*

The Turbine Island Ventilation Systems consist of the turbine building ventilation system (TBVS) and the switchgear building ventilation system, turbine island (SWBVS). The function of the TBVS and of the SWBVS is to provide heating, ventilation, and cooling in the Turbine Building (TB) and remainder of the Electrical Switchgear Building (SWGB) in order to maintain temperatures within the operating requirements for equipment operation and to establish acceptable ambient conditions for personnel to operate and maintain the equipment within the building.

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements:

The U.S. EPR FSAR includes the following COL information items in Section 9.4.4:

- COL Information Item 9.4-1

  A COL applicant that references the U.S. EPR design certification will provide site specific design information for the turbine building ventilation system (TBVS).

- COL Information Item 9.4-2

  A COL applicant that references the U.S. EPR design certification will provide site specific design information for the switchgear building ventilation system, turbine island (SWBVS).

9.4.4.2 *Summary of Application*

The site specific design information to address the COL information item for the TBVS is provided in COL FSAR Sections 9.4.4.1 through 9.4.4.6.

The COL applicant stated that the site specific design information to address the COL information item for the SWBVS will be included when the detailed design is sufficiently complete. The information and conclusions are expected to be similar to that provided for the TBVS in Section 9.4.4.1 through 9.4.4.6.

The COL information item for SWBVS cannot be evaluated until detailed design information is provided. Therefore, in RAI 382, Question 09.04.04-4, the staff requested that the COL applicant provide the site specific design information for the SWBVS. RAI 382, Question 09.04.04-4, **is being tracked as an open item.**

The U.S. EPR FSAR provides a very brief description of the turbine building ventilation system indicating the system is non-safety related, maintains equipment operating temperatures, provides a habitable environment for personnel, and does not provide an accident response or radiological effluent control.

9.4.4.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the U.S. EPR FSAR.

In addition, the relevant requirements of NRC regulations for the TBVS, and the associated acceptance criteria, are specified in NUREG-0800, Section 9.4.4, “Turbine Area Ventilation System.”

The applicable regulatory requirements for the TBVS are as follows:

1. GDC 2, “Design Bases for Protection Against Natural Phenomena,” as it relates to the system being capable of withstanding the effects of earthquakes.

2. GDC 5, indicates that sharing a structure, system or component between multiple units will not significantly impair the ability of the SSCs to perform its safety function in the event one unit experiences and accident condition.

3. GDC 60, “Control of Release of Radioactive Materials to the Environment,” as it relates to the system being capable to suitably control release of gaseous radioactive effluents to the environment.

4. 10 CFR 52.47(b0(1), as it relates to the requirement that a design certification application contain the proposed inspections, tests, analyses, and acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria are met, a plant that incorporates the design certification and is constructed will operate in conformance with the design certification, the provisions of the Atomic Energy Act of 1954 and NRC regulation.

The related acceptance criteria are as follows:

1. For GDC 2, conformance with RG 1.29, “Seismic Design Classification,” Revision 4, March 2007, Regulatory Position C.1, for safety related portions and Regulatory Position C.2 for non-safety related portions.

2. For GDC 5, acceptance is based on the determination that sharing the TBVS and SWBVS structures, systems, and components in multiple-unit plants does not significantly impair their ability to perform their safety function, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining unit(s).

3. For GDC 60, conformance with RG 1.52, “Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants,” Revision 3, June 2001.

4. RG 1.140 “Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants,” Revision 2, June 2001, as it relates to design, inspection, testing, and maintenance criteria for post-accident and normal atmosphere cleanup systems, ventilation exhaust systems, air filtration, and adsorption units.

5. For 10 CFR 52.47(b)(1), conformance with the guidance of RG 1.203, Section C.II.1, “Inspections, Tests, Analyses, and Acceptance Criteria,” and that contained in SRP Sections 14.3, “Inspections, Tests, Analyses, and Acceptance Criteria”; and 14.37, “Plant Systems Inspections, Tests, Analyses, and Acceptance Criteria.”

9.4.4.4 *Technical Evaluation*

The staff reviewed COL FSAR Section 9.4.4 and checked the referenced design certification FSAR to ensure that the combination of the information in the U.S. EPR FSAR and the information in the COL FSAR represent the complete scope of required information relating to this review topic. U.S. EPR FSAR Tier 2, Section 9.4.4 has been reviewed by the staff under Docket No. 52-020. The staff’s technical evaluation of the information incorporated by reference related to the TBVS has been documented in the staff safety evaluation report on the design certification application for the U.S. EPR.

The staff reviewed the information contained in the COL FSAR and determined that the COL applicant needed to provide design information that demonstrates conformance with applicable NRC regulations. Therefore, in RAI 35, Question 09.04.04-1, the staff requested that the COL applicant provide P&IDs of the system; interface requirements; site requirements; system performance requirements; ambient temperature limits for areas serviced; and ITAAC information where applicable.

In an August 21, 2009, response to RAI 35, Question 09.04.04-1, the COL applicant provided a copy of the flow diagram for the TBVS and a proposed revision to the COL FSAR to provide additional TBVS details. The COL applicant provided a description of the TBVS as summarized below.

- The Turbine Building does not contain safety related equipment. Therefore, the TBVS does not serve any safety related function, has no safety design basis, and is not required to operate during or following a design-basis accident.

- The TBVS operates during startup, shutdown, and normal plant operations to maintain acceptable air temperatures in the Turbine Building for equipment operation and for personnel working in the building.

- The system is not relied upon during station blackout and abnormal (e.g., Loss of Offsite Power) operation.

- The TBVS is sized to provide the heating, ventilation, and cooling requirements during startup, shutdown, and normal plant operations. The system is designed to maintain a positive pressure to mitigate intrusion of dust and dirt into the Turbine Building.

- The ambient outside design temperatures for the TBVS are -23.3 °C (-10 °F) minimum and 37.8 °C (100 °F) maximum. The TBVS maintains the bulk average temperature within the building during normal plant operation at or above 10 °C (50 °F) in winter and at or below 46.1 °C (115 °F) in summer.

- The ventilation rate is based on maintaining permissible temperatures in areas with appreciable heat gains. For areas with no appreciable heat gains, the rate of ventilation is based on the number of air changes per hour, depending on the specific area being ventilated.

- The TBVS performs no safety related functions; therefore, a systems failure analysis is not required.

- There are no safety related SSCs in the Turbine Building that directly provide a reactor trip.

- The non-safety TBVS shares no SSCs between units. Therefore, this does not adversely impair any safety related system, as required by GDC 5.

- The TBVS is not exposed to any radiological contamination; therefore, the requirements of GDC 60 are not applicable.

GDC 2

The guidance for GDC 2 is based on RG 1.29, Regulatory Positions C.1 for safety related and C.2 for non-safety related SSCs. U.S. EPR FSAR Tier 1, Section 4.3 states that the COL applicant will provide the design of the Switchgear Building, which would, therefore, include the design of the SWBVS (COL Information Item 9.4-2). U.S. EPR FSAR Tier 1, Section 4.4 states that the COL applicant will provide design of the Turbine Building, which would, therefore, include the design of the TBVS (COL Information Item 9.4-1)

TBVS

The staff reviewed the COL applicant's August 21, 2009, response to RAI 35, Question 09.04.04-1, including the proposed COL FSAR changes and the system flow diagram. The staff determined that the COL applicant had not sufficiently demonstrated compliance with the requirements of GDC 2 for the TBVS. Specifically, the COL FSAR states that there "are no safety related SSCs in the turbine building that directly provide a reactor trip; therefore GDC 2 is not applicable." The staff notes that the applicability of GDC is to SSCs "important to safety"

rather than just “Safety related SSCs.” As a result, the staff also notes that the COL applicant has not demonstrated compliance with GDC 2. In follow-up RAI 239, Question 09.04.04-3, the staff requested that the COL applicant provide enough information in the COL FSAR to conclude the system meets the requirements of GDC 2.

In a May 28, 2010, response to RAI 239, Question 09.04.04-3, the COL applicant stated that TBVS is not required to operate during or following a design basis accident. There are no safety related SSCs in the Turbine Building. In addition, the COL applicant stated that there are no important to safety SSCs in the Turbine Building. Therefore, GDC 2 is not applicable to the Turbine Building Ventilation System. With the RAI response, the COL applicant provided a markup of COL FSAR Section 9.4.4.3 that clarified that there are no SSCs that are safety related or are important to safety in the Turbine Building. The staff finds the proposed markup to COL FSAR Section 9.4.4.3 sufficient because it clarifies that there are no SSCs that would be relied upon to function in an accident that would be affected by a failure of the TBVS, or which would require TBVS to function. The staff subsequently reviewed COL FSAR, Revision 8, Section 9.4.4 and noted that proposed revisions of RAIs 35 and 239 have been correctly incorporated into the COL FSAR. Therefore, the staff considers RAI 35, Question 09.04.04-1 and RAI 239, Question 09-04.04-3, resolved as they apply to GDC 2 information.

In U.S. EPR FSAR Tier 2, Section 9.4.4, the design certification applicant stated that the TBVS components are non-safety related. The staff reviewed U.S. EPR FSAR Tier 2, Table 3.2.2-1, “Classification Summary,” Sheets 1-186. The staff finds that the TB, component code UMA is assigned a Safety Classification as “NS-AQ” and Seismic Category as “Class II.” The staff finds that the turbine island ventilation system, component codes SAM1, SAM2, SAC70, are designated non-safety related and non-seismic. The staff reviewed the safety classification of SSCs in the TB serviced by this HVAC system and finds that there are no safety related components that are served by or would be adversely affected by failure of the TBVS. Therefore, the staff finds that U.S. EPR FSAR, Tier 2, Chapter 3 and U.S. EPR FSAR Tier 2, Chapter 9.4.4 are within the safety and seismic classifications for the turbine island ventilation system.

In CCNPP Unit 3 FSAR Tier 2 Section 9.4.4.3 the applicant states that there are no safety related SSCs or important to safety SSCs in the Turbine Building.

Accordingly, based on the equipment classifications and the above COL FSAR statements, the staff finds that RG 1.29, Regulatory Position C.2 applies to the TBVS. The staff reviewed the postulated design-basis accident scenarios and assumptions in U.S. EPR FSAR Tier 2, Chapter 15, which are incorporated by reference in the COL FSAR. The staff finds that TBVS does not perform any safety related function. Based on site layout of the CCNPP Unit 3 design, the staff concludes that failure of TBVS components would not adversely affect any other safety related system or cause injury to control room personnel. Therefore, the staff finds that RG 1.29, Regulatory Position C.2 would apply to these components, and on this basis, meets the requirements of GDC 2.

SWBVS

In U.S. EPR FSAR Tier 2, Section 9.4.4, the design certification applicant stated that the SWBVS components are non-safety related. The staff reviewed U.S. EPR FSAR Tier 2, Table 3.2.2-1 “Classification Summary” (Sheets1−186). The staff finds that the Switchgear Building (SWGB), component code UBA is assigned a Safety Classification as “NS-AQ” and Seismic Category as “Class II.” The staff finds that the turbine island ventilation system,

component codes SAM1, SAM2, SAC70, is designated non-safety related and non-seismic. The staff reviewed the safety classification of SSCs in the SWB serviced by the SWBVS (i.e., HVAC systems) and finds that there are no safety related components that are served by or would be adversely affected by failure of these HVAC systems. Therefore, the staff finds that U.S. EPR FSAR, Tier 2, Chapter 3 and U.S. EPR FSAR Tier 2, Chapter 9 are consistent with regard to the safety and seismic classifications for the turbine island ventilation system. Accordingly, based on these classifications, the staff finds that RG 1.29, Regulatory Position C.2 applies to the SWBVS. The staff reviewed the postulated design-basis accident scenarios and assumptions in U.S. EPR FSAR Tier 2, Chapter 15, which are incorporated by reference in the COL FSAR. The staff finds that the SWBVS components do not perform any safety related function. Based on site layout of the CCNPP Unit 3 design, the staff concludes that failure of SWBVS components would not adversely affect any other safety related system or cause injury to control room personnel. Therefore, the staff finds that RG 1.29, Regulatory Position C.2 would apply to these components, and on this basis, meets the requirements of GDC 2.

GDC 5

The staff reviewed the design of the TBVS and the SWBVS to ensure that the relevant requirements of GDC 5 are met.

GDC 5 governs the sharing of structures, systems, and components important to safety among nuclear power plant units in order to ensure such sharing will not significantly impair their ability to perform their safety functions. The staff finds that the CCNPP Unit 3 design is a single-unit station, and the requirements of GDC 5 are not applicable to the single-unit design.

GDC 60

GDC 60, control of releases of radioactive materials to the environment, requires that the nuclear power unit design include means to control suitably the release of radioactive materials in gaseous and liquid effluents and to handle radioactive solid wastes produced during normal reactor operation, including anticipated operational occurrences.

For the TBVS and the SWBVS, the staff reviewed COL FSAR Sections 4.3 and 4.4 and U.S. EPR FSAR Tier 2, Section 9.4.4 as well as COL FSAR Section 9.4.4 as discussed below.

U.S. EPR FSAR Tier 1, Section 4.3 states that the COL applicant will provide the design of the Switchgear Building, which would, therefore, include the design of the SWBVS (COL Information Item 9.4-2). U.S. EPR FSAR Tier 1, Section 4.4 states that the COL applicant will provide design of the Turbine Building, which would, therefore, include the design of the TBVS (COL Information Item 9.4-1). U.S. EPR FSAR Tier 2, Section 9.4.4 information is limited to a summary of the overall functions of the turbine island ventilation system.

The staff reviewed the COL FSAR Section 9.4.4. The COL applicant stated that the above two COL information items are addressed in this section.

TBVS

The staff reviewed the TBVS design functions, as stated in COL FSAR Section 9.4.4.1, and the TBVS system description in COL FSAR Section 9.4.4.2. The staff's review of COL FSAR, Revision 6, Section 9.4.4.2 indicated that the TBVS does not necessitate a "… realignment or operator action …in response to radiation or other safety signals for the TBVS." COL FSAR

Section 9.4.4.3 states that the "TBVS is not exposed to any radiological contamination; therefore the requirements of GDC 60 are not applicable." However, the staff noted that the exhaust from the turbine gland seal exhausters is directed and discharged via the Nuclear Auxiliary Building Exhaust. Therefore, in RAI 205, Question 09.04.04-2, the staff requested that the COL applicant address the apparent inconsistency and clarify the statement that no realignment is needed in response to a radiation or other safety actuation signals from the TBVS and revise affected COL FSAR Sections. In a March 3, 2010, response to RAI 205, Question 09.04.04-2, the COL applicant indicated that exhausts from the main condenser evacuation system and the turbine gland seal exhausters are directed to, and discharged via, the Nuclear Auxiliary Building Exhaust, which is a separate system. The TBVS is not exposed to any radiological contamination. Therefore, the TB roof exhaust ventilators and TB relief vents are not a source of unmonitored uncontrolled discharge points of radioactive materials. The COL applicant stated that COL FSAR, Revision 6, Section 9.4.4.2 will be revised to more clearly state that there are no radiation or safety actuations associated with TBVS.

The COL applicant provided a markup of proposed revision to the COL FSAR Section 9.4.4. Based on review of the RAI response and the COL FSAR revision, the staff finds that the TBVS is not expected to contain or interface with any radioactive materials; therefore, it is not subject to the requirements of GDC 60. The staff finds the proposed markup to COL FSAR revision sufficient. The staff subsequently reviewed COL FSAR, Revision 8, Section 9.4.4 and notes that the proposed revision of RAI 205 has been correctly incorporated into the COL FSAR. Accordingly, the staff considers RAI 205, Question 09.04.04-2 resolved.

Based on the staff's review of the design basis information as stated in the COL FSAR for the TBVS, the staff finds the information supplied by the COL applicant adequate to satisfy COL Information Item 9.4-1. The staff concluded that the TBVS is located in a separate building from potentially contaminated areas and is not expected to contain or interface with any radioactive materials; it has no normal atmosphere radioactive contamination clean-up functions. Therefore, the staff finds that the TBVS is not a normal atmosphere cleanup system that would function to control releases of radioactive materials to the environment, and is not subject to the requirements of GDC 60 and the guidance of RG 1.140.

SWBVS

The staff reviewed the SWBVS design information as stated in COL FSAR Section 9.4.4. This section indicates that the site specific design information to address the COL information item for the SWBVS, COL Information Item 9.4-2, is provided in this section.

The staff noted COL FSAR, Revision 8, Section 9.4.4 states that the site specific design information to address the COL information item for the SWBVS will be included when the detailed design is sufficiently complete.

The staff finds that COL Information Item 9.4-2, for SWBVS cannot be evaluated until detailed design information is provided. Therefore, tin RAI 382, Question 09.04.04-4, and requested that the COL applicant provide the site specific design information for the SWBVS. **RAI 382, Question 09.04.04-4, is being tracked as an open item.**

Based on the staff's review of the design basis information as stated in the COL FSAR for the SBVS, the staff determined that the supplied information is insufficient to satisfy COL Information Item 9.4-2. The staff awaits additional design information on this system.

9.4.4.5 *ITAAC*

The staff reviewed the proposed ITAAC for the TBVS and SWBVS and its associated safety related features. The design certification applicant's proposed ITAAC requirements in U.S. EPR FSAR Tier 1, Tables 2.6.8-4, and U.S. EPR FSAR Tier 2, Section 14.3 were reviewed by the staff.

The staff confirms that the ITAAC information provided in the standard design for the TBVS adequately addresses the system. ITAAC information is not required for the TBVS. Therefore, the staff finds the ITAAC requirements for the TBVS acceptable to meet the requirements of 10 CFR 52.47(b) (1).

The staff finds that insufficient information has been provided to satisfy ITAAC requirements for the SWBVS because information required in COL Information Item 9.4-2 has not yet been supplied by the COL applicant. RAI 382, Question 09.04.04-1 has been issued to address this finding.

9.4.4.6 *Technical Specifications*

There are no technical specifications associated with the turbine island ventilation system. The staff finds that the proposed technical specifications follow the guidance of NUREG-0800, Section 16 and NUREG-1431, "Standard Technical Specifications (STS) for Westinghouse Plants," for the TBVS, and are therefore acceptable.

9.4.4.7 *Initial Plant Testing Program*

Initial plant testing requirements given for the turbine island ventilation system in U.S. EPR FSAR Tier 2, Section 14.2, "Initial Plant Test Program," are Turbine island Ventilation Systems (Test #087), and the requirement to confirm the site specific test as described in COL Information Item 14.2-13. The staff confirms that these tests as described in the U.S. EPR FSAR are an acceptable means to verify the system will perform as stated in COL FSAR Section 9.4.4.

9.4.4.8 *Post Combined License Activities*

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

9.4.4.9 *Conclusion*

The staff reviewed the COL application and checked the referenced U.S. EPR FSAR. The staff's review confirmed that the COL applicant addressed the required information relating to the turbine building ventilation system.

The staff reviewed the CCNPP Unit 3 design TBVS and SWBVS using the acceptance criteria guidance defined in NUREG-0800, Section 9.4.4. The staff concludes that the system, as described in the COL FSAR is designed to comply with the requirements of GDC 2. The staff finds that the requirements of GDC 60 will not apply to the TBVS because the TBVS is not a system that must process radioactive effluent. Since the U.S. EPR design is a single unit, GDC 5 is not applicable.

The site specific design of the SWBVS is to be provided to the staff through COL Information Item 9.4-2. When this information is supplied, the staff will review the COL application in accordance with the guidance of RG 1.206 and NUREG 0800, Section 9.4.4 for the SWBVS. The staff's COL application review will confirm compliance with 10 CFR 42.47(b)(1) and confirm that GDC 5 and GDC 60 do not apply to the SWBVS.

The COL information item relating to SWBVS cannot be evaluated until site specific design information of SWBVS is provided. This is being tracked as an open item in RAI 382, Question 09.04.04-4.

The SER on the U.S. EPR is not yet complete. The staff will update Section 9.4.4 of this report to reflect the final disposition of the design certification application.

9.4.5 Safeguard Building Controlled-Area Ventilation System

COL FSAR Section 9.4.5 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.4.5, "Safeguard Building Controlled-Area Ventilation System." The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issues relating to this section remained for review. The staff's review confirmed that there are no outstanding issues related to this section.

The staff reviewed the information in the U.S. EPR FSAR Tier 2, Section 9.4.5 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the safeguard building controlled-area ventilation system incorporated by reference in the COL FSAR will be documented in the staff's SER on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.4.5 of this report to reflect the final disposition of the design certification application.

9.4.6 Electrical Division of Safeguard Building Ventilation System

COL FSAR Section 9.4.6 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.4.6, "Electrical Division of Safeguard Building Ventilation System." The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issues relating to this section remained for review. The staff's review confirmed that there are no outstanding issues related to this section.

The staff is reviewing the information in U.S. EPR FSAR Tier 2, Section 9.4.6 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the Electrical Division of Safeguard Building Ventilation System incorporated by reference in the COL FSAR have been documented in the staff's SER on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.4.6 of this report to reflect the final disposition of the design certification application.

9.4.7 Containment Building Ventilation System

COL FSAR Section 9.4.7 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.4.7, "Containment Building Ventilation System." The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issues relating to this section remained for review. The staff's review confirmed that there are no outstanding issues related to this section.

The staff is reviewing the information in U.S. EPR FSAR Tier 2, Section 9.4.7 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the Containment Building Ventilation System incorporated by reference in the COL FSAR have been documented in the staff's SER on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.4.7 of this report to reflect the final disposition of the design certification application.

9.4.8 Radioactive Waste Building Ventilation System

COL FSAR Section 9.4.8 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.4.8, "Radioactive Waste Building Ventilation System." The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issues relating to this section remained for review. The staff's review confirmed that there are no outstanding issues related to this section.

The staff reviewed the information in the U.S. EPR FSAR Tier 2, Section 9.4.8 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the Radioactive Waste Building Ventilation System incorporated by reference in the COL FSAR have been documented in the staff SER on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.4.8 of this report to reflect the final disposition of the design certification application.

9.4.9 Emergency Power Generating Building Ventilation System

COL FSAR Section 9.4.9 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.4.9, "Emergency Power Generating Building Ventilation System." The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issues relating to this section remained for review. The staff's review confirmed that there are no outstanding issues related to this section.

The staff is reviewing the information in the U.S. EPR FSAR Tier 2, Section 9.4.9 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the Emergency Power Generating Building Ventilation System incorporated by reference in the COL FSAR will be documented in the staff's SER on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.4.9 of this report to reflect the final disposition of the design certification application.

9.4.10 Station Blackout Room Ventilation System

COL FSAR Section 9.4.10 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.4.10. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in U.S. EPR FSAR Tier 2, Section 9.4.10 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the Station Blackout Room Ventilation System incorporated by reference in the COL FSAR will be documented in the staff's SER on the design certification application for the U.S. EPR. The

SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.4.10 of this report to reflect the final disposition of the design certification application.

9.4.11 Essential Service Water Pump Building Ventilation System

COL FSAR Section 9.4.11 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.4.11. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff's review confirmed that there is no outstanding issue related to this subsection.

The staff is reviewing the information in U.S. EPR FSAR Tier 2, Section 9.4.11 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the Essential Service Water Pump Building Ventilation System incorporated by reference in the COL FSAR will be documented in the staff SER on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.4.11 of this report to reflect the final disposition of the design certification application.

9.4.12 Main Steam and Feedwater Valve Room Ventilation System

COL FSAR Section 9.4.12 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.4.12. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff's review confirmed that there is no outstanding issue related to this subsection.

The staff is reviewing the information in U.S. EPR FSAR Tier 2, Section 9.4.12 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the Main Steam and Feed Water Valve Room Ventilation System incorporated by reference in the COL FSAR will be documented in the staff's SER on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.4.12 of this report to reflect the final disposition of the design certification application.

9.4.13 Smoke Confinement System

COL FSAR Section 9.4.13 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.4.13. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in U.S. EPR FSAR Tier 2, Section 9.4.13 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the Smoke Confinement System incorporated by reference in the COL FSAR will be documented in the staff's SER on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.4.13 of this report to reflect the final disposition of the design certification application.

9.4.14 Access Building Ventilation System

COL FSAR Section 9.4.14 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.4.14. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff's review confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in U.S. EPR FSAR Tier 2, Section 9.4.14 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the Access Building Ventilation System incorporated by reference in the COL FSAR will be documented in the staff's SER on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.4.14 of this report to reflect the final disposition of the design certification application.

9.4.15 UHS Makeup Water Intake Structure Ventilation System

9.4.15.1 *Introduction*

The COL applicant that references the U.S. EPR design certification is required to provide the site specific information for the safety related UHS support systems, such as the Makeup Water System for the ESW cooling tower basins (U.S. EPR FSAR Tier 2, Section 9.2.5.2). This would also include the UHS Makeup Water Intake Structure Ventilation System.

This section was added as a supplement to the US EPR FSAR.

> The UHS Makeup Water Intake Structure Ventilation System maintains acceptable temperatures to support operation of the UHS Makeup Water Intake System pumps, traveling screens, and associated electrical distribution equipment, which are required to operate under design basis accident conditions. The UHS Makeup Water Intake Structure Ventilation System also maintains acceptable room temperatures within the intake structure personnel access.

9.4.15.2 *Summary of Application*

In COL FSAR Section 9.4.16, the COL applicant provided the following supplemental design information:

> The UHS Makeup Water Intake Structure contains four divisions of emergency makeup water system pump rooms. The UHS Makeup Water Intake Structure Ventilation System recirculates air for cooling or heating of the four UHS Makeup Water System pump rooms and the associated electrical rooms and traveling screen rooms. A drawing of the UHS Makeup Water Intake Structure Ventilation system is shown in COL FSAR Figure 9.4-2.
>
> The UHS Makeup Water Intake Structure Ventilation System maintains a minimum temperature of 41°F (5°C) and a maximum temperature of 104°F (40°C) in the UHS Makeup Water Intake Structure. These systems will support operation of the UHS Makeup Water Intake System pumps, dual flow traveling screens, screen wash system and associated electrical distribution equipment as

well as to support personnel access to these spaces. This temperature range maintains a mild environment in the building, as defined in US EPR FSAR Section 3.11.

During normal plant operation, the UHS Makeup Water System pumps are not in operation, except for the performance of periodic surveillance tests. During accident conditions the UHS Makeup Water Intake Structure Ventilation System functions to maintain acceptable room temperature conditions in the UHS Makeup Water Intake Structure, in case the UHS Makeup Water pumps are required to operate. The UHS Makeup Water pump, traveling screen, transformer and air-cooled condenser rooms are designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods and external missiles.

There are four independent pair of pump and electrical rooms (each pair is associated with a particular UHS Makeup Water System train. Failure of one train of the UHS Makeup Water Intake Structure Ventilation System could result in the operability of one train of the UHS Makeup Water System. However, this failure does not affect the other three trains of the UHS Makeup Water System.

The ventilation trains for the UHS Makeup Water Intake Structure include the following components: Air Conditioning Units, Ductwork and Accessories, Air Conditioning Unit Condensate Drip Pans, Air Supply Fans, Unit Heaters, Campers and Electrical Duct Heaters.

ITAAC: ITAAC requirements are listed in COL application, Part 10, Inspections, Tests, Analysis, and Acceptance Criteria and ITAAC Closure, Revision 9, Table 2.4-20, "Ultimate Heat Sink Makeup Water Intake Structure Ventilation System Inspections, Tests, Analyses, and Acceptance Criteria." COL FSAR, Revision 6, these ITAAC requirements were listed in Tables 2.4-21 and 2.4-22.

9.4.15.3 *Regulatory Basis*

The relevant requirements of NRC regulations for this area of review, and the associated acceptance criteria, are given in NUREG-0800, Section 9.4.5 and are summarized below. Review interfaces with other SRP sections also can be found in NUREG 0800, Section 9.4.5.

The applicable regulatory requirements for the UHS Makeup Water Intake Structure Ventilation System are as follows:

1. GDC 2, as it relates to the system being capable of withstanding the effects of earthquakes.

2. GDC 4, "Environmental and Dynamic Effects Design Bases," as it relates to Engineered Safety Feature Ventilation Systems (ESFVS) being appropriately protected against dynamic effects and being designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing and postulated accidents. The evaluation with respect to GDC 4 also includes evaluation of the adequacy of environmental support provided to structures, systems and components important to safety located within areas served by the ESFVS.

3. GDC 5, “Sharing of Structures, Systems, and Components,” as it relates to shared systems and components important to safety.

4. GDC 17, “Electric Power Systems,” as it relates to ensuring proper functioning of the essential electric power system.

5. GDC 60, “Control of Release of Radioactive Materials to the Environment,” as it relates to the system being capable to suitably control release of gaseous radioactive effluents to the environment.

6. 10 CFR 50.63, “Loss of All Alternating Current Power,” as it relates to necessary support systems providing sufficient capacity and capability for coping with a station blackout event. An analysis to determine capability for withstanding (if an acceptable alternate ac source is provided) or coping with a station blackout event is required. The analysis should address, as appropriate, the potential failures of equipment/systems during the event (e.g., loss of or degraded operability of HVAC systems, including the ESFVS, as appropriate), the expected environmental conditions associated with the event, the operability and reliability of equipment necessary to cope with the event under the expected environmental conditions and the habitability of plant areas requiring operator access during the event and associated recovery period.

7. 10 CFR 52.80(a), as it relates to the requirement that a COL application contain the proposed ITAAC that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act of 1954, and NRC regulations.

Acceptance Criteria adequate to meet the above requirements include:

1. For GDC 2, acceptance is based on the guidance of RG 1.29, “Seismic Design Classification,” Revision 4, March 2007, Regulatory Position C.1, for safety related portions and Regulatory Position C.2 for non-safety related portions.

2. For GDC 4, acceptance is based on meeting the acceptance criteria in the following SRP sections, as they apply to the ESFVS: SRP Sections 3.5.1.1, 3.5.1.4, 3.5.2, and SRP Section 3.6.1.

3. For GDC 5, acceptance is based on the determination that the use of the ESFVS in multiple-unit plants during an accident in one unit does not significantly affect the capability to conduct a safe and orderly shutdown and cool-down in the remaining unit(s).

4. For GDC 17, acceptance is based on the guidance of NUREG-CR/0660, Subsection A, item 2 and under Subsection C section, "Recommendations," item 1 for protection of essential electrical components from failure due to the accumulation of dust and particulate materials.

5. For GDC 60, acceptance is based on the guidance of RG 1.52 and RG 1.140 as related to design, inspection, testing and maintenance criteria for post-accident and normal atmosphere cleanup systems, ventilation exhaust systems, air filtration, and adsorption units of light –water-cooled nuclear power plants. For RG 1.52, Revision 3, the

applicable is Regulatory Position C.3. For RG 1.140, Revision 2, the applicable is Regulatory Positions are C.2 and C.3.

6. For 10 CFR 50.63, acceptance is based on the applicable guidance of RG 1.155, "Station Blackout," including Regulatory Position C.3.2.4.

9.4.15.4 *Technical Evaluation*

The staff reviewed COL FSAR Section 9.4.15 and checked the referenced design certification FSAR to ensure that the combination of the information in the U.S. EPR FSAR and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff's technical evaluation of the information incorporated by reference related to UHS Makeup Water Intake Structure Ventilation System will be documented in the staff's SER on the design certification application for the U.S. EPR.

The staff reviewed COL FSAR Section 9.4. in accordance with SRP Section 9.4.5, Section III, Review Procedures.

GDC 2 – Natural Phenomena

Guidance for GDC 2 is based on RG 1.29, Regulatory Positions C.1 for safety related and C.2 for non-safety related. In accordance with RG 1.29, Regulatory Position C.1, any nuclear power plant SSC important to safety shall be designed to withstand the effects of earthquakes without loss of capability to perform their safety functions. COL FSAR Table 3.2-1, "Classification Summary for Site specific SSCs," shows that UHS Makeup Water Intake Structure Ventilation System is classified as safety related and designed to Seismic Category I standards. The staff notes that this complies with the requirements of RG 1.29, Regulatory Position C.1.

Additionally, COL FSAR Table 3.2-1 shows that the UHS Makeup Water Intake Structure that house the UHS Makeup Water Intake Structure Ventilation System is Seismic Category I designed structures that are also located and designed to provide protection from flood, hurricane/tornado winds, and missiles. U.S. EPR FSAR Tier 2 Sections 3.3, 3.4, 3.5, 3.7, and 3.8 provide the bases for the adequacy of the structural design of these buildings with respect to natural phenomena.

The staff notes that the UHS Makeup Water Intake Structure Ventilation System does not contain nonessential components or interface with nonessential systems; therefore, no additional evaluations regarding system isolation, specification changes or operational occurrences of essential components resulting from failure of nonessential components, are required.

In the event a single active failure occurs in one ventilation train associated with the UHS Makeup Water Intake Structure Ventilation System, the remaining three trains will continue to operate because they are independent and physically separated. The impacted ventilation train will result in the inoperability of the associated UHS Emergency Makeup Water System train.

The staff finds that the design of the UHS Makeup Water Intake Structure Ventilation System RG 1.29, Regulatory Position C.1 and, therefore, meets the GDC 2 requirements.

GDC 4 – Dynamic Effects

The UHS Makeup Water Intake Structure Ventilation System consists of four redundant trains each located in a separate pump room in the UHS Makeup Water Intake Structure. The building is designed to withstand the effects of natural phenomena, such as earthquakes, tornados, hurricanes, floods and external missiles (COL FSAR Sections 3.5.1.4, 3.5.2, 9.4.15.1).

There are four independent pairs of pump and electrical rooms (each pair is associated with a particular UHS Makeup Water System train). Failure of one train of the UHS Makeup Water Intake Structure Ventilation System results in the inoperability of one train of the UHS Makeup Water System. However, this failure does not affect the other three trains of the UHS Makeup Water System. Only one train is required to support a safe plant shutdown or mitigate an accident.

Each of the four UHS Makeup Water Intake Structure Ventilation System trains is physically separated; therefore, only one train can be physically affected by an internal hazard (fire, flood, or pipe break).

The COL applicant indicated in COL FSAR Table 3.11-1, "Site specific Environmentally Qualified Electrical/I&C Equipment," the system equipment is located in a mild environment. Therefore, the equipment does not need to be environmentally qualified. The staff notes that this complies with the requirements of GDC 4.

The staff concludes the design of the UHS Makeup Water Intake Structure Ventilation System satisfies GDC 4 regarding potential dynamic effects, such as pipe whip, jet impingement, and missile impacts caused by equipment failure or events outside the plant.

GDC 5 – Sharing of Structures, Systems, and Components

GDC 5 governs the sharing of structures, systems, and components important to safety between multiple units in order to ensure such sharing will not significantly impair their ability to perform their safety functions. The staff finds that the CCNPP Unit 3 design is a single unit station, and the requirements of GDC 5 are not applicable to the single-unit design.

GDC 17 - Electric Power Systems

In accordance with GDC 17, the UHS Makeup Water Intake Structure Ventilation System is required to provide adequate means for controlling airborne particulate material, such as dust that could result in electrical equipment failure. One way to meet these requirements is to follow NUREG-CR/0660, which requires that the air intake systems should be installed 6.1 m (20 ft) above grade elevation or the electrical enclosures shall be equipped with suitable seals or gaskets, or justify an alternative. COL FSAR Section 9.4.15, or COL FSAR Chapter 8, "Electric Power," did not provide evidence that the air intakes for each division are installed at a minimum of 6.1 m (20 ft) above building grade or provide any indication that the electrical equipment enclosures are provided with seals or gaskets. Therefore, in RAI 87, Question 09.04.05-1, Part B, the staff requested that the COL applicant clarify how the design of the Makeup Water Intake Structure Ventilation System meets the requirements of GDC-17.

In a July 24, 2009, response to RAI 87, Question 09.04.05-1, Part B, the COL applicant stated that the UHS Makeup Water Intake Ventilation for the Electrical Building is located below grade

and there are no exterior air intakes. The four UHS Makeup Water Electrical Building Rooms are considered confined spaces, since the structure is below grade and the roof access openings are all watertight to endure potential floods. Low voltage electrical equipment is protected from dust, dirt, and grit by National Electrical Manufacturers Association (NEMA) Type 12 enclosures. Medium voltage transformers are specified to operate in this environment. This design protects equipment against airborne particulate material, which could cause electrical equipment failure. The staff finds this design establishes compliance with GDC 17.

The staff reviewed the COL applicant's July 24, 2009, response to RAI 87, Question 09.04.05-1, Part B, including the proposed COL FSAR change. The staff finds that the applicant has adequately demonstrated compliance with GDC 17 relative to the UHS Makeup Water Intake Structure Ventilation System. The staff reviewed proposed COL FSAR revisions and finds them acceptable. The staff subsequently reviewed COL FSAR, Revision 6, Sections 9.4.15.2.1 and 9.4.15.6 and notes that the proposed revision of RAI 87, Question 09.04.05-1, Part B, has been correctly incorporated into the COL FSAR. Accordingly, the staff considers RAI 87, Question 09.04.05-1, Part B, resolved.

GDC 60 - Atmosphere Cleanup Systems

The UHS Makeup Water Intake Structure Ventilation Systems are not expected to contain or interface with any radioactive materials; therefore, they are not subject to the requirements of GDC 60.

10 CFR 50.63 – Station Blackout

10 CFR 50.63, “Loss of Alternating Current Power,” is applicable for situations that would require safety related equipment be operational during a station blackout event. The UHS Makeup Water System is not required to operate for the first 72 hours upon receipt of an accident signal (COL FSAR Section 9.2.5.5) because of the heat removal capacity contained in the UHS tower basin. The maximum coping time required for the plant to sustain a station blackout (SBO) is 8 hours (U.S. EPR FSAR Tier 2, Section 8.4.2.6.1); therefore, the UHS Makeup Water System is not required to be operational. Since the UHS Makeup Water System is not operational during the SBO event, the associated ventilation trains are also not required to be operational (COL FSAR Section 9.4.15.2.3).

10 CFR 52.80(a) - ITAAC

The staff also reviewed the ITAAC requirements in COL application, Part 10: ITAAC and ITAAC Closure, Revision 5, Table 2.4-21,”Ultimate Heat Sink Makeup Water Intake Structure Ventilation System Inspections, Tests, Analyses, and Acceptance Criteria,” and COL FSAR Table 2.4-22, “Ultimate Heat Sink Electrical Building Ventilation System Inspections, Tests, Analyses, and Acceptance Criteria.” COL FSAR Tables 2.4-21 and 2.4-22 both show ITAAC testing to confirm the capability to maintain building temperatures between 41 °F (5 °C) and 104 °F (40 °C), which is consistent with COL FSAR Section 9.4. The staff finds the ITAAC acceptance criteria for these ventilation systems appropriate, but also requires additional information as discussed below.

The COL applicant provided the performance requirements for the system, but has not provided detailed design information related to the sizing of the HVAC system. Adequate sizing of the system must be assured through the ITAAC, which verifies the capability of the system to control temperature and remove the design heat load. In RAI 233, Question 09.04.05-2, the

staff requested that the COL applicant provide a description in the COL FSAR for the verification of system's capability to remove the design heat load, and of methods for determining the design heat loads including limiting assumptions for all modes of operation for Sizing of the HVAC System. As part of this description, the staff requested that the COL applicant specify design-basis outdoor air temperatures, along with bases for selection of these limiting ambient temperatures.

In a July 29, 2010, response to RAI 233, Question 09.04.05-2, the COL applicant included a proposed revision to the COL FSAR Sections 9.4.15.1, 9.4.15.2, 9.4.15.4, 14.2.14.8 and 14.2.14.9 and COL application, Part 10, ITAAC Tables 2.4-21 and 2.4-22. The COL applicant stated that UHS Makeup Intake Structure Ventilation System and the UHS Electrical Building Ventilation are designed to remove equipment room design basis heat loads during all modes of system operation, including and following a design basis accident. The bounding case for design of these ventilation systems assumes each division of the UHS Makeup System is operating at capacity, coincident with the maximum design outdoor ambient conditions. Mechanical and electrical equipment heat loads to the rooms are based on equipment nameplate ratings. The summer and winter design-basis temperature as described in COL FSAR Section 2.3 are used to ensure adequate system capacity for cooling and heating, respectively. COL application, Part 10, ITAAC Tables 2.4-21 and 2.4-22, Item 7 provide ITAAC to demonstrate that each division of UHS Makeup water Intake Structure Ventilation System will support the operation of the associated division by maintaining a room temperature between a minimum of 5 °C (41 °F) and a maximum of 40 °C (104 °F) design limits.

The staff finds the COL applicant response to RAI 233, Question 09-04-05-2 acceptable and that the proposed FSAR changes have been included in COL FSAR Revision 9. Accordingly, the staff considers RAI 233, Question 09.04.05-2 resolved.

9.4.15.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.4.15.6 *Conclusion*

The staff reviewed the COL application and checked the referenced design certification FSAR. The staff's review confirmed that the COL applicant addressed the required information relating to the UHS Makeup Water Intake Structure Ventilation System and there is no outstanding information expected to be addressed in the COL FSAR related to this section.

The staff is reviewing the information in the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the UHS Makeup Water Intake Structure Ventilation System incorporated by reference in the COL FSAR will be documented in the staff's SER on the design certification application for the U.S. EPR. The SER on the U.S. EPR is not yet complete. The staff will update Section 9.4.15 of this report to reflect the final disposition of the design certification application.

The staff notes that the COL applicant provided sufficient information in the COL FSAR to meet the requirements of GDC 2 with respect to the UHS Makeup Water Intake Ventilation System being capable of withstanding the effects of earthquakes by complying with the guidance RG 1.29.

The staff notes that the COL applicant provided sufficient information in the COL FSAR to meet the requirements of GDC 4 and GDC 17 with respect to the UHS Makeup Water Intake Ventilation System being capable of maintaining environmental conditions in areas serviced by equipment important to safety that could be exposed to normal, transient or accident conditions, and protection from failure due to accumulation of dust and particulate materials.

The UHS Makeup Water Intake Structure Ventilation System is not expected to contain or interface with any radioactive materials; therefore, it is not subject to the requirements of GDC 60. Also, the UHS Makeup Water System is not required to be operable during the SBO coping period. Therefore, 10 CFR 50.63 does not apply.

The staff finds the ITAAC requirements to ensure that site specific information not provided in the COL FSAR is identified and addressed with respect to the UHS Makeup Water Intake Structure Ventilation System, and that this system can be properly inspected, tested and operated in accordance with COL FSAR requirements. The staff finds that this meets the requirements of 10 CFR 52.80(a).

9.4.16 Fire Protection Building Ventilation System

9.4.16.1 *Introduction*

This section is added as a supplement to the U.S. EPR FSAR.

The Fire Protection Building (FPB) Ventilation System provides an environment suitable for the operation of the Fire Protection System pumps. This system provides an ambient air flow quantity necessary to maintain the indoor environment for operation of the fire protection pumps and to support personnel access to the three FPB pump rooms.

9.4.16.2 *Summary of Application*

Site specific design information for the FPB Ventilation System is provided in COL FSAR Sections 9.4.16.1 through 9.4.16.6.

The FPB Ventilation System uses outside air to ventilate three pump rooms, the two 100 percent capacity diesel engine driven pump rooms and the electric motor driven pump room. The separate and independent heating and ventilation systems for each of the diesel engine driven pump rooms are identical. Each diesel pump room is supplied with wall mounted outside air intake louvers with motor operated dampers, electric unit heaters, exhaust fans, engine combustion air inlet ductwork with air intake filter, and combustion gas exhaust ductwork for proper pump performance. The electric motor driven pump room is supplied with wall mounted outside air intake louvers with motor operated dampers, electric unit heaters and an exhaust fan. The ventilation system for the diesel driven pumps and associated equipment are required to operate after a seismic event and are designed to meet Seismic Category II-SSE requirements. The ventilation system in the electric motor driven pump room is a non-seismic, augmented quality system.

During normal conditions, the ventilation system for each room use two 50 percent wall mounted intake air louvers for inlet air with exhaust through a single 100% exhaust fan. The intake louvers and exhaust fans are supplied with motor operated dampers. The intake louvers and the exhaust fans are interlocked to modulate air flow based on minimum and maximum

design temperatures. During winter conditions, air is heated by two electric unit heaters. These heaters are controlled by local thermostats to maintain the required minimum room temperature.

Combustion air for the diesel engine driven pumps is supplied through duct located in each diesel engine driven pump room. Each combustion air inlet is supplied with an air intake filter, and each diesel pump supplied with a combustion gas exhaust duct for proper pump performance.

ITAAC: ITAAC requirements in COL application, Part 10: ITAAC, Revision 8, Table 2.4-21, "Fire Protection Building Ventilation System Inspections, Tests, Analyses, and Acceptance Criteria." In COL FSAR Revision 6, these tables were listed in Table 2.4-23.

9.4.16.3 *Regulatory Basis*

The relevant requirements of NRC regulations for this area of review and the associated acceptance criteria are given in NUREG-0800, Section 9.4.3, "Auxiliary and Rad-Waste Building Ventilation System," and are summarized below. Review interfaces with other SRP sections can be found in NUREG-0800, Section 9.4.3.

The applicable regulatory requirements for the FPB Ventilation System are as follows:

1. GDC 2, "Design Bases for Protection against Natural Phenomena," as it relates to the system being capable of withstanding the effects of earthquakes.

2. GDC 5, "Sharing of structures, systems and components," as it relates to shared systems and components important to safety.

3. GDC 60, "Control of Release of Radioactive Materials to the Environment," as it relates to the capability of the system to suitably control release of gaseous radioactive effluents to the environment.

4. 10 CFR 52.80(a), as it relates to the requirement that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act of 1954, and NRC regulations.

Acceptance Criteria adequate to meet the above requirements include:

1. For GDC 2, conformance with RG 1.29, "Seismic Design Classification," Revision 4, March 2007, Regulatory Position C.1, for safety related portions and Regulatory Position C.2 for non-safety related portions.

2. For GDC 5, acceptance is based on the determination that sharing of FPBVS structures systems and components in multiple-unit plants does not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cool-down of the remaining unit(s).

3. For GDC 60, conformance with RG 1.52 "Design, Testing, and Inspection Criteria for Air Filtration and Adsorption Units of Post-Accident Engineered-Safety-Feature Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," Revision 3, June 2001.

4. RG 1.140, "Design, Inspection, and Testing Criteria for Air Filtration and Adsorption Units of Normal Atmosphere Cleanup Systems in Light-Water-Cooled Nuclear Power Plants," Revision 2, June 2001, as it relates to design, inspection, testing, and maintenance criteria for post-accident and normal atmosphere cleanup systems, ventilation exhaust systems, air filtration, and adsorption units.

9.4.16.4 *Technical Evaluation*

The Fire Protection Building ventilation system located in the two 100 percent capacity diesel engine-driven pump rooms is an augmented quality system designed to meet Seismic Category II-SSE requirements. As shown in COL FSAR Section 3.2.1.2, Seismic Category II-SSE systems are designed to remain functional during and following a safe-shutdown earthquake (SSE). The ventilation system in the electric motor driven pump room is a non-seismic, augmented quality system.

The COL applicant provided the following additional information on the FPB Ventilation System in a June 5, 2009, response to RAI 79, Question 14.03.07-1. During normal plant operation, fire protection system pumps do not operate except for a jockey pump and periodic surveillance tests. The FPB Ventilation System maintains acceptable room temperatures for pump start and operation. Room temperature is monitored by sensors located in each pump room. If one or more components for the ventilation system of a diesel engine driven pump room fails, the ventilation system may not maintain the required conditions for that room. Since there are two redundant diesel engine driven pump rooms, each with a separate ventilation system and air supply, a ventilation failure in one diesel engine driven pump room does not affect the other diesel engine driven pump room.

The FPB Ventilation System is designed to maintain ambient conditions inside the building to allow reliable pump operation. The design maximum temperature of 120°F in the pump rooms is based on an outside ambient temperature of 100°F and room equipment heat loads. The equipment inside the pump rooms is designed to withstand a temperature of 120°F. A minimum temperature of 5 °C (40 °F) will be maintained in the building based on a minimum ambient temperature of 23.3 °C (-10 °F).

The ventilation systems are located inside each pump room of the Fire Protection Building, which is designed to withstand the effects of an SSE. The ventilation systems for the diesel-engine pump rooms remain functional after an SSE. COL FSAR Chapter 3.2 provides additional discussion of the seismic requirements for the Fire Protection System. The two identical diesel engine driven pumps and diesel pump room ventilation systems provide redundancy. Therefore, no single failure of the ventilation system compromises the fire-protection functions of the system. In the event of Loss of Offsite Power or in the event of Station Blackout, the emergency power system is supplied to the FPB Ventilation System to the two diesel engine driven pump room components to maintain the normal room design temperature conditions.

The staff reviewed COL FSAR, Revision 6, Section 9.4.16 and Tables 3-10-1 and 3-11-1 and notes that revisions proposed in the [date] response to RAI 79, Question 14.03.07-1 had been

correctly incorporated into the COL FSAR. The staff also reviewed COL FSAR Revision 8 and considers RAI 79, Question 14.03.07-1 adequately resolved.

GDC 2 - Natural Phenomena

Guidance for GDC 2 is based on RG 1.29, Regulatory Positions C.1 for safety related and C.2 for non-safety related. In accordance with RG 1.29, Regulatory Position C.1, any nuclear power plant SSC important to safety shall be designed to withstand the effects of earthquakes without loss of capability to perform their safety functions.

The FPB is designed to withstand the effects of an SSE. COL FSAR Chapter 3 provides the bases for structural design adequacy of the FPB. Each FPB ventilation system is located within the separate pump rooms of the building. The ventilation systems in the diesel-engine pump rooms remain functional after an SSE event. COL FSAR Chapter 3.2 provides additional discussion of the seismic requirements for the Fire Protection System.

The staff reviewed the above information and Seismic Category II-SSE criteria presented in COL FSAR Chapter 3.2, relative to the fire protection system, and finds them acceptable. The staff finds that the design of the FPB ventilation system conforms to the guidance in RG 1.29 Regulatory Position C.5 and RG 1.189, and therefore, meets GDC-2 requirements. The ventilation system for the motor-driven fire-protection pump is not seismically qualified because adequate fire-protection coverage is supplied by the two diesel-engine driven pumps.

GDC 5 – Sharing of Structures, Systems, and Components

The staff notes that GDC 5 governs the sharing of structures systems and components important to safety between multiple units in order to ensure such sharing will not significantly impair the ability to perform their safety functions. The staff finds that the CCNPP Unit 3 design is a single unit station, and the requirements of GDC are not applicable to the single-unit design.

GDC 60 - Atmosphere Cleanup Systems

The staff notes that the FPB Ventilation Systems are not expected to contain or interface with any radioactive materials; therefore, are not subject to the requirements of GDC 60.

10 CFR 52.80(a) - ITAAC

The staff reviewed the ITAAC requirements in COL application, Part 10: ITAAC, Revision 8, Table 2.4-21. The staff finds the ITAAC requirements for the FPB ventilation system equipment identified as seismic category appropriate in that the criteria adequately addressed the design capability.

The ITAAC requirements for the FBP ventilation system cannot be evaluated until ITAAC for emergency power supply for the FPB two diesel driven pump room ventilation system components is also included. Therefore, in RAI 394, Question 09.04.03-1, the staff requested that the COL applicant provide the proposed ITAAC for power supplies for the two diesel driven pump room ventilation system components or provide justification for why ITAAC is not needed. The staff cannot conclude that FPB ventilation system meets 10 CFR 80 (a) until resolution of RAI 384, Question 09.04.03-1. , **RAI 384, Question 09.04.03-1 is being tracked as an open item.**

9.4.16.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.4.16.6 *Conclusion*

The staff reviewed the Fire Protection Building Ventilation System design in accordance with the acceptance criteria defined in NUREG-0800, SRP Section 9.4.3.

The staff notes that the COL applicant provided sufficient information in the COL FSAR to meet the requirements of GDC 2 with respect to the FP Building Ventilation System being capable of withstanding the effects of earthquakes by complying with RG 1.29.

The staff finds that ITAAC requirements to meet 10CFR 80 (a) for the FBP ventilation system cannot be evaluated until resolution of RAI 384, Question 09.04.03-1 regarding emergency power supply for the FPB two diesel driven pump room ventilation system components. Therefore, the staff cannot conclude that FPB Ventilation System meets the acceptance criteria of SRP Section 9.4.3.

9.5 Other Auxiliary Systems

9.5.1 Fire Protection System (Related to RG 1.206, Section C.III.1, Chapter 9, C.I.9.5.1, Fire Protection Program)

9.5.1.1 *Introduction*

The fire protection system provides assurance, through a defense-in-depth philosophy, that the NRC's fire protection objectives are satisfied. These objectives are: (1) to prevent fires from starting; (2) to detect rapidly, control, and extinguish promptly those fires that do occur; and (3) to provide protection for SSCs important to safety so that a fire that is not promptly extinguished by the fire suppression activities will not prevent the safe shutdown of the plant. In addition, fire protection systems must be designed such that their failure or inadvertent operation does not adversely impact the ability of the SSCs important to safety to perform their safety functions. These objectives are stated in NUREG-0800, Section 9.5.1, "Fire Protection Program," and are indentified as the Fire Protection Program goals and objectives in RG 1.189, "Fire Protection for Nuclear Power Plants."

9.5.1.2 *Summary of Application*

COL FSAR, Appendix 9A, Revision 9, Section 9.5.1 incorporates by reference U.S. EPR FSAR Tier 2, Revision 3, Section 9.5.1.

COL FSAR, Appendix 9A also states that the conceptual information in U.S. EPR FSAR Tier 2, Figures 9.A-98 through 106 related to the Access Building is applicable to the plant.

In addition, COL FSAR Section 9.5.1 and COL FSAR, Appendix 9B the COL applicant provided the following:

COL Information Items

The COL applicant provided additional information in COL FSAR Section 9.5.2.3 to resolve COL Information Item 9.5-1.

> A COL applicant referencing the U.S. EPR certified design will identify additional site specific communication locations necessary to support effective communication between plant personnel in all vital areas of the plant during normal operation, as well as during accident conditions.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C.1.7.1 to resolve COL Information Item 9.5-2.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide (RG) 1.189, Regulatory Position C.1.7.1, Design and Procurement Document Control.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C.1.7.2 to resolve COL Information Item 9.5-3.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.1.7.2, Instructions, Procedures and Drawings.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C.1.7.3 to resolve COL Information Item 9.5-4.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.1.7.3, Control of Purchased Material, Equipment, and Services.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C1.8 to resolve COL Information Item 9.5-5.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.1.8, Fire Protection Program Changes/Code Deviations.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C1.8.1 to resolve COL Information Item 9.5-6.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.1.8.1, Change Evaluations.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C1.8.5 to resolve COL Information Item 9.5-7.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.1.8.5, 10 CFR 50.72 Notification, and 10 CFR 50.73 Reporting.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C1.8.7 to resolve COL Information Item 9.5-8.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.1.8.7, Fire Modeling.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C5.5 to resolve COL Information Item 9.5-9.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.5.5, Post Fire Safe Shutdown Procedures.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C5.5.1 to resolve COL Information Item 9.5-10.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.5.5.1, and Safe Shutdown Procedures.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C5.5.2 to resolve COL Information Item 9.5-11.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.5.5.2, Alternative/ Dedicated Shutdown Procedures.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C5.5.3 to resolve COL Information Item 9.5-12.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.5.5.3, Repair Procedures.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C6.2.4 to resolve COL Information Item 9.5-13.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.6.2.4, Independent Spent Fuel Storage Areas.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C6.2.6 and Section 9.5.1.2.1 to resolve COL Information Item 9.5-14.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.6.2.6, Cooling Towers.

The COL applicant provided additional information in COL FSAR Table 9.5.1-1, Item C7.6 to resolve COL Information Item 9.5-15.

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address Regulatory Guide 1.189, Regulatory Position C.7.6, Nearby Facilities.

The COL applicant provided additional information in COL FSAR Section 9.5.1.2.1 to resolve COL Information Item 9.5-16.

> A COL applicant that references the U.S. EPR design certification will perform an as-built, post-fire Safe Shutdown Analysis, which includes final plant cable routing, fire barrier ratings, purchased equipment, equipment arrangement and includes a review against the assumptions and requirements contained in the Fire Protection Analysis. The post-fire Safe Shutdown Analysis will demonstrate that safe shutdown performance objectives are met prior to fuel loading and will include a post-fire safe shutdown circuit analysis based on the methodology described in NEI 00-01, "Guidance for Post-Fire Safe-Shutdown Circuit Analysis."

The COL applicant provided additional information in COL FSAR Section 9.5.1.3 to resolve COL Information Item 9.5-17.

> A COL applicant that references the U.S. EPR design certification will evaluate the differences between the as-designed and as-built plant configuration to confirm the Fire Protection Analysis remains bounding. This evaluation will be performed prior to fuel loading and will consider the final plant cable routing, fire barrier ratings, combustible loading, ignition sources, purchased equipment, equipment arrangement and includes a review against the assumptions and requirements contained in the Fire Protection Analysis. The applicant will describe how this as-built evaluation will be performed and documented, and how the NRC will be made aware of deviations from the FSAR, if any.

The COL applicant provided additional information in COL FSAR Section 9.5.1.3 to resolve COL Information Item 9.5-18.

> A COL applicant that references the U.S. EPR design certification will perform a supplemental Fire Protection Analysis for site specific areas of the plant not analyzed by the FSAR.

The COL applicant provided additional information in COL FSAR Section 9.5.1.2.1 to resolve COL Information Item 9.5-19.

> A COL applicant that references the U.S. EPR design certification will provide a description and simplified Fire Protection System piping and instrumentation diagrams for site specific systems.

The COL applicant provided additional information in COL FSAR Section 9.5.1.2.1 to resolve COL Information Item 9.5-20.

> A COL applicant that references the U.S. EPR design certification will describe the program used to monitor and maintain an acceptable level of quality in the fire protection system freshwater storage tanks.

COL Information Item 13.1-1

> A COL applicant that references the U.S. EPR design certification will provide site specific information for management, technical, support, and operating organizations. (For the Fire Protection Program Only)

COL Information Item 17.2-1

> A COL applicant that references the U.S. EPR design certification will provide the Quality Assurance Programs associated with the construction and operations phases. (For Fire Protection Only)

<u>Supplemental Information</u>

The COL applicant provided the following supplemental information:

COL FSAR, Appendix 9B, Section 9.5.1.2.1 supplements U.S. EPR FSAR, Appendix 9A. COL FSAR, Appendix 9B contains the site specific method of performing and the results of the Fire Protection Analysis, which contains the Safe Shutdown Analysis and the Fire Hazards Analysis.

COL FSAR Section 9.5.1.2.1 states that for all aspects of the site specific Fire Protection Program (FPP), the same codes and standards and applicable edition years apply for fire protection as listed in U.S. EPR FSAR Tier 2, Section 9.5.1.7.

COL FSAR Section 9.5.1.2.1 also states that COL FSAR Table 9.5-1 provides supplemental information to that provided in U.S. EPR FSAR Tier 2, Table 9.5.1-1. In COL FSAR Table 9.5-1, in the column, "CCNPP Unit 3 Supplement," the COL applicant provided site specific detail to address conformance to RG 1.189.

COL FSAR Section 9.5.1.2.1 includes supplemental information related to fire water distribution system piping and instrumentation diagrams, plant arrangement, cooling towers, as-built post-fire safe shutdown analysis, ventilation, smoke, fire detection, fire water supply system, and suppression systems.

COL FSAR Section 9.5.1.3 includes supplemental information related to an as-built FHA for all areas of the plant and a site specific FHA that will be performed for the areas described in COL FSAR, Appendix 9B.

COL FSAR Section 9.5.1.4 includes supplemental information related to the inspection and testing requirements that will be employed by the COL applicant.

COL FSAR Section 9.5.1.6 includes supplemental information related to the organizational and procedural aspects of the FPP, quality assurance measures, and fire protection program personnel training and qualification and aspects of the fire brigade.

COL application, Part 10, ITAAC and ITAAC Closure, includes Fire Protection Program Revisions and site specific Fire Protection-related ITAAC for the Ultimate Heat Sink, Fire Protection Building, Switchgear Building, Fire Water Distribution System, Fire Suppression Systems, and Offsite Power System.

9.5.1.3 *Regulatory Basis*

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

In addition the relevant requirement of NRC regulations for the fire protection system, and the associated acceptance criteria are given in NUREG-0800, Section 9.5.1. The applicable regulatory requirements for the fire protection system are as follows:

- 10 CFR 50.48, “Fire Protection,” as it relates to fire protection for Nuclear Power Plants.

The related acceptance criteria are as follows:

- Regulatory Guide 1.189, as it relates to fire protection for Nuclear Power Plants.
- Branch Technical Position (BTP) CMEB 9.5.1 in NUREG 0800, Revision 3, as it relates to Fire Protection.

9.5.1.4 *Technical Evaluation*

The staff reviewed COL FSAR Section 9.5.1 and checked the referenced design certification FSAR to ensure that the combination of the information in the design certification application and the information in the COL application represent the complete scope of information relating to the fire protection system except as noted below. The results of the staff’s evaluation of the information incorporated by reference in the COL FSAR will be documented, and its supplements. The staff’s technical evaluation of the information incorporated by reference related to the fire protection system will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR.

<u>COL Information Items</u>

The staff reviewed the information contained in COL FSAR, Appendix 9B, Section 9.5.1 and the documents listed below:

- UniStar Nuclear Energy Letter UN#09-211, “Response to NRC Request for Additional Information RAI No. 75,” May 8, 2009
- UniStar Nuclear Energy Letter UN#09-279, “Response to NRC Request for Additional Information RAI No. 75,” June 15, 2009
- UniStar Nuclear Energy Letter UN#09-324, Response to Request for Additional Information RAI No. 75, June 21, 2009
- UniStar Nuclear Energy Letter UN#09-338, Response to Request for Additional Information RAI No. 75, July 30, 2009
- UniStar Nuclear Energy Letter UN#09-488, Response to NRC Request for Additional Information RAI No. 178, December 01, 2009
- UniStar Nuclear Energy Letter UN#09-522, Response to NRC Request for Additional Information RAI No. 177, Question 09.05.01-13, December 17, 2009

- UniStar Nuclear Energy Letter UN#10-130, Response to NRC Request for Additional Information RAI No. 243, May 12, 2010
- UniStar Nuclear Energy Letter UN#10-272, Response to NRC Request for Additional Information RAI No. 177, October 22, 2010
- UniStar Nuclear Energy Letter UN#11-155, Response to NRC Request for Additional Information RAI No. 177, May 27, 2011
- UniStar Nuclear Energy Letter UN#11-188, Response to NRC Request for Additional Information RAI No. 311, June 21, 2011
- UniStar Nuclear Energy Letter UN#11-274, Response to NRC Request for Additional Information RAI No. 321, October 27, 2011
- UniStar Nuclear Energy Letter UN#11-286, Response to NRC Request for Additional Information RAI No. 324, November 16, 2011
- COL Information Item 9.5.1

> A COL applicant referencing the U.S. EPR certified design will identify additional site specific communication locations necessary to support effective communication between plant personnel in all vital areas of the plant during normal operation, as well as during accident conditions.

The staff reviewed the information in COL FSAR Section 9.5.2.3 and finds that, in accordance with the guidelines in RG 1.189 adequate communication exists for the site specific areas of the plant as follows:

The UHS Makeup Water Intake Structure contains safety related equipment and is a site specific vital area of the plant. Communication equipment will be provided in this area to support effective communication between plant personnel during normal operation, as well as during accident conditions. This location will contain equipment to allow use of the plant digital telephone system, PA and alarm system, and sound powered system. A portable wireless communication system will also be provided for use by fire brigade and other operations personnel required to achieve safe plant shutdown.

All the communication subsystems are available for use during normal operation of the plant. The staff notes that, except for the sound-powered system, the communication subsystems are powered from the Class 1E Emergency Uninterruptible Power Supply System (EUPS) or the Class 1E Emergency Power Supply System (EPSS), which are supported by the emergency and station blackout diesel generators to provide backup power. Therefore, all the communication subsystems are expected to be available for use during all accident conditions. However, all communications equipment is categorized as non-safety related, and is not relied upon to mitigate an accident. The sound-powered system does not require an external power source.

The staff finds this acceptable and also that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5.2

  > A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.1.7.1, Design and Procurement Document Control.

  COL FSAR Section 17.5 states that the Quality Assurance Program Description (QAPD) is established in UN-TR-06-001-A. UN-TR-06-001-A, Revision 1, Section V applies to non-safety related SSCs credited for regulated events such as for the fire protection system for which UniStar has committed to the quality requirements of RG 1.189 Regulatory Position 1.7, "Quality Assurance." UN-TR-06-001-A, Section V, Revision 1, states that measures shall be established to include design and procurement document control requirements in design and procurement documents and that deviation from these documents are controlled. COL FSAR Table 9.5-1 states that the FPP quality requirements are included in plant configuration control processes that describe the above measures. The staff reviewed these measures and finds that they adequately address RG 1.189, Regulatory Position C.1.7.1.

  The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-3

  > A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.1.7.2, Instructions, Procedures and Drawings.

  COL FSAR Section 17.5 states that the QAPD is established in UN-TR-06-001-A. UN-TR-06-001-A, Revision 1, Section V applies to non-safety related SSCs credited for regulated events such as for the fire protection system for which UniStar has committed to the quality requirements of RG 1.189, Regulatory Position 1.7, "Quality Assurance." The staff reviewed UN-TR-06-001-A, Section V, Revision 1 and finds that it adequately addresses RG 1.189, Regulatory Position C.1.7.2 as follows:

  COL FSAR Table 9.5-1 and UN-TR-06-001-A, Section V state that the FPP provides instruction, procedures, and drawings to control fire prevention and firefighting; design, installation, inspection, test, indoctrination, training, maintenance and modification of fire protection features/systems with appropriate administrative controls.

  The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-4

  > A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.1.7.3, Control of Purchased Material, Equipment, and Services.

  COL FSAR Section 17.5 states that the QAPD is established in UN-TR-06-001-A. UN-TR-06-001-A, Revision 1, Section V applies to non-safety related SSCs credited for

regulated events such as for the fire protection system for which UniStar has committed to the quality requirements of RG 1.189, Regulatory Position 1.7, "Quality Assurance." UN-TR-06-001-A, Section V, Revision 1 states that UniStar QAPD, Section G, "Control of Purchased Material, Equipment, and Services," shall be used to provide the overall program for control of purchased material, equipment, and services. The staff notes that UniStar QAPD, Section G shows that adequate measures are given to ensure that purchased material, equipment, and services conform to the procurement documents. The staff finds this adequately addresses RG 1.189 QA, Regulatory Position C.1.7.3.

The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-5

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.1.8, Fire Protection Program Changes/Code Deviations.

The staff notes that supplemental information for RG 1.189, Section C.1.8, in COL FSAR Table 9.5-1 indicates that Fire Protection Program changes or deviations will be assessed in accordance with existing regulatory guidance, and in the event a risk-informed, performance–based plant change evaluation process for new reactors is endorsed by the NRC, UniStar Nuclear Energy may opt to adopt such a process to augment the existing regulatory guidance for assessing program changes or deviations.

The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-6

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.1.8.1, Change Evaluations.

The staff reviewed COL FSAR Table 9.5-1, RG 1.189, Regulatory Position C.1.8.1, which states that "FPP program changes will be evaluated consistent with 10 CFR 50.59 and the applicable change processes in 10 CFR 52."

The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-7

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.1.8.5, 10 CFR 50.72 Notification, and 10 CFR 50.73 Reporting.

The staff reviewed COL FSAR Table 9.5-1, RG 1.189, Regulatory Position C.1.8.5, which states, "the plant will report fire events and any fire protection program deficiencies consistent with 10 CFR 50.72 and 10 CFR 50.73."

The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-8

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.1.8.7, Fire Modeling.

The staff reviewed COL FSAR Table 9.5-1, RG 1.189, Regulatory Position C.1.8.7, which states, "If fire models are used to evaluate changes, the plant will apply models consistent with RG 1.189 including limitations on their use and adequate verification and validation (as required)."

The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-9

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.5.5, Post-Fire Safe- Shutdown Procedures.

The staff reviewed COL FSAR Table 9.5-1, RG 1.189, Regulatory Position C.5.5, which states, "The plant will have detailed procedures and training to ensure fire-safe shutdown and other fire-safe conditions required to minimize radioactive material release are achieved and maintained."

The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-10

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.5.5.1, Safe- Shutdown Procedures.

See COL Information Item 9.5-9 above for staff evaluation.

- COL Information Item 9.5-11

> A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.5.5.2, Alternative/ Dedicated Shutdown Procedures.

See COL Information Item 9.5-9 above for staff evaluation.

- COL Information Item 9.5-12

  > A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.5.5.3, Repair Procedures.

  The staff reviewed COL FSAR Table 9.5-1, RG 1.189, Regulatory Position C.5.5.3, which states, “Consistent with the U.S. EPR FSAR, the plant does not permit repairs to achieve hot or cold shutdown conditions; procedures are not required.”

  The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-13

  > A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.6.2.4, Independent Spent Fuel Storage Areas.

  The staff reviewed COL FSAR Table 9.5-1, RG 1.189, Regulatory Position C.6.2.4, which states, “No Independent Spent Fuel Storage Areas are planned for the plant at this time and are not included in this COL application.”

  The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-14

  > A COL applicant that references the U.S. EPR design certification will submit site specific information to address the Regulatory Guide 1.189, Regulatory Position C.6.2.6, Cooling Towers.

  The staff reviewed COL FSAR Table 9.5-1, RG 1.189, Regulatory Position C.6.2.6, which states that the Circulating Water System Cooling Tower (CWCT) Structure is addressed in COL FSAR, Appendix 9B. The staff also reviewed COL FSAR Section 9.5.1.2.1, which states that the CWCT is remotely located such that a fire will not adversely affect any systems or equipment important to safety and that fire protection features provided to protect the CWCT include a dedicated, underground, fire protection yard loop which surrounds the CWCT, and supplies yard hydrants located in accordance with NFPA 24. COL FSAR Section 9.5.1.2.1 also states that the yard loop is supplied from two independent supply lines from the main fire water distribution system underground yard loop and that other fire protection features provided include automatic fire detection, manual fire alarms and portable fire extinguishers.

  The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-15

  > A COL applicant that references the U.S. EPR design certification will submit site specific information to address Regulatory Guide 1.189, Regulatory Position C.7.6, Nearby Facilities.

  The staff reviewed COL FSAR Table 9.5-1, RG 1.189, Regulatory Position C.7.6, which states, "Appendix 9A of the U.S. EPR FSAR provides the technical analysis for the nuclear island and related power block structures and demonstrates that the EPR has the ability to achieve and maintain safe-shutdown and to minimize the release of radioactive materials to the environment. FSAR Appendix 9B of this COL application provides an analysis of fire hazards and details fire protection attributes for the remainder of the plant."

  The staff reviewed COL FSAR Appendix 9B and finds that Nearby Facilities are adequately addressed since they meet the guidance in RG 1.189, except for RAI 177, Question 09.05.01-14, which is discussed below.

  The staff reviewed the COL applicant's October 22, 2010, May 27, 2011, and April 15, 2013, responses to RAI 177, Question 09.05.01-14 and finds that the response meet the guidance of RG 1.189 and that a future COL FSAR Revision will fully address this COL information item. **RAI 177, Question 09.05.01-14 is being tracked as a confirmatory item.**

COL Information Item 9.5-16

> A COL applicant that references the U.S. EPR design certification will perform an as-built, post-fire Safe Shutdown Analysis, which includes final plant cable routing, fire barrier ratings, purchased equipment, equipment arrangement and includes a review against the assumptions and requirements contained in the Fire Protection Analysis. The post-fire Safe Shutdown Analysis will demonstrate that safe shutdown performance objectives are met prior to fuel loading and will include a post-fire safe shutdown circuit analysis based on the methodology described in NEI 00-01, "Guidance for Post-Fire Safe-Shutdown Circuit Analysis."

The staff reviewed COL FSAR Section 9.5.1.2.1 and finds that the COL applicant will perform an as-built, post-fire Safe Shutdown Analysis, including final plant cable routing, fire barrier ratings, purchased equipment, equipment arrangement and a review against the assumptions and requirements contained in the Fire Protection Analysis. The post-fire Safe Shutdown Analysis will demonstrate that safe shutdown performance objectives are met prior to fuel loading and will include a post-fire safe shutdown circuit analysis based on the methodology described in NEI 00-01 (NEI, 2001).

The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

COL Information Item 9.5-17

> A COL applicant that references the U.S. EPR design certification will evaluate the differences between the as-designed and as-built plant configuration to confirm the Fire Protection Analysis remains bounding. This evaluation will be performed prior to fuel loading and will consider the final plant cable routing, fire barrier ratings, combustible loading, ignition sources, purchased equipment, equipment arrangement and includes a review against the assumptions and requirements contained in the Fire Protection Analysis. The applicant will describe how this as-built evaluation will be performed and documented, and how the NRC will be made aware of deviations from the FSAR, if any.

The staff reviewed COL FSAR Section 9.5.1.3 and finds that the COL applicant will evaluate the differences between the as-designed and as-built plant configuration to confirm the Fire Protection Analysis remains bounding. This evaluation will consider the final plant cable routing, fire barrier ratings, combustible loading, ignition sources, purchased equipment, equipment arrangement and includes a review against the assumptions and requirements contained in the Fire Protection Analysis. The evaluation will address fire areas (identified in U.S. EPR FSAR Tier 2, Table 9A-2, Footnote 15) which have the potential for the presence of radiological sources. A summary of the results of the evaluation, including any identified deviations from the COL FSAR and confirmation that the Fire Protection Analysis remains bounding will be provided prior to fuel load.

The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-18

> A COL applicant that references the U.S. EPR design certification will perform a supplemental Fire Protection Analysis for site specific areas of the plant not analyzed by the FSAR.

The staff reviewed COL FSAR Section 9.5.1.3 and finds that COL FSAR Appendix 9B addresses the FPA for the remaining power block and balance of plant structures. In addition, the staff finds that the plant will maintain an integrated FHA and supporting evaluations that demonstrate that the plant can perform the following functions:

- achieve and maintain post-fire safe shutdown conditions for a fire in any fire area of the plant, including alternative shutdown fire areas
- maintain safe plant conditions and minimize potential release of radioactive material in the event of a fire during any plant operating mode
- detail the plant fire prevention, detection, suppression, and containment features, for each fire area containing SSCs achieve and maintain these safe conditions with due consideration of plant fire risk as characterized in the plant-specific fire probabilistic risk assessment (Fire PRA) important to safety

The Staff also compared the FPA methodologies given in COL FSAR Appendix 9B and U.S. EPR FSAR Appendix 9A which is incorporated by reference (IBR) and find them identical. The staff finds the FPA methodologies in COL FSAR Appendix 9B acceptable since they are identical to the U.S. EPR IBR methodologies.

The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-19

> A COL applicant that references the U.S. EPR design certification will provide a description and simplified Fire Protection System piping and instrumentation diagrams for site specific systems.

The staff reviewed COL FSAR Section 9.5.1.2.1 and finds that COL FSAR Figures 9.5-1, 9.5-2 and 9.5-3 were to supplement the generic piping and instrumentation diagram provided in U.S. EPR FSAR Tier 2, Figure 9.5.1-1.

The staff notes that COL FSAR Figure 9.5-1 illustrates the site specific fire main yard loop supplying the Cooling Tower area. This non-seismic loop supplies the sprinkler system protecting the Water Treatment Building as well as the yard fire hydrants.

The staff notes that COL FSAR Figure 9.5-2 illustrates the site specific fire main yard loop supplying the Intake Structure area. The Seismic Category II-SSE loop supplies fire water to the above ground manual and automatic suppression systems identified in COL FSAR Figure 9.5-3. This figure illustrates the Seismic Category II-SSE standpipe and hose stations and the Seismic Category II sprinkler systems specified for the UHS Makeup Water Intake Structure.

The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 9.5-20

> A COL applicant that references the U.S. EPR design certification will describe the program used to monitor and maintain an acceptable level of quality in the fire protection system freshwater storage tanks.

The staff reviewed COL FSAR Section 9.5.1.2.1 and finds that the suction storage tank makeup is supplied from the desalinization plant which ultimately draws suction from the Chesapeake Bay. The fire protection water supply is treated to potable quality to help prevent occurrence of biological fouling or corrosion by means of desalination and chemical treatment. The rate of makeup flow to the fire water storage tanks is sufficient to refill the minimum fire protection volume in one tank within 8 hours. In addition to water treatment, the fire water storage tanks are inspected periodically for biological growth and subsequent corrosion; fire service mains, fire hydrants and fire suppression systems are also flow tested and/or drained periodically to verify treatment success and to confirm system functionality. The rate of makeup flow to the fire water storage tanks is sufficient to refill the minimum fire protection volume in one tank within 8 hours.

The staff finds this acceptable and that COL FSAR Revision 9 fully addresses this COL information item.

- COL Information Item 13.1-1

> A COL applicant that references the U.S. EPR design certification will provide site specific information for management, technical, support, and operating organizations. (For the Fire Protection Program Only)

The staff reviewed COL FSAR Sections 9.5.1.6.2 and 13.1 and finds the organizational structure, functional responsibilities, and levels of authority and interfaces of the fire protection program are given therein. Specially, the staff finds that the Upper Level Manager is the Site Vice President described in COL FSAR Section 13.1.2.2.1, the General Supervisor – Operations Support is described in COL FSAR Section 13.1.2.2.1.1.1.2, the General Supervisor – Engineering Support is described in COL FSAR Section 13.1.2.2.1.2.2, the Onsite manager Plant General Manager is described in COL FSAR Section 13.1.2.2.1.1, the Nuclear training manager is described in COL FSAR Section 13.1.2.2.1.3, and the Onsite individual responsible for fire protection QA Site Director – Quality and Performance Improvement is described in COL FSAR Section 13.1.2.2.1.4.

The staff also finds that the Fire Marshall has responsibility to implement the day-to-day requirements of the Fire Protection Program. This position reports to the Plant General Manager and assists the Fire Protection Engineer, General Supervisor – Engineering Support, and the General Supervisor – Operations Support in administrating and implementing the Fire Protection Program through procedures, training, inspections, testing and evaluations.

The staff also finds that the UniStar Nuclear Operating Services, LLC site organizational structure is represented in COL FSAR Figure 13.1-4. The site specific management positions for the FPP identified above are included in COL FSAR Figure 13.1-4.

The staff finds this acceptable since it meets the guidance given in RG 1.189 Regulatory Position C.1.1 and that COL FSAR Revision 9 addresses this COL information item for the Fire Protection Program.

- COL Information Item 17.2-1

> A COL applicant that references the U.S. EPR design certification will provide the Quality Assurance Programs associated with the construction and operations phases. (For Fire Protection Only)

The staff reviewed COL FSAR Sections 9.5.1.6.5, 17.2, and 17.5 and finds that the Quality Assurance Program is established in UniStar Nuclear Energy topical report No. UN-TR-06-001-A, "Quality Assurance Program Description." The staff finds that the Quality Assurance Program for the Fire Protection Program complies with the applicable provision of 10 CFR Part 50, Appendix B for the Safety Related components/cables as detailed in UN-TR-06-001-A, and conforms to RG 1.189, Regulatory Position 1.7, Option 2 for Non-Safety Related components/cables given in UN-TR-06-001-A, Section V. See COL Information Items 9.5-1, 9.5-2, and 9.5-3 for specific details related to the Quality Assurance Program for the Fire Protection Program.

The staff finds this acceptable since it meets the guidance given in RG 1.189, Regulatory Position C.1.7 and that COL FSAR Revision 9 fully addresses this COL information item for the Fire Protection Program.

Supplemental Information

In addition, COL FSAR Section 9.5.1 describes site specific aspects of the FPP that are not addressed in the responses to the COL information items. The staff reviewed this additional description for conformance of COL FSAR Section 9.5.1 to the regulatory bases identified in Section 9.5.1.3 of this report. The following is a summary of the staff's evaluation:

The staff review and approval of COL FSAR Appendix 9B is given above in the technical evaluation of COL Information Item 18.

The staff notes that COL FSAR Section 9.5.1.2.1, Fire Water supply system states that the highest sprinkler system demand is for the Turbine Building and is 9085 Lpm (2400 gpm at 161 psig) and the highest standpipe system demand is for the Containment Building and is 4732 Lpm (1250 gpm at 176 psig). The staff finds this acceptable since these pressures and flow rates are needed to calculate the required capacity of the fire water supply as per RG 1.189, Regulatory Position C.3.2.1.

The staff reviewed COL FSAR Section 9.5.1.4, "Inspection and Testing Requirements," and finds this section acceptable since it is in accordance with RG 1.189, Regulatory Position C.1.7.5.

The staff reviewed COL FSAR Section 9.5.1.6.1, "Fire Prevention," and finds this section acceptable since it is in accordance with RG 1.189, Regulatory Position C.2 regarding administrative controls and procedures to minimize fire hazards in areas important to safety.

The staff reviewed COL FSAR Section 9.5.1.6.3, "Fire Protection Training and Personnel Qualifications for the Fire Protection System Operation, Testing, and Maintenance, General Employee Training, and Fire Watch Training," and finds this section acceptable since it is in accordance with RG 1.189, Regulatory Position C.1.6.

The staff notes that COL FSAR Section 9.5.1.6.4, "Fire Brigade Organization, Training, and Records," discusses Fire Brigade Equipment requirements, annunciator response procedures, pre-fire plans, and Emergency Plan coordination. The staff finds this section acceptable since it is in accordance with RG 1.189, Regulatory Positions C.3.4 and 3.5.

The staff notes that CCNPP Unit 3 does not conform to the requirement for the fire protection program to be fully implemented prior to fuel receipt at the plant site. CCNPP Unit 3 will use a two tier approach such that the elements of the Fire Protection Program necessary to support receipt and storage of fuel onsite will be implemented prior to initial fuel receipt, and elements of the Fire Protection Program necessary to support fuel load and plant operation will be implemented prior to initial fuel load as per COL FSAR Section 13.4. Fire Protection Program procedures shall be prepared 6 months before initial fuel receipt for those procedures that implement elements of the Fire Protection Program supporting fuel onsite as per COL FSAR Section 13.4.

The staff accepts the CCNPP Unit 3 Fire Protection Program and procedure implementation milestones as given in COL FSAR Section 13.4, since they will provide appropriate protection

consistent with the plant's completion schedule, and since adequate time is given for any NRC review of procedures.

COL application, Part 10, ITAAC and ITAAC Closure, includes the following:

- COL FSAR, Part 10 ITAAC, Appendix A, Item 4, relates to a License Condition for Fire Protection Program Revisions in accordance with SECY 05-0197. The staff finds this acceptable since it is in accordance with SECY 05-0197.
- COL FSAR, Part 10 ITAAC, Appendix B, Item 2.4, contains site specific ITAAC. Site specific ITAAC for Fire Protection include the Ultimate Heat Sink, Fire Protection Building, Switchgear Building, Fire Water Distribution System, Fire Suppression Systems, and Offsite Power System. These ITAAC address fire protection analysis, post-fire safe shutdown analysis, 3 hour rated barrier inspections, and Seismic Category II-SSE verification, as applicable. The staff finds these acceptable since these ITACC verify where needed barriers that have a minimum 3 hour rating and mitigate the propagation of smoke to the extent that safe shutdown is not adversely affected, verify where needed that at least one success path of the minimum set of SSCs is available for safe shutdown, and verify where needed the Seismic Category II-SSE qualification.

9.5.1.5 *Post Combined License Activities*

There are no Post COL License Activities for this section.

9.5.1.6 *Conclusion*

The staff reviewed the COL application and checked the referenced design certification FSAR. The staff confirmed that the COL applicant addressed the required information relating to the fire protection system, and there is no outstanding information expected to be addressed in the COL FSAR related to this section except as noted above. **RAI 177, Question 09.05.01-14 is being tracked as a confirmatory item**.

The staff is reviewing the information in the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the fire protection system incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR is not yet complete. The staff will update this Section 9.5.1 of this report to reflect the final disposition of the design certification application.

The staff concludes that the COL applicant's FPP design criteria and associated implementation are acceptable and meet the applicable requirements of 10 CFR Part 50 and 10 CFR Part 52, and are consistent with NRC policy contained in SECY 90-016 and SECY 05-0197, except for confirmatory items RAIs indentified above. As described above, the staff finds that the COL applicant has met the guidelines of RG 1.206, RG 1.189, Revision 1, and NUREG-0800, Revision 5, SRP Section 9.5.1, except as noted above. In addition, the staff compared the additional COL information within the COL application to the relevant NRC regulations, acceptance criteria defined in NUREG-0800, Revision 5, Section 9.5.1, and other NRC regulatory guides and concludes that the COL applicant is in compliance with NRC regulations and guidance as stated in the Technical Evaluation above.

9.5.2 Communication System

9.5.2.1 *Introduction*

The communication system provides intra-plant communications and plant-to-offsite communications during normal, maintenance, transient, fire, and accidents conditions, including loss of offsite power. The communication system is provided to assure adequate ability to communicate from all safety related and vital areas during plant operations and especially during accident conditions. Communication is provided by the plant digital telephone system, the public address (PA) and alarm system, and sound powered telephones. The sound powered telephones require no power supply. All other fixed communication systems are powered from the Class 1E emergency uninterruptible power supply system (EUPS) or the Class 1E emergency power supply system (EPSS), which are supported by the emergency and station blackout diesel generators.

9.5.2.2 *Summary of Application*

COL FSAR Section 9.5.2 incorporates by reference U.S. EPR FSAR Tier 2, Section 9.5.2.

In addition, in COL FSAR Section 9.5.2.3, the COL applicant provided the following:

<u>COL Information Items</u>

The COL applicant provided additional information in COL FSAR Section 9.5.2.3 to address COL information items as follows:

COL Information Item 9.5.2-1

> A COL applicant referencing the U.S. EPR certified design will identify additional site specific communication locations necessary to support effective communication between plant personnel in all vital areas of the plant during normal operation, as well as during accident conditions.

COL Information Item 9.5-21

> A COL applicant that references the U.S. EPR design certification will provide a description of the offsite communication system that interfaces with the onsite communication system**.**

The COL applicant provided additional information in COL FSAR Section 9.5.2.3 to address the COL Information Item as follows:

> The ultimate heat sink (UHS) makeup water intake structure contains safety related equipment and is a site specific vital area of the plant. Equipment as discussed in the Introduction above is supplied in this location to provide necessary communications. It is also noted that a portable wireless communication system is available to fire brigade and other operations personnel during accident conditions. Because of the redundant sources of power, it is expected that all fixed communication systems will be available during accident conditions. It is, however, noted that this equipment is classified as non-safety and is therefore not relied upon to mitigate an accident.

In addition to the COL information item provided by the COL applicant, the staff identified additional COL information items based on references to other design certification FSAR sections made in U,S, EPR FSAR Tier 2, Section 9.5.2.1 to satisfy the regulatory requirements stated in the SRP.

> COL Information Item 9.5.2-2: "Emergency Response Facilities." Section 9.5.2.2 of the U.S. EPR DC FSAR states that the details of the emergency response facilities, including the Technical Support Center (TSC), Operational Support Center (OSC), and the Emergency Operations Facility (EOF), are provided by the COL applicant as addressed in Section 13.3 of the U.S. EPR DC FSAR.
>
> COL Information Item 9.5.2-3: "Security Communications." Section 9.5.2.1.7 of the U.S. EPR DC FSAR states that design features required for security, including alarms and communications, are listed in Section 13.6. A physical security plan, as addressed in Section 13.6 is provided by the COL applicant per 10 CFR 52.9(a)(35) that satisfies the requirements of 10 CFR Part 73.

9.5.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed within the FSER related to the U.S. EPR FSAR.

In addition, the relevant requirements of NRC regulations for the Communication System and the associated acceptance criteria, are given in NUREG-0800, Section 9.5.2.

The applicable regulatory requirements for each COL information item are as follows:

1. COL Information Item 9.5.2-1 is based on 10 CFR Part 50, Appendix E, Part IV.E(9).

2. COL Information Item 9.5.2-2 is based on 10 CFR 50.34(f)(2)(xxv), "to provide an onsite Technical Support Center, an onsite Operational Support Center, and, for construction permit applications only, a near site Emergency Operations Facility"; and 10 CFR 50.47(b)(8), "Equipment and Facilities to Support Emergency Response."

3. COL Information Item 9.5.2-3 is based on 10 CFR 73.45 (g)(4)(i), "Provide Communications Networks"; 10 CFR 73.46 (f), "Fixed Site Physical Protection Systems, Subsystem, Components, and Procedures-Communications Subsystems"; 10 CFR 73.55(e), "Requirements for Physical Protection of Licensed Activities in Nuclear Power Reactors Against Radiological Sabotage- Detection Aids"; and 10 CFR 73.55(f), "Communications Subsystems."

4. COL Information Item 9.5-21 is based on 10 CFR Part 50, Appendix E, Part IV.D(1) to describe administrative and physical means for notifying local, State, and Federal officials and agencies and agreements reached with these officials and agencies for the prompt notification of the public and for public evacuation or other protective measures, should they become necessary. This description shall include identification of the appropriate officials, by title and agency, of the State and local government agencies within the Emergency Planning Zones (EPZ)s.

The related acceptance criteria are identified in SRP Section 9.5.2.

9.5.2.4 *Technical Evaluation*

The staff reviewed COL FSAR Section 9.5.2 and checked the referenced design certification FSAR to ensure that the combination of the design certification FSAR and the information in the COL FSAR represent the complete scope of information relating to this review topic. The staff confirmed that the information contained in the COL application and incorporated by reference addresses the required information relating to this section. U.S. EPR FSAR Tier 2, Section 9.5.2 is being reviewed by the staff under Docket No. 52-020. The staff's technical evaluation of the information incorporated by reference related to the Communication System will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR.

The staff reviewed the information contained in the COL FSAR.

The staff reviewed conformance of COL FSAR Section 9.5.2 to the guidance in RG 1.206, Section C.III.1, Chapter 9, C.I.9.5.2, "Communication System."

COL Information Items

The staff reviewed COL Information Items 9.5.2-1, 9.5.2-2 and 9.5.2-3 from U.S. EPR FSAR Tier 2, Table 1.8-2 included under COL FSAR Section 9.5.2 of the CCNPP COL FSAR. The staff's review of this COL application is limited to the COL information items described in Sections 9.5.2.4.1 thru 9.5.2.4.4 of this report.

9.5.2.4.1 COL Information Item 9.5.2-1: Additional Site specific Communications Locations

COL Information Item 9.5.2-1

> A COL applicant referencing the U.S. EPR certified design will identify additional site specific communication locations necessary to support effective communication between plant personnel in all vital areas of the plant during normal operation, as well as during accident conditions.

To resolve this COL information item, in COL FSAR Section 9.5.2.3, the COL applicant provided a description of communications systems that will be provided in the UHS Makeup Water Intake Structure. This location contains safety related equipment and is a site specific vital of the plant. The COL applicant stated that communications equipment will be provided in this area to support effective communication between plant personnel during normal operation, as well as during accident conditions. This location will contain equipment to allow use of the plant digital telephone system, public announcement, alarm system, and sound-powered system. A portable wireless communication system will also be provided for use by fire brigade and other operations personnel required to achieve safe plant shutdown.

10 CFR 52.47(a)(9) requires, in part, that an evaluation of the standard plant design against the SRP revision in effect 6 months before the docket date of the COL application. SRP Section 9.5.2.III.1 directs the staff to verify that effective communication will not be impeded by transmission through barriers, high-noise areas, personnel use of protective equipment, inadequate number of communication channels, interference between channels or subsystems, or interference from other electronic or electrical equipment. In RAI 42, Question 09.05.02-1, the staff requested that the COL applicant demonstrate how this acceptance criterion in SRP

Section 9.5.2 is addressed. Specifically, the staff requested that the COL applicant provide additional information to evaluate the susceptibility of the wireless communication system to noise level, electromagnetic interference (EMI), and radio frequency interference (RFI). In a January 14, 2009, response to RAI 42, Question 09.05.02-1, the COL applicant stated that a revision to COL FSAR Section 14.2.14 in the next revision of the COL FSAR will be made to include test method and acceptance criteria for the UHS Makeup Water Intake Structure and the UHS Electrical Building communication system. The revisions to COL FSAR Section 14.2.14 will include additional acceptance criteria to demonstrate that the communications equipment in the UHS Makeup Water Intake Structure and UHS Electrical Building is capable of operating under maximum noise conditions. Subsequently, the COL applicant's response to RAI 253, Question 03.07.02-42 identified the elimination of the UHS Electrical Building from the design. This change has been incorporated in Revision 7 of the COL FSAR. The staff finds the proposed revisions to COL FSAR Section 14.2.14 acceptable, since they include start-up testing to demonstrate communications equipment in the UHS Makeup Water Intake Structure and UHS Electrical Building is capable of operating under maximum noise conditions.

Except for the sound-powered system, the communication subsystems are powered from the Class 1E Emergency Uninterruptible Power Supply System or the Class 1E Emergency Power Supply System, which are supported by the emergency and station blackout diesel generators to provide backup power. Therefore, all subsystems are expected to be available for use during all accident conditions. 10 CFR Part 50, Appendix E, Part IV.E(9), requires that the licensee provide at least one onsite and one offsite communications system, with each system having a backup power source. The staff finds that the use of Class 1E EUPS and EPSS adequate in providing backup power meets the requirements of 10 CFR Part 50, Appendix E, Part IV.E(9) and thus satisfies COL Information Item 9.5.1-1.

9.5.2.4.2 COL Information Item 9.5.2-2: Emergency Response Facilities

COL Information Item 9.5.2-2 Emergency Response Facilities states that the details of the emergency response facilities, as required by 10 CFR 50.34(f)(2)(xxv) and 10 CFR 50.47(b)(8), including the Technical Support Center (TSC), Operational Support Center (OSC), and the Emergency Operations Facility (EOF), are provided by the COL applicant as addressed in U.S. EPR FSAR Tier 2, Section 13.3. To resolve this COL information item, COL FSAR Section 13.3 states that the U.S. EPR FSAR Tier 2, Section 13.3 includes the following COL information item:

> A COL applicant that references the U.S. EPR design certification will provide a site specific emergency plan in accordance with 10 CFR 50.47 and 10 CFR 50 Appendix E.

The COL applicant addressed this COL information item follows:

> A comprehensive Emergency Plan is provided in COLA Part 5.

The staff reviewed CCNPP Unit 3 Emergency Plan, Section F, "Emergency Communications," which describes the provisions utilized for prompt communications among principal emergency response organizations, communications with the emergency response organization, and communications with the general public. The COL applicant stated that extensive and reliable communication systems are installed at CCNPP Unit 3. Examples of the communications network include systems such as normal and dedicated telephone lines on landlines, microwave

and fiber-optic voice channels, cell phones, satellite phones, base and mobile radio units, and computer peripherals. This network provides:

- Voice communication through normal telephone, dedicated line and automatic ring-down between selected facilities, conference call capability, speaker phones, and operator assistance where required.

- Communications between emergency vehicles and appropriate fixed locations, as well as with state mobile units and fixed locations.

- Facsimile, computer network, and modem transmission.

The COL applicant maintains the capability to make initial notifications to the designated offsite agencies on a 24-hour per day basis. The offsite notification system provides communications to state and local warning points and emergency operations centers (EOCs) from the Control Room (CR), TSC, and EOF. Backup methods include facsimile and commercial telephone lines. State and local warning points are continuously staffed.

The COL applicant established several communication systems that ensure reliable and timely exchange of information necessary to provide effective command and control over any emergency response: (1) Between the site and state and local agencies within the EPZs; (2) with federal emergency response organizations; (3) between the plant, EOF, and state and local EOCs; and (4) between emergency response facilities and monitoring teams. A general description of the systems is as follows:

1. Offsite Notification System: The offsite notification system is a dedicated communications system that has been installed for the purpose of notifying state and local authorities of declared nuclear emergencies. This system links together the CCNPP Control Room(s), EOF, TSC(s), and state and local authorities as appropriate.

2. Dedicated Phone Lines: A dedicated phone link is established by limiting a phone line to one purpose, blocking its use for all other purposes. Several dedicated telephone links have been established between (a) the Control Room, TSC, and/or OSC; (b) the Control Room, TSC, and EOF; (c) the TSC and EOF; and (d) the emergency director, Control Room, TSC, and EOF.

3. Private Branch Exchange (PBX) Telephone System: The PBX telephone system provides communication capability between telephones located within the plant. The PBX is used to connect the Control Room, TSC, EOF, and OSC. The PBX telephone system also provides for outside communications through interconnections with the corporate telephone communications system and commercial telephone lines.

4. Local Commercial Telephone System: This system provides standard commercial telephone service through the public infrastructure, consisting of central offices and the wire line and microwave carrier. The commercial telephone system includes connections to PBX, emergency telephone system, dedicated lines to emergency facilities, and lines to the Joint Interoperability Centers (JIC). The commercial vendor provides primary and secondary power for their lines at their central office.

5. Emergency Response Data System (ERDS): The ERDS will supply the NRC with selected plant data points on a near real time basis.

6. Monitoring Team Communications: A separate communications system has been installed to allow coordinated environmental monitoring and assessment during an emergency. This system consists of the necessary hardware to allow communication between the Control Room, TSC, EOF, and mobile units in licensee vehicles. Commercial cell phones or other means are available as back up to the primary monitoring team communications system.

Communication with the NRC Operations Center will be performed via the NRC emergency notification system (ENS) and the health physics network (HPN) circuits or commercial telephone line. Installation and use of these NRC telephones is under the direction of the NRC. The ENS includes dedicated telephone equipment to establish communication between the site's control room and the NRC, with an extension of that line in the TSC. A separate line is available in the EOF with the capability of being patched with the site through the NRC. This line is used for NRC event notifications and status updates. The HPN also includes a separate dedicated telephone link between the NRC, TSC, and EOF for conveying health physics information to the NRC as requested or as an open line.

10 CFR 50.34(f)(2)(xxv) requires the licensee to provide an onsite TSC, an onsite OSC, and, for construction permit applications only, a near site EOF. 10 CFR 50.47(b)(8) requires the licensee to provide equipment and facilities to support emergency response. The staff reviewed the information provided in CCNPP Unit 3 Emergency Plan, Section F. The staff finds the description of the communications systems available for communication during normal and emergency operations adequate and meets the requirements of 10 CFR 50.34(f)(2)(xxv) and 10 CFR 50.47(b)(8) and thus satisfies COL Information Item 9.5.2-2.

9.5.2.4.3 COL Information Item 9.5.2-4: Security Communications

COL Information Item 9.5.2-3, "Security Communications," states that design features required for security, including alarms and communications, as required by 10 CFR 73.55, are listed in COL FSAR Section 13.6. A physical security plan as addressed in COL FSAR Section 13.6 is provided by the COL applicant per 10 CFR 52.9(a)(35) that satisfies the requirements of 10 CFR Part 73. To resolve this COL information item, COL FSAR Section 13.6 states that the U.S. EPR FSAR Tier 2, Section 13.6 includes the following COL information items and conceptual design information:

> A COL applicant that references the U.S. EPR design certification will provide a Physical Security Plan to the NRC to fulfill the requirements of 10 CFR 52.79(a)(35).

The COL applicant submitted a Physical Security Plan to satisfy this COL information item. The NRC Office of Nuclear Security and Incident Response (NSIR) will review the resolution to the COL Information Item 9.5.2-3 on the security communications as part of their review of the physical security plan. NSIR reviewed this COL for compliance with 10 CFR 52.79(a)(35), 10 CFE 73.55(e), and 10 CFR 73.55(t) will be completed as a part of the review for Section 13.6.9.5.2.4.9.

9.5.2.4.4 COL Information Item 9.5.2-3: Emergency Offsite Interfaces

Based on the staff's review of U.S. EPR FSAR Tier 2, Section 9.5.2, the design certification applicant modified U.S. EPR FSAR Tier 2, Section 9.5.2.1.1 to include COL Information

Item 9.5-21. This COL information item is identified in U.S. EPR FSAR Tier 2, Table 1.8-2, “U.S. EPR Combined License Information Items.”

COL Information Item 9.5-21

> A COL applicant that references the U.S. EPR design certification will provide a description of the offsite communication system that interfaces with the onsite communication system.

The staff reviewed CCNPP Unit 3 Emergency Plan, Section F, “Emergency Communications.” CCNPP Unit 3 Emergency Plan, Section F, Figure F-1 provides a depiction of the initial notification paths and the organizational titles from the Licensee Emergency Response Facilities (ERFs) to Federal, State, and local emergency response organizations, and industry support agencies. This includes the use of the ENS to communicate between the (1) TSC and NRC Headquarters, and (2) EOF and NRC Headquarters. In addition, communication is established between the EOF and the local and state authorities for initial notification and subsequent updates

CCNPP Unit 3 Emergency Plan, Part II, Section A.1.a.2 and A.1.a.3 identify the State of Maryland, Calvert County, Dorchester County and St Mary's County as the state and local authorities that the plant emergency operations facilities will be interfacing with during plant emergencies. The CCNPP Unit 3 Emergency Plan, Part II, Section F.l.a, commits to provide a system to notify the identified 24 hour warning points and the EOC for each of these agencies. Section A.1.a.2 and A.1.a.3 also states that the County Emergency Operations Centers (EOCs) serve as the primary coordinating center for local government response within the county's jurisdiction and for coordination between counties.

Section F.1.b-d.(1) of the CCNPP Unit 3 Emergency Plan commits to establishing a dedicated communications system to notify State and Local authorities. This section states that offsite is a dedicated communications system that has been installed for the purpose of notifying state and local authorities of declared nuclear emergencies. This system links together the CCNPP Control Room(s), the EOF, TSC(s) and state and local authorities as appropriate.” To verify the adequacy of the dedicated communications system to notify State and Local authorities, the applicant provides in COL application Table 2.3-1, "ITAAC for Emergency Planning," which commits in Inspection, Tests, Analysis 2.1 to: “[a] test of the dedicated offsite notification system will be performed to demonstrate the capabilities for providing initial notification to the offsite authorities after a simulated emergency classification.”

The staff finds the identification of the Maryland State and local County interfaces in CCNPP Unit 3 Emergency Plan, Part II, Section A.1.a.2 and A.1.a.3, as well as the ITAAC to commit to testing the dedicated communications system to these authorities acceptable in meeting the requirements of Appendix E to 10 CFR Part 50, Part IV.D(1).

In addition, 10 CFR 52.47(a)(22) requires applicants to provide information necessary to demonstrate that operating experience insights have been incorporated into the plant design. NRC Bulletin 80-15 states that licensees should address Emergency Notification System backup power availability in case of loss-of-offsite power. CCNPP Unit 3 COL FSAR Section 9.5.2.1.1 states that U. S. EPR FSAR includes the following COL Item in Section 9.5.2.1.1:

A COL applicant that references the U.S. EPR design certification will provide a description of the offsite communication system that interfaces with the onsite communication system.

This COL item is identified in CCNPP COL FSAR Table 1.8-2 as COL item 9.5-21.

To address this COL item, Section 9.5.2.1.1 states that the Emergency Notification System (ENS) is powered locally from either a safety related or non safety-related power source with a UPS. The UPS has either a battery or generator backup. The ENS is routed through the site PBX to provide access to multiple outbound call paths. The long distance portion of the system is provided by the NRC using direct access lines (DALs) to the federal long distance service directed through a toll-free (800/888) exchange.

The staff finds the use of a safety-related or non safety-related power source in the emergency notification system with an UPS, having either a battery or generator backup provides an adequate backup power source to the ENS in case of loss-of-off site power. As such, the staff finds the applicant's response and proposed FSAR modifications adequately address NRC Bulletin 80-15, and thus satisfy COL Item 9.5-21

9.5.2.5 *Post Combined License Activities*

There are no post COL activities related to this section.

9.5.2.6 *Conclusions*

The staff reviewed the COL application and checked the referenced design certification FSAR. The staff confirmed that the COL applicant addressed the required information relating to the Communication System, and there is no outstanding information expected to be addressed in the COL FSAR related to this section.

The staff is reviewing the information in the U.S. EPR FSAR on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the communications system incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR is not yet complete. The staff will update this Section 9.5.2 of this report to reflect the final disposition of the design certification application.

In addition, the staff compared the additional COL information within the COL application to the relevant NRC regulations, acceptance criteria defined in NUREG-0800, Section 9.5.2, and other NRC regulatory guides, and concludes that the COL applicant is in compliance with the NRC regulations, particularly 10 CFR 50.34(f)(2)(xxv); 10 CFR 50.47(b)(8), 10 CFR Part 50, Appendix E, Part IV.E(9); and 10 CFR Part 50, Appendix E, Part IV.D(1). The COL applicant has adequately described the availability of backup power sources for the ENS in case of loss-of-offsite-power to address BL 80-15 as required by 10 CFR 52.47(a)(33). The review by NSIR for compliance to 10 CFR 52.79(a)(35), 10 CFR 7.55(e), and 10 CFR 73.55(f) will be completed as a part of the review of Section 13.6.

9.5.3 Lighting System

COL FSAR Section 9.5.3 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier2, Section 9.5.3. The staff reviewed the COL application and checked the

referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in U.S EPR FSAR Tier 2, Section 9.5.3 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the lighting system incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.5.3 of this report to reflect the final disposition of the design certification application.

9.5.4 Diesel Generator Fuel Oil Storage and Transfer System

Each EDG has a separate and independent fuel oil (FO) storage and transfer system (DGFOSTS). Each system is comprised of a storage tank, a day tank, two pumps (fuel delivery and injection), and related piping and controls. The system stores a minimum of 7 days of fuel oil and delivers it to the EDG as required for continuous operation.

COL FSAR Section 9.5.4 incorporates by reference, with no departures or supplements, U.S, EPR FSAR Tier 2, Section 9.5.4. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in U.S EPR FSAR Tier 2, Section 9.5.4 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the diesel generator fuel oil storage and transfer system incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.5.4 of this report to reflect the final disposition of the design certification application.

9.5.5 Diesel Generator Cooling Water System

COL FSAR Section 9.5.5 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.5.5. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in U.S EPR FSAR Tier 2, Section 9.5.5 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the diesel generator cooling water system incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.5.5 of this report to reflect the final disposition of the design certification application.

9.5.6 Diesel Generator Starting Air System

COL FSAR Section 9.5.6 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.5.6. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in U.S EPR FSAR Tier 2, Section 9.5.6 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the diesel generator starting air system incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.5.6 of this report to reflect the final disposition of the design certification application.

9.5.7 Diesel Generator Lubricating System

COL FSAR Section 9.5.7 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.5.7. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in U.S EPR FSAR Tier 2, Section 9.5.7 on Docket No. 52-020. The results of the staff's technical evaluation of the information related to the diesel generator lubricating system incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.5.7 of this report to reflect the final disposition of the design certification application.

9.5.8 Diesel Generator Air Intake and Exhaust System

COL FSAR Section 9.5.8 incorporates by reference, with no departures or supplements, U.S. EPR FSAR Tier 2, Section 9.5.8. The staff reviewed the COL application and checked the referenced design certification FSAR to ensure that no issue relating to this section remained for review. The staff confirmed that there is no outstanding issue related to this section.

The staff is reviewing the information in U.S EPR FSAR Tier 2, Section 9.5.8 on Docket No. 2-020. The results of the staff's technical evaluation of the information related to the diesel generator air intake and exhaust system incorporated by reference in the COL FSAR will be documented in the staff safety evaluation report on the design certification application for the U.S. EPR. The SER on the U.S. EPR FSAR is not yet complete. The staff will update Section 9.5.8 of this report to reflect the final disposition of the design certification application.