3.0 DESIGN OF STRUCTURES, COMPONENTS, EQUIPMENT, AND SYSTEMS

3.1 Conformance with NRC General Design Criteria

Section 3.1 of the Turkey Point Units 6 and 7 Combined License (COL) Final Safety Analysis Report (FSAR), Revision 8, incorporates by reference Section 3.1, "Conformance with NRC General Design Criteria," of Revision 19 of the AP1000 Design Control Document (DCD).

In addition, in the Turkey Point Units 6 and 7 FSAR, the applicant provided the following:

Departure

- PTN DEP 6.4-1

The applicant provided additional information about PTN DEP 6.4-1 in Section 3.1.2 of the FSAR related to design changes affecting habitability of the main control room and changes to the calculated doses to control room operators. This information, as well as related PTN DEP 6.4-1 information appearing in other chapters of the FSAR, is reviewed in Section 21.2 of this report.

The U.S. Nuclear Regulatory Commission (NRC) staff (the staff) reviewed the application and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this section.[1] The NRC staff's review confirmed that the applicant addressed the required information to satisfy the evaluation criteria. There is no outstanding information expected to be addressed in the Turkey Point Units 6 and 7 COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793, "Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design," and its supplements. Section 21.2 of this report evaluates the departure from the DCD provided in PTN DEP 6.4-1.

3.2 Classification of Structures, Components, and Systems

3.2.1 Seismic Classification

3.2.1.1 *Introduction*

Nuclear power plant structures, systems, and components (SSCs) important to safety are to be designed to withstand the effects of earthquakes without loss of capability to perform their safety functions. Important-to-safety SSCs are defined in Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," Appendix A, "General Design Criteria for Nuclear Power Plants," as those SSCs that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. Important-to-safety SSCs include safety-related SSCs that perform safety-related functions to ensure: (1) the integrity of the reactor coolant pressure boundary (RCPB), (2) the

[1] Section 1.2.2 contains a discussion of the staff's review related to verification of the scope of information to be included in a COL application that references a design certification (DC). This footnote will be referenced in several places throughout the chapter of this Safety Evaluation.

capability to shut down the reactor and maintain it in a safe-shutdown condition, and (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures. The earthquake for which these safety-related plant features are designed is defined as the safe-shutdown earthquake (SSE). The SSE is based on an evaluation of the maximum earthquake potential for the site and is an earthquake that produces the maximum vibratory ground motion for which SSCs are designed to remain functional. In passive nuclear plants, there may be nonsafety-related active systems and equipment that perform functions to support safe operation of the facility. Some of these functions may be deemed risk significant and, therefore, are candidates for regulatory oversight, and the regulatory treatment of nonsafety systems (RTNSS) process is applied. Specifically for seismic classification, the RTNSS process is used to define seismic requirements for these SSCs.

The methodology in the referenced AP1000 DCD classifies SSCs into three categories: seismic Category I, seismic Category II, and nonseismic (NS). Those plant features that are designed to remain functional, if an SSE occurs, are designated seismic Category I. Seismic Category I applies to both functionality and integrity, and seismic Category II applies only to integrity. If the failure of an NS SSC during an SSE could result in the loss of function of safety-related items, then they are designated as Seismic Category II. This methodology is similar to Regulatory Guide (RG) 1.29, "Seismic Design Classification," Revision 4, except that RG 1.29 does not use the terms seismic Category II and NS.

3.2.1.2 *Summary of Application*

Section 3.2 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.2 of the AP1000 DCD, Revision 19. Section 3.2 of the DCD includes Section 3.2.1.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.2, the applicant provided the following:

Departure

- PTN DEP 3.2-1

The applicant provided additional information about PTN DEP 3.2-1 in Section 3.2 of the FSAR related to design modifications to the condensate return portion of the Passive Core Cooling System. This information, as well as related PTN DEP 3.2-1 information appearing in other chapters of the FSAR, is reviewed in Section 21.1 of the SER.

Supplemental Information

- Standard (STD) Supplement (SUP) 3.2-1

The applicant provided supplemental information by adding text to the end of DCD Section 3.2.1, "Seismic Classification," stating that there are no safety-related SSCs at Turkey Point Units 6 and 7 outside the scope of the DCD. The applicant also stated that the nonsafety-related SSCs outside the scope of the DCD are classified as NS.

- PTN SUP 3.2-1

The applicant provided supplemental information by adding text to the end of DCD Section 3.2.1.3, "Classification of Building Structures," stating that the seismic classification of the deep well injection system (DIS) is provided in Table 3.2-201.

3.2.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations for the seismic classification are given in Section 3.2.1, Revision 2, of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition."

The regulatory basis for acceptance of the supplemental information of defining the scope of safety-related SSCs is established in General Design Criteria (GDC) 2, "Design Bases for Protection against Natural Phenomena," which requires that all SSCs important to safety be designed to withstand the effects of natural phenomena, including earthquakes. Guidance on how to meet this requirement is in RG 1.29.

3.2.1.4 *Technical Evaluation*

The NRC staff reviewed Section 3.2 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to seismic classification. The results of the NRC staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this safety evaluation report (SER) provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER for the reference COL application (Vogtle Electric Generating Plant (VEGP), Units 3 and 4) were equally applicable to the Turkey Point Units 6 and 7 COL application, the staff undertook the following reviews:

- The staff compared the VEGP COL FSAR, Revision 5, to the Turkey Point Units 6 and 7 COL FSAR. In performing this comparison, the staff considered changes made to the Turkey Point Units 6 and 7 COL FSAR (and other parts of the COL application, as applicable) resulting from requests for additional information (RAIs).

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff completed its review and finds the evaluation performed for the standard content to be directly applicable to the Turkey Point Units 6 and 7 COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. Section 1.2.3 of this SER provides an explanation of why the standard content material from the SER for the reference COL application (VEGP) contains evaluation material from the SER for the Bellefonte Nuclear Plant (BLN), Units 3 and 4, COL application.

The staff reviewed the following information in the Turkey Point Units 6 and 7 COL FSAR:

Supplemental Information

- STD SUP 3.2-1

The NRC staff reviewed STD SUP 3.2-1, related to the seismic classification of safety-related SSCs included under Section 3.2.1 of the Turkey Point Units 6 and 7 COL FSAR, which states that there are no safety-related SSCs outside the scope of the DCD at Turkey Point Units 6 and 7. Therefore, the seismic classification is acceptable.

- PTN SUP 3.2-1

The NRC staff reviewed PTN SUP 3.2-1, related to the seismic classification of the deep well injection system included under Section 3.2.1 of the Turkey Point Units 6 and 7 COL FSAR. PTN SUP 3.2-1, Table 3.2-201, provides seismic Categories I, II, and NS classification of building structures. The DIS is a nonsafety-related system that contains structure subsystems of which failures would not impair the capability for safe shutdown. Therefore, the seismic classification is acceptable.

The following portion of this technical evaluation section is reproduced from Section 3.2.1.4 of the VEGP SER:

> *Important to Safety SSCs*
>
> *GDC 2 states, in part, that SSCs important to safety shall be designed to withstand the effects of earthquakes. BLN COL FSAR Section 3.2.1 states there are no safety-related SSCs outside the scope of the DCD. In request for additional information (RAI) 3.2.1-1, the applicant was requested to clarify if there is any site-specific non-safety-related SSCs outside the scope of the DCD that are important to safety and, if so, identify the appropriate seismic classification of such SSCs. The applicant's response identified that there are no site-specific non-safety-related SSCs outside the scope of the DCD that are important to safety and that non-safety-related SSCs outside the scope of the DCD are classified as non-seismic. In Revision 1 of the BLN COL FSAR, the applicant added the statement that the non-safety-related SSCs outside the scope of the DCD are classified as non-seismic. The revised BLN COL FSAR is acceptable, and the staff's concern is closed. The staff based its conclusion on the applicant's response that there are no site-specific non-safety-related SSCs outside the DCD that are important to safety.*

Seismic Classification of Other Site-Specific SSCs

Section 1.8 of the AP1000 DCD, Revision 16 identified certain site-specific SSCs that are outside the scope of the AP1000 standard plant, such as the circulating water system (CWS) and its heat sink, for which the COL applicant must provide site-specific information. The seismic classification of the CWS is not identified in DCD Table 3.2-3. Section 1.8 of BLN COL FSAR identifies certain COL items that represent interfaces for the standard design, but the seismic classification is not identified for the CWS.

In RAI 3.2.1-2, the applicant was requested to clarify if there are any site-specific SSCs outside the scope of the DCD that are not included in DCD Tables 3.2-2 and 3.2-3 that are to be seismically classified in the COL. For example, site-specific structures, the CWS and miscellaneous items such as reactor vessel insulation are not included in the tables. If so, the applicant was requested to identify the appropriate seismic classification of such SSCs. This concern was also identified in an RAI for the review of AP1000 Revision 16 and the DC applicant clarified that the seismic categorization of CWS and reactor vessel insulation are not plant-specific and are to be classified in the DCD. Therefore, this concern is closed and seismic classification of these components is to be addressed in the DCD rather than the BLN COL FSAR.

Quality Assurance for Seismic Category II SSCs

It is not clear in the BLN COL FSAR how Title 10 of the Code of Federal Regulations (CFR) 50, Appendix B is applied to seismic Category II SSCs, including those that may be site-specific. DCD Appendix 1A identifies that AP1000 conforms to RG 1.29, Regulatory Position C.4 and Section 1.8 identifies COL Information Item 17.5-1 for quality assurance (QA) in the design phase. DCD Section 17.5.2 identifies that the COL applicant will address its QA program and that the QA program will include provisions for seismic Category II SSCs. In RAI 3.2.1-4, the applicant was requested to clarify the extent that pertinent QA requirements of Appendix B to 10 CFR Part 50 in Regulatory Position C.4 of RG 1.29 apply to those activities affecting the safety-related functions of those portions of SSCs covered under Regulatory Positions 2 and 3 of RG 1.29, including any site-specific SSCs. If this issue will be resolved in the DCD rather than the COL for all plant SSCs, including those that are site-specific, the applicant was requested to advise the NRC staff that this was the case. The RAI response identified that there are no site-specific seismic Category II SSCs and that the application of 10 CFR Part 50, Appendix B is addressed by the DCD. Since there are no site-specific seismic Category II SSCs, this COL concern is closed for the BLN COL FSAR.

Consistency with RG 1.29, Revision 4

Section 3.2.1 of the BLN COL FSAR does not identify any departures relative to seismic classification identified in the DCD and BLN COL FSAR, Appendix 1AA identifies conformance with RG 1.29, Revision 3 as stated in the DCD rather than Revision 4 of RG 1.29, dated March 2007. In RAI 3.2.1-3, the applicant was requested to clarify if seismic classifications of site-specific SSCs are consistent

with RG 1.29, Revision 4. The RAI response identified that seismic classification of site-specific SSCs not addressed in the DCD is consistent with RG 1.29, Revision 4. This position is acceptable to the staff, since it represents the current RG revision. The applicant revised Appendix 1AA in Revision 1 of the BLN COL FSAR to indicate conformance to RG 1.29, Revision 4.

3.2.1.5 *Post-Combined License Activities*

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

3.2.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR is acceptable and meets the requirements of 10 CFR Part 50, Appendix A, and GDC 2. The staff based its conclusion on the following:

- PTN DEP 3.2-1, related to design modifications to the condensate return portion of the Passive Core Cooling System, is reviewed and found acceptable by the staff in Section 21.1 of this SER.

- STD SUP 3.2-1 is acceptable because the Turkey Point Units 6 and 7 COL FSAR states that there are no safety-related SSCs outside the scope of the AP1000 DCD. The Turkey Point Units 6 and 7 COL FSAR also states that the nonsafety-related SSCs outside the scope of the DCD are classified as NS. Therefore, the requirements of 10 CFR Part 50, Appendix A, GDC 2, the acceptance criteria in NUREG-0800, Section 3.2.1, and the guidelines in RG 1.29 are satisfied.

- PTN SUP 3.2-1 is acceptable because the Turkey Point Units 6 and 7 COL FSAR states that the DIS is a nonsafety-related system that contains structure subsystems of which failures would not impair the capability for safe shutdown. The building structures of the DIS are seismically classified to be seismic Categories I, II, and NS classifications. Therefore, the requirements of 10 CFR Part 50, Appendix A, GDC 2, the acceptance criteria in NUREG-0800, Section 3.2.1, and the scope of RG 1.29 are satisfied.

3.2.2 AP1000 Classification Systems (Related to RG 1.206, Section C.III.1, Chapter 3, C.I.3.2.2, "System Quality Group Classification")

3.2.2.1 *Introduction*

The system and component quality group classification addresses, in part, the general design criterion that nuclear power plant SSCs important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety function to be

performed. Important-to-safety SSCs are defined in 10 CFR Part 50, Appendix A, as those SSCs that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. Important-to-safety SSCs include safety-related SSCs that perform one of the following safety-related functions to ensure: (1) the integrity of the RCPB, (2) the capability to shut down the reactor and maintain it in a safe-shutdown condition, and (3) the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposures. The RTNSS process is applied to define supplemental quality requirements for SSCs that are nonsafety-related but perform risk significant function.

The system and component quality group classification in combination with the RTNSS process define appropriate classifications, codes and standards, and special treatment important to safety pressure-retaining components and their supports, depending on their safety function. RG 1.26, "Quality Group Classifications and Standards for Water-, Steam-, and Radioactive-Waste-Containing Components of Nuclear Power Plants," Revision 4, provides the regulatory guidance for classifying SSCs important to safety and the appropriate quality standards.

3.2.2.2 *Summary of Application*

Section 3.2 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.2 of the AP1000 DCD, Revision 19. Section 3.2 of the DCD includes Section 3.2.2.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.2, the applicant provided the following:

Supplemental Information

- STD SUP 3.2-1

The applicant provided supplemental information by adding text stating that there are no safety-related SSCs at Turkey Point Units 6 and 7 outside the scope of the DCD.

- PTN SUP 3.2-2

The applicant provided supplemental information by stating that information on the classification of the DIS is in Table 3.2-202.

3.2.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations for the system quality group classification are given in Section 3.2.2, Revision 2, of NUREG-0800.

The basis for acceptance of the supplemental information that defines the scope of safety-related SSCs is established in RG 1.26 and applicable American Society of Mechanical Engineers (ASME) Codes and industry standards. RG 1.26 provides regulatory guidance for

classifying SSCs important to safety and applying the appropriate quality standards. Conformance to the guidance contained in RG 1.26 is one way to ensure that component quality will be commensurate with the importance of the safety functions of these systems. Thus, this constitutes the basis for satisfying GDC 1, "Quality Standards and Records," for pressure-retaining components and their supports.

3.2.2.4 Technical Evaluation

The NRC staff reviewed Section 3.2 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the system quality group classification. The results of the NRC staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and the use of this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER for the reference COL application (VEGP, Units 3 and 4) were equally applicable to the Turkey Point Units 6 and 7 COL application, the staff undertook the following reviews:

- The staff compared the VEGP COL FSAR, Revision 5, to the Turkey Point Units 6 and 7 COL FSAR. In performing this comparison, the staff considered changes made to the Turkey Point Units 6 and 7 COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff completed its review and finds the evaluation performed for the standard content to be directly applicable to the Turkey Point Units 6 and 7 COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. Section 1.2.3 of this SER provides an explanation of why the standard content material from the SER for the reference COL application (VEGP) contains evaluation material from the SER for the BLN, Units 3 and 4, COL application.

The staff reviewed the following information in the Turkey Point Units 6 and 7 COL FSAR:

Supplemental Information

- STD SUP 3.2-1

The NRC staff reviewed STD SUP 3.2-1 related to the seismic classification of safety-related SSCs included under Section 3.2.2 of the Turkey Point Units 6 and 7 COL FSAR, which states

that there are no safety-related SSCs outside the scope of the DCD at Turkey Point Units 6 and 7.

The NRC staff reviewed STD SUP 3.2-1 related to quality group classification of systems included under Section 3.2.2 of the Turkey Point Units 6 and 7 COL FSAR. STD SUP 3.2-1 is identical to STD SUP 3.2-1 in the BLN COL FSAR with respect to quality group classification of systems included under Section 3.2.2 of the FSAR. Additional information was needed to evaluate STD SUP 3.2-1, and RAIs were submitted to the BLN applicant. The Turkey Point Units 6 and 7 applicant incorporated the BLN RAI response. As such, review of STD SUP 3.2-1 is addressed through the comparison with the BLN SER. As discussed below, there are no site-specific nonsafety-related SSCs outside the scope of the AP1000 DCD that are important to safety, so there are no changes to the quality group classifications listed in Turkey Point Units 6 and 7 COL FSAR, Section 3.2.

- PTN SUP 3.2-2

The NRC staff reviewed PTN SUP 3.2-2, related to the quality group classification of the deep well injection system included under Section 3.2.2 of the Turkey Point Units 6 and 7 COL FSAR. PTN SUP 3.2-2, Table 3.2-202, indicates Class E classification for the DIS components. As specified in AP1000 DCD, the Class E is used for nonsafety-related components that have no safety-related function to perform. These components do not contain sufficient radioactive material that a release could exceed applicable limits. Therefore, the classification is acceptable.

The following portion of this technical evaluation section is reproduced from Section 3.2.2.4 of the VEGP SER:

> *Special Treatment for Risk-Significant SSCs*
>
> *GDC 1 identifies, in part, that SSCs important to safety shall be designed, fabricated, erected and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function. Supplemental quality standards and QA programs applicable to passive SSCs used in non-safety-related regulatory treatment of non-safety systems that may be important to safety are not clearly defined in the BLN COL FSAR for site-specific SSCs.*
>
> *In RAI 3.2.2-2, the applicant was requested to clarify what supplemental quality standards are applied to non-safety-related site-specific SSCs that are important to safety to ensure that all SSCs important to safety are designed, fabricated, erected, and tested to quality standards commensurate with the safety function to be performed. Any site-specific SSCs that are considered important to safety may also require special treatment, but the response to RAI 3.2.1-1 identified that there are no site-specific non-safety-related SSCs outside the scope of the DCD that are important to safety. Therefore, this concern is closed.*
>
> *Codes and Standards*

The Staff Requirements Memorandum (SRM), dated July 21, 1993, concerning SECY-93-087 identified that the staff will review passive plant design applications using the newest codes and standards endorsed by the NRC and unapproved revisions to the codes will be reviewed on a case by case basis. Editions of various codes and standards referenced in DCD Section 3.2.6 are not current and newer codes and standards are not referenced in BLN COL FSAR Sections 3.2 or 1.8. In RAI 3.2.2-3, the applicant was requested to clarify if any different or current codes and standards are applied to the design and procurement of site-specific SSCs, other than those identified in the DCD. The RAI response identified that the applicant intends to implement the DCD identified codes and standards and that the codes and standards applied to the design and procurement of non-safety-related site-specific SSCs are those identified in various sections of the BLN COL FSAR. Although codes and standards for site-specific SSCs would be expected to be identified and reviewed in the COL application rather than the DCD, the response to RAI 3.2.1-1 identified that there are no site-specific non-safety-related SSCs outside the scope of the DCD that are important to safety. Therefore, this concern is closed.

Consistency with RG 1.26, Revision 4

Section 3.2.2 of the BLN COL FSAR does not identify any departures relative to quality group classification identified in the DCD and BLN COL FSAR, Appendix 1AA identifies conformance with RG 1.26, Revision 3 in the DCD rather than Revision 4, dated March 2007. In RAI 3.2.2-1, the applicant was requested to clarify if quality group classifications of site-specific SSCs are consistent with RG 1.26, Revision 4. The applicant's response clarified that the quality group classification of site-specific SSCs is consistent with RG 1.26, Revision 4. This position is acceptable to the staff, since it represents the current RG revision. This staff concern is closed and the BLN COL FSAR Appendix 1AA has been revised accordingly to reflect this RAI response.

3.2.2.5 Post-Combined License Activities

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

3.2.2.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR is acceptable and meets the requirements of 10 CFR Part 50, Appendix A, GDC 1. The staff based its conclusion on the following:

- STD SUP 3.2-1 is acceptable with regard to quality group classifications because no change was made to the quality group classifications in Section 3.2 and there are no

site-specific nonsafety-related SSCs outside the scope of the AP1000 DCD that are important to safety. Therefore, the requirements of 10 CFR Part 50, Appendix A, GDC 1, the acceptance criteria in NUREG-0800, Section 3.2.2, and the guidelines in RG 1.26 are satisfied.

- PTN SUP 3.2-2 is acceptable with regard to quality group classifications because Class E is used for classification of the deep well injection system components. Therefore, the requirements of 10 CFR Part 50, Appendix A, GDC 1, the acceptance criteria in NUREG-0800, Section 3.2.2, and the scope of RG 1.26 are satisfied.

3.3 Wind and Tornado Loadings

Seismic Category I and II buildings and structures are designed to withstand extreme wind and tornado loading conditions in compliance with the requirements dictated in GDC 2 in Appendix A to 10 CFR Part 50, which states that SSCs important to safety shall be designed to withstand the effects of natural phenomena, such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches, without loss of capability to perform their safety functions. The design bases for these structures shall reflect the appropriate consideration of the most severe of the natural phenomena that have been historically reported in the area of the plant, with sufficient margin to account for limited accuracy, quantity, and period of time for collection of data.

In Section 3.3 of this SER, the staff reviewed the seismic Category I and II structures subjected to wind and tornado loadings; other natural-phenomena effects, such as earthquakes, floods, tsunami, and seiches, are evaluated in Sections 3.4, 3.7, and 3.8 of this SER.

3.3.1 Wind Loadings

3.3.1.1 *Introduction*

Seismic Category I structures must withstand the effects of the specified design wind speed for the plant to ensure conformance with 10 CFR Part 50, Appendix A, GDC 2. The specific areas of review are the design wind speed, its recurrence interval, speed variation with height, and applicable gust factors from the standpoint of use in defining the input parameters for the appropriate structural design criteria for wind loading.

3.3.1.2 *Summary of Application*

Section 3.3 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.3 of the AP1000 DCD, Revision 19. Section 3.3 of the DCD includes Section 3.3.1.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.3.1, the applicant provided the following:

Departures

- PTN DEP 2.0-1

The portion of PTN DEP 2.0-1 included in Turkey Point Units 6 and 7 COL FSAR, Section 3.3.1 is identical to the information added by PTN COL 3.3-1 and is addressed by the staff in its evaluation of PTN COL 3.3-1 in this SER section.

AP1000 COL Information Items

- PTN COL 3.3-1

The applicant provided additional information in PTN COL 3.3-1 to address COL Information Item 3.3-1 (COL Action Item 3.3.2.2-1) by stating that the wind velocity characteristics for the Turkey Point Units 6 and 7 site are given in Turkey Point Units 6 and 7 COL FSAR, Section 2.3.1.3.1. The applicant stated that these values exceed the design wind velocities specified in AP1000 DCD, Section 3.3.1.1 for the standard AP1000 plant design. In addition, the applicant stated that the higher wind velocity does not have an adverse impact on the safety-related structures and components. The portion of PTN COL 3.3-1 relating to design tornado site characteristics and the effects of hurricane winds and windborne missiles on the safety-related SSCs due to failures in an adjacent AP1000 plant is reviewed in SER Section 3.3.2.

- PTN COL 3.5-1

The portion of PTN COL 3.5-1 included in Turkey Point Units 6 and 7 COL FSAR, Section 3.3.1 is identical to the information added by PTN COL 3.3-1 and is addressed by the staff in its evaluation of PTN COL 3.3-1 in this SER section. The additional information in PTN COL 3.5-1 included in Turkey Point Units 6 and 7 COL FSAR, Section 3.5 is addressed in Section 3.5 of this SER.

3.3.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations for wind loadings are given in Section 3.3.1, Revision 3, of NUREG-0800.

The regulatory basis for PTN COL 3.3-1 is 10 CFR Part 50, Appendix A, GDC 2, and the regulatory guidance is in RG 1.76, “Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants,” Revision 1, which states that SSCs important to safety shall be designed to withstand the effects of natural phenomena, such as earthquakes, tornados, hurricanes, floods, tsunami, and seiches, without loss of capability to perform their safety functions.

3.3.1.4 *Technical Evaluation*

The NRC staff reviewed Section 3.3 of Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] On the basis of its review, the staff confirms that the information in the application and incorporated by reference addresses the required information relating to wind loadings. The results of the NRC staff’s evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the following information in the Turkey Point Units 6 and 7 COL FSAR:

AP1000 COL Information Item

- PTN COL 3.3-1

The NRC staff reviewed PTN COL 3.3-1 related to design wind loads applied on safety-related SSCs included under Section 3.3.1.1 of the Turkey Point Units 6 and 7 COL FSAR.

The commitment was also captured as COL Action Item 3.3.2.2-1 in NUREG-1793, Appendix F, "Combined License Action Items," which states:

> COL applicants referencing the AP1000 certified design will address site interface criteria for wind and tornadoes.

The applicant stated in PTN COL 3.3-1 that the wind velocity characteristics for Turkey Point Units 6 and 7 are given in Turkey Point Units 6 and 7 COL FSAR, Section 2.3.1.3.1. The applicant stated that these values exceed the DCD design wind velocity values for the standard AP1000 plant.

For consistency, the NRC staff reviewed the site-specific information provided to address item PTN COL 3.3-1 referring FSAR Section 2.3.1.3.1. American Society of Civil Engineers (ASCE) 7-05 was used to validate wind design information in relation to the Turkey Point Units 6 and 7 site. The applicant has presented consideration to ASCE 7-05 in Table 2.0-201, "Comparison of AP1000 DCD Site Parameters and PTN Site Characteristics." In this table, the applicant identified the 3-second gust, 50-year return wind speed and 3-second gust, 100-year return wind speed to be 150 mph and 161 mph, respectively. FSAR Section 3.3.1.1 states that the Turkey Point Units 6 and 7 Maximum 50-year and 100-year return, 3-second-gust wind speeds based on Table C6-7 of ASCE 7-05 exceed the AP1000 design wind speed of 145 mph. The FSAR also states that the higher wind velocities do not have an adverse effect on safety-related structures and components. The staff generated RAI 4759, Question 03.03.01-1, to request a technical justification to support this statement and to request an explanation about the consideration given to the most severe natural phenomena historically reported, with sufficient margin, for the design of the safety-related structures.

In the response to RAI 4759, Question 03.03.01-1, dated August 30, 2010, the applicant stated that an analysis was performed using the 150-mph operating wind speed. During the same year, the analysis referred to in the RAI response was audited to confirm that the operating wind speed was used in accordance with ASCE 7-05 to produce structural loads. In its calculation, the applicant was able to show acceptable considerations to the guidance and to the site-specific operating wind velocity and topography.

Also, the applicant described the work performed to evaluate the most severe natural phenomena recorded for the site and vicinities. Hurricane Andrew was identified as producing the maximum reported wind speed for the Turkey Point Units 6 and 7. Hurricane Andrew produced higher wind speeds than the operating 3-second gust, 50- and 100-year return wind speeds. The staff performed detailed review of the acceptability of these parameters. The review is described in Section 2.3.1 of this SER. Higher velocity winds from hurricanes and tornadoes, and the effect of windborne missile impacts on safety-related SSCs, are discussed in Sections 3.3.2 and 3.5.3 of this SER.

Based on the above review, the staff finds that the information supplied by the applicant to close Action Item 3.3-1 for site interface criteria for wind is adequate in meeting the NRC regulatory requirements. Based on this, RAI 4759, Question 03.03.01-1, is resolved.

3.3.1.5 *Post-Combined License Activities*

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

3.3.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR is acceptable and meets the requirements of GDC 2. The staff based its conclusion on the following:

- PTN COL 3.3-1, as it relates to design wind loads, is acceptable based on the site-specific wind velocities, reviewed in Section 2.3 of this SER, even when these are not bounded by the AP1000 DCD design wind velocities. The staff was able to conclude this because the applicant provided a confirmatory calculation to demonstrate that the exceeding wind speeds will not cause adverse effects on the safety-related SSCs. The staff audited this calculation to confirm that the applicant followed acceptable guidance while considering the exceeding wind velocities. By doing so, the applicant addressed the site-specific operating wind criteria and therefore complies with GDC 2.

3.3.2 Tornado Loading

3.3.2.1 *Introduction*

Tornado loadings are considered for design in accordance with Section 3.3.2, "Tornado Loadings," of the AP1000 DCD. Section 3.3.2 of the AP1000 DCD addresses tornado loadings for seismic Category I structures using applicable tornado design parameters to determine forces on structures as explained in Section 3.3.1.2 of the AP1000 DCD. Also in Section 3.3.2.1 of the AP1000 DCD, it is stated that the estimated probability of tornado wind speeds to be greater than the design-basis tornado is between 10^{-6} and 10^{-7} per year for an AP1000 at a "worst location" anywhere within the contiguous United States.

The specific areas of review in accordance with Section 3.3.2 of NUREG-0800 include:

- the tornado wind translational and rotational speeds
- the tornado-generated atmospheric pressure change
- the spectrum of tornado-generated missiles

Similar considerations to hurricanes in the coastal and tropical regions, per RG 1.221 “Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants,” include:

- the hurricane wind speeds
- the spectrum of hurricane-generated missiles

3.3.2.2 *Summary of Application*

Section 3.3 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.3 of the AP1000 DCD, Revision 19. Section 3.3 of the DCD includes Section 3.3.2.

In addition, in Turkey Point Units 6 and 7COL FSAR, Section 3.3.2, the applicant provided the following:

AP1000 COL Information Items

- PTN COL 3.3-1

The applicant provided additional information in PTN COL 3.3-1 to resolve COL Information Item 3.3-1 (COL Action Item 3.3.2.2-1). In PTN COL 3.3-1, the applicant stated that tornado characteristics for Turkey Point Units 6 and 7, given in Section 2.3.1.3.2 of the Turkey Point Units 6 and 7 COL FSAR, are bounded by the tornado design parameters given in AP1000 DCD, Section 3.3.2.1 for the standard AP1000 plant. In addition, the applicant stated that the 1.0E-07 annual exceedance probability hurricane wind speed of 260 mph at the Turkey Point site, based on RG 1.221, is bounded by the design tornado wind speed given in DCD Subsection 3.3.2.1; the effects of wind and tornado due to failures in an adjacent AP1000 plant are bounded by the evaluation of the buildings and structures in a single unit; and that the Turkey Point Units 6 & 7 site satisfies the site interface criteria for wind and tornado and will not have a tornado-initiated failure of structures and components. The applicant further stated that missiles caused by external events separate from the tornado are addressed in FSAR Subsections 3.3, 3.5.1.5, and 3.5.1.6. The portion of PTN COL 3.3-1 relating to design wind velocity characteristics is reviewed in SER Section 3.3.1.

- PTN COL 3.5-1

The portion of PTN COL 3.5-1 included in Turkey Point Units 6 and 7 COL FSAR, Section 3.3.2 is identical to the information added by PTN COL 3.3-1 and is addressed by the staff in its evaluation of PTN COL 3.3-1 in this SER section. The additional information in PTN COL 3.5-1 included in Turkey Point Units 6 and 7 COL FSAR, Section 3.5 is addressed in Section 3.5 of this SER.

3.3.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations for tornado loading are given in Section 3.3.2, Revision 3, of NUREG-0800.

Acceptance of the information addressing PTN COL 3.3-1 is established based on site-specific parameters and verification of bounding conditions for relevant parameters related to the AP1000 DCD interface criteria for tornado, site arrangement, and building construction. The design of AP1000 safety-related SSCs for tornado loads, using acceptable procedures, must meet the requirements of 10 CFR Part 50, Appendix A, GDC 2, which states that SSCs important to safety shall be designed to withstand the effects of natural phenomena, such as earthquakes, tornados, hurricanes, floods, tsunami, and seiches, without loss of capability to perform their safety functions.

3.3.2.4 *Technical Evaluation*

The NRC staff reviewed Section 3.3.2 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to tornado loading. The results of the NRC staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the following information in the Turkey Point Units 6 and 7 COL FSAR:

AP1000 COL Information Item

- PTN COL 3.3-1 and PTN 3.5-1

The NRC staff reviewed PTN COL 3.3-1 and PTN COL 3.5-1 included under Sections 3.3.2 and 3.5.1 of the Turkey Point Units 6 and 7 COL FSAR. Specific information provided by the applicant to address COL Action Item 3.3.2.2-1 includes development of site-specific parameters and verification of bounding conditions, site arrangement, and building construction. This information is provided to satisfy the commitment documented in Appendix F of NUREG-1793, which states:

> COL applicants referencing the AP1000 certified design will address site interface criteria for winds and tornadoes.

In PTN COL 3.3-1, the applicant stated that the tornado characteristics for Turkey Point Units 6 and 7, given in Section 2.3.1.3.2 of the Turkey Point Units 6 and 7 COL FSAR, are bounded by the tornado design parameters given in DCD Section 3.3.2.1 for the standard AP1000 plant design. In addition, the applicant stated that the effects of wind and tornado due to failures in an adjacent AP1000 plant are bounded by the evaluation of the buildings and structures in a single unit.

In Section 2.3.1 of this SER, the staff concluded that tornado site characteristics chosen by the applicant were acceptable. Since these values match the design tornado site characteristics included in the AP1000 DCD, the staff concludes that the design tornado site characteristics for the Turkey Point site are in compliance with GDC 2.

The scope of PTN COL 3.3-1 also includes the effects of wind and tornado on the safety-related SSCs due to failure of nonsafety-related buildings in an adjacent AP1000 plant and Turkey

Point Units 6 and 7. The applicant states that these effects are bounded by the evaluation of the buildings and structures in a single unit.

In order to assure the failure of structures or components not designed for wind or tornado loadings does not affect the capability of safety-related SSCs to perform their intended safety functions, the COL applicants were offered three options in Section 3.3.2.3 of the AP1000 DCD:

(1) Design the adjacent nonsafety-related structure to the design basis tornado loading.

(2) Analyze the effect of failure of adjacent nonsafety-related structures on nuclear island (NI) structures to assure that no impairment of safety function will result.

(3) Design a structural barrier to protect seismic Category I SSCs from adjacent structural collapse.

In PTN COL 3.3-1, the applicant used Option (2), indicating that the effects of wind and tornado on the safety-related SSCs due to failure of an adjacent nonsafety-related building are bounded by the evaluation of the structures in a single unit at Turkey Point Units 6 and 7. The analysis of the impact of building collapse on the NI structures is in Section 3.7.2.8 of the AP1000 DCD. The staff's review of this analysis is provided in NUREG-1793 and its supplements.

RG 1.221 provides the NRC staff position for selection of design-basis hurricane wind speeds and hurricane-generated missiles that a new nuclear power plant should be designed for to prevent undue risk to public health and safety. As described in Section 2.3 of this SER, the staff compared the information provided in the FSAR Section 2.3 regarding hurricane winds against the information in RG 1.221. The applicant provided additional information in its response to RAI 6251, Question 02.03.01-3, dated May 14, 2012, regarding the effects of hurricane wind and hurricane missile on safety-related structures and a comparison between DCD Tier 1 tornado-generated missiles and those in RG 1.221. The evaluation of the three missiles (1-in diameter steel sphere, 6-in diameter pipe, and 4,000 lbs automobile) compared velocities generated from both hurricane and tornado events. All vertical velocities generated by the tornado were higher than those from the hurricane. Using the horizontal velocities of the steel sphere and the 6-in pipe, the applicant performed a local analysis calculation to confirm that the wall thicknesses of the NI structures are sufficient to prevent penetration and scabbing. The penetration and scabbing generated from the steel sphere in a concrete wall were both estimated to be less than 2 inches. For the 6-in diameter pipe, the applicant stated that wall thickness needed to avoid penetration and scabbing were determined to be within the minimum thickness provided for the NI external walls. These calculations were verified by the staff to be acceptable, based on a staff confirmatory analysis that considered the concrete barrier design procedure in Section 3.5.3 of the AP1000 DCD.

The effect of the automobile missile over the concrete wall was evaluated by the applicant using shear stress and ductility analyses. After reviewing this portion of the response, the staff had questions about the use and consideration of the automobile missile in the load combinations used for structural analysis, as stated in Standard Review Plan (SRP) Section 3.3.2. Guidance in the SRP Section 3.3.2, and design codes like ACI 349 and Section III of the ASME Code, highlights the need to combine the wind pressure with the missile impact load to estimate the extreme environmental load. This information was not part of the response. Also, the staff was concerned about the potential damage the steel sphere could generate on the protecting barriers of structural openings of safety related structures. Because of the higher wind

velocities and the expanded hurricane's wind field area, it is expected that missiles could travel faster; becoming more energetic towards impact. Given these outstanding questions and concerns, the staff generated RAI 6544, Question 03.05.03-1 which supersedes RAI 6251, Question 02.03.01-3. As a result, RAI 6251, Question 02.03.01-3 is closed. As part of its response to RAI 6251, Question 2.03.01-3, the applicant provided draft revisions to the FSAR that included the hurricane missiles as part of the design parameters. The staff was able to confirm the inclusion of the draft revisions in Revision 7 of the FSAR.

In the applicant's response to RAI 6544, Question 03.05.03-1, dated May 9, 2014, the applicant explained the dynamic FEM time-history analysis performed to evaluate the different walls that were used to estimate the shear stress demands, using the forcing function for the automobile impact load from the AP1000 DCD. The applicant explained how the critical sections for the walls were selected for evaluation and provided values for the punching shear, the one-way response beam reaction shear and the allowable shear values for each of the walls considered for the analysis. In addition, the applicant explained how the walls were selected in order to consider potentially vulnerable locations around the NI. The staff performed an audit to support the statements that the automobile missile would not compromise the integrity of the NI walls.

During the audit, the staff reviewed the applicant's calculation notes for the automobile missile impact analysis described in its response and found the calculation results to be consistent with the results presented in its response The applicant demonstrated that for the most critical case of all the walls considered, sufficient capacity to demand margin still exist. Furthermore, demands for the impact at the corner, the edge and at the center of the critical walls were compared to shear capacities specified by ACI Code 349-01, and demonstrated that the external walls are capable of withstanding the automobile missile impact without compromising the safety related function of the structural barrier. The staff prepared an audit report which summarized the detail information of the audit (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16105A431).

The staff reviewed the additional and supplement information provided by the applicant as result of the audit and verified the missile velocities used as evaluated in the SER section 3.5.2. On the bases of its review, the staff finds that the applicant's evaluation of the external walls are capable of withstanding the automobile missile impact without compromising the safety related function of the structural barrier. Therefore, it is acceptable to the staff..

Based on the above discussion, the NRC staff finds PTN COL 3.3-1 and PTN COL 3.5-1 to be resolved. As such, RAI 6544, Question 03.05.03-1, is being tracked as **Confirmatory Item** 3.5-1 pending the applicant's update of the FSAR.

Resolution of Turkey Point Confirmatory Item 3.5-1

Confirmatory Item 3.5-1 is an applicant commitment to revise its FSAR Sections 3.5.2 and 3.5.5 regarding hurricane-generated missile protection. The staff verified that the Turkey Point Units 6 and 7 COL FSAR, Revision 8 was appropriately revised. As a result, Confirmatory Item 3.5-1 is now closed.

3.3.2.5 *Post-Combined License Activities*

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

3.3.2.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that, the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR, Section 3.3.2 is acceptable and meets the requirements of 10 CFR Part 50, Appendix A, GDC 2. The staff based its conclusion on the following:

- PTN COL 3.3-1, as it relates to design tornado loads, is acceptable based on the design tornado site characteristics, reviewed in Section 2.3 of this SER, matching the AP1000 DCD design tornado site characteristics and, therefore, complying with GDC 2. PTN COL 3.3-1, as it relates to the effects of wind and tornado on the safety-related SSCs due to failure of nonsafety-related buildings in an adjacent AP1000 plant, is acceptable because the applicant incorporated by reference acceptable methodology from AP1000 DCD, Section 3.7.2.8.

- PTN COL 3.5-1, as it relates to hurricane missiles that are more energetic than the tornado missiles in the AP1000 DCD, is acceptable based on the evaluation of hurricane missile effects on the Turkey Point Units 6 and 7 safety-related structures in response to RAI 6544, Question 03.05.03-1, and therefore, complies with GDC 2.

3.4 Water Level (Flood) Design

3.4.1 Flood Protection

3.4.1.1 *Introduction*

Seismic Category I SSCs have flood protection measures for both external flooding and postulated internal flooding from plant component failures.

3.4.1.2 *Summary of Application*

Section 3.4 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.4 of the AP1000 DCD, Revision 19. Section 3.4 of the DCD includes Section 3.4.1.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.4, the applicant provided the following:

AP1000 COL Information Item

- PTN COL 3.4-1

The applicant provided additional information in PTN COL 3.4-1 to resolve COL Information Item 3.4-1 (COL Action Item 3.4.1.1-1), which addresses plant-specific information on

site-specific flooding hazards protective measures. PTN COL 3.4-1, in Turkey Point Units 6 and 7 COL FSAR, Section 3.4.1.3, "Permanent Dewatering System," states that no permanent dewatering system is required because site groundwater levels are 2 ft below site grade level as described in Turkey Point Units 6 and 7 COL FSAR, Section 2.4.1.2.5.

PTN COL 3.4-1, in Turkey Point Units 6 and 7 COL FSAR, Section 3.4.3, "Combined License Information," states that the site-specific water levels given in Turkey Point Units 6 and 7 COL FSAR, Section 2.4 satisfy the interface requirements identified in AP1000 DCD, Section 2.4.

3.4.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations for flood protection measures are given in Section 3.4.1, Revision 3, of NUREG-0800.

Further, the acceptance criteria associated with the relevant requirements of the NRC regulations for the identification of floods and flood design considerations are given in Section 2.4.12, Revision 3, of NUREG-0800.

3.4.1.4 *Technical Evaluation*

The NRC staff reviewed Section 3.4 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to flood protection measures. The results of the NRC staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the following information in the Turkey Point Units 6 and 7 COL FSAR:

AP1000 COL Information Item

- PTN COL 3.4-1

The NRC staff reviewed PTN COL 3.4-1, which addresses the permanent dewatering system and site-specific water levels in Sections 3.4.1.3 and 3.4.3 of the Turkey Point Units 6 and 7 COL FSAR, respectively.

The applicant provided additional information in PTN COL 3.4-1 to address COL Information Item 3.4-1. COL Information Item 3.4-1 states:

> The Combined License applicant referencing the AP1000 certified design will demonstrate that the site satisfies the interface requirements as described in Section 2.4. If these criteria cannot be satisfied because of site-specific flooding

> hazards, the Combined License applicant may propose protective measures as discussed in Section 2.4.

The commitment was also captured as COL Action Item 3.4.1.1-1 in Appendix F of NUREG-1793, which states:

> The COL applicant will evaluate events leading to potential flooding and demonstrate that the design will fall within the values of these site parameters.

In Turkey Point Units 6 and 7 COL FSAR, Section 3.4, the applicant provided the following plant-specific information to resolve COL Information Item 3.4-1 (COL Action Item 3.4.1.1-1) on site-specific flooding hazards protective measures:

- PTN COL 3.4-1, in Turkey Point Units 6 and 7 COL FSAR, Section 3.4.1.3, "Permanent Dewatering System," states that no permanent dewatering system is required because site groundwater levels are 2 ft below site grade level as described in Turkey Point Units 6 and 7 COL FSAR, Section 2.4.1.2.5.

- PTN COL 3.4-1, in Turkey Point Units 6 and 7 COL FSAR, Section 3.4.3, "Combined License Information," states that the site-specific water levels given in Turkey Point Units 6 and 7 COL FSAR, Section 2.4 satisfy the interface requirements identified in AP1000 DCD, Section 2.4.

In Section 2.4.12 of this SER, the staff accepted the Turkey Point Units 6 and 7 applicant's position that no permanent dewatering system is required and that the site-specific groundwater characteristics for the Turkey Point Units 6 and 7 site fall within the Tier 1 and Tier 2 DCD parameter values. Therefore, the staff concludes that the site-specific information in PTN COL 3.4-1 is acceptable.

3.4.1.5 *Post-Combined License Activities*

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

3.4.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR is acceptable and meets the regulatory guidance in Sections 2.4.12 and 3.4.1 of NUREG-0800. The staff based its conclusion on the following:

- PTN COL 3.4-1, is acceptable based on the staff's conclusions in NUREG-1793 regarding the need for a permanent dewatering system and on the staff's conclusions in

Section 2.4.12 of this SER regarding the adequacy of the site-specific groundwater levels.

3.4.2 Analytical and Test Procedures (Related to RG 1.206, Section C.III.1, Chapter 3, C.I.3.4.2, "Analysis Procedures")

Analysis methods and procedures are described for the design of AP1000 standard plants to assess the maximum water levels due to internal flooding caused by equipment failure or external flooding caused by natural phenomena and make sure that they do not jeopardize the safety of the plant or the ability to achieve and maintain safe shutdown conditions.

Section 3.4 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference, with no departures or supplements, Section 3.4.2, "Analytical and Test Procedures," of Revision 19 of the AP1000 DCD. Section 3.4.2 of the AP1000 DCD states that the analytical approach for external and internal flooding events is described in DCD Section 3.4.1.2, "Evaluation of Flooding Events." The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] On the basis of its review, the staff confirms that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

3.5 Missile Protection

Seismic Category I structures are analyzed and designed to be protected from a wide spectrum of missiles (e.g., missiles from rotating and pressurized equipment, gravitational missiles, and missiles generated from tornado winds). Once a potential missile is identified, its statistical significance is determined (a significant missile is one that could cause unacceptable consequences or violate the requirements of 10 CFR Part 100, "Reactor Site Criteria").

3.5.1 Missile Selection and Description

3.5.1.1 *Introduction*

SSCs important to safety are protected against internally generated missiles (outside containment), in accordance with Section 3.5.1.1 of NUREG-0800. The missiles generated outside containment by rotating or pressurized (high-energy fluid system) equipment are included.

The design credits only safety-related systems to establish and maintain safe shutdown conditions. The safety-related systems and components needed to bring the plant to safe shutdown, including the main control room, are located inside the containment shield building and the auxiliary building. Both buildings are seismic Category I NI structures having thick structural concrete walls that provide internal and external missile protection. No nonsafety-related systems or components that require protection from missiles are housed in these buildings.

All SSCs that are necessary to perform safety functions are to be protected against damage from the following:

- internally generated missiles (outside containment)
- internally generated missiles (inside containment)
- turbine missiles
- missiles generated by tornadoes and extreme winds
- site proximity missiles (except aircraft)
- aircraft hazards

3.5.1.2 *Summary of Application*

Section 3.5 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.5 of the AP1000 DCD, Revision 19. Section 3.5 of the DCD includes Section 3.5.1.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.5, the applicant provided the following:

AP1000 COL Information Item

- PTN COL 3.3-1 and PTN COL 3.5-1

The applicant provided additional information in PTN COL 3.3-1 to resolve COL Information Item 3.3-1 (COL Action Item 3.3.2.2-1) and PTN COL 3.5-1 to resolve COL Information Item 3.5-1 (COL Action Item 3.5.1.5-1).

PTN COL 3.3-1 and PTN COL 3.5-1, in Turkey Point Units 6 and 7 COL FSAR, Section 3.5.1.4, "Missiles Generated by Natural Phenomenon," state that hurricane missiles are defined in accordance with RG 1.221. PTN COL 3.3-1 and PTN COL 3.5-1 also state that the hurricane missile parameters considered for Turkey Point Units 6 and 7 are summarized in Table 3.5-201. This information was provided under Section 3.5.2 of the Turkey Point Units 6 and 7 COL FSAR and is reviewed under Section 3.5.2 of this report.

PTN COL 3.3-1 and PTN COL 3.5-1, in Turkey Point Units 6 and 7 COL FSAR, Section 3.5.1.5, "Missiles Generated by Events near the Site," state that the buildings and structures at the Turkey Point Units 6 and 7 site are common structures at a nuclear power plant. They are of similar design and construction to those that are typical at nuclear power plants. Therefore, any missiles resulting from a tornado-initiated failure are not more energetic than tornado missiles postulated for design of the AP1000. Also, PTN COL 3.3-1 and PTN COL 3.5-1 state that Turkey Point Units 6 and 7 COL FSAR, Section 2.2.3 explosion overpressure effects did not exceed the 1-psi (7-kPa) criterion of RG 1.91, "Evaluations of Explosions Postulated To Occur on Transportation Routes near Nuclear Power Plants," and state that blast-generated missile effects are not considered further because overpressure is the controlling effect and its criterion is not exceeded.

In addition, PTN COL 3.3-1 and PTN COL 3.5-1 in Turkey Point Units 6 and 7 COL FSAR, Section 3.5.1.6, "Aircraft Hazards," state that no further evaluation of aircraft impact is required, because the core damage frequency (CDF) associated with aircraft impacts is less than 1×10^{-8} per year.

Supplemental Information

- STD SUP 3.5-1

The applicant provided supplemental information by adding text to the end of AP1000 DCD, Section 3.5.1.3. This supplemental information states that the potential for a turbine missile from another AP1000 plant in close proximity has been considered for Turkey Point Units 6 and 7 in accordance with RG 1.115, "Protection against Low-Trajectory Turbine Missiles," Revision 1.

- STD SUP 3.5-2

The applicant provided supplemental information by stating that the turbine system maintenance and inspection program is discussed in AP1000 DCD, Section 10.2.3.6.

- PTN SUP 3.5-1

The applicant provided supplemental information by stating that there is no turbine missile hazard from Units 1 through 5. The basis for the applicant's conclusion is that the five existing steam turbine generators are oriented along an N/S axis and are located far enough north of Turkey Point Units 6 and 7, and therefore, there is no potential for turbine missiles from Units 1 through 5.

3.5.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations for missile selection and description are given in Revision 3 of Sections 3.5.1.1 through 3.5.1.3 and Revision 4 of Sections 3.5.1.4 through 3.5.1.6, of NUREG-0800.

The regulatory basis for acceptance of PTN COL 3.5-1 is based on the development of site-specific parameters and verification of bounding conditions compared to the DCD interface criteria for missile generation, site arrangement, and building construction. The design of AP1000 safety-related structures for protection against missiles using acceptable procedures must meet the requirements of Appendix A to 10 CFR Part 50, GDC 4, "Environmental and Dynamic Effects Design Bases." Section 100.21, "Non-Seismic Siting Criteria," paragraph (e), provides regulatory requirements for potential hazards associated with nearby transportation routes, and industrial and military facilities.

Additional regulatory guidance related to the review of the issues in this SER section are given in RG 1.91, Revision 1, and RG 1.115.

3.5.1.4 *Technical Evaluation*

The NRC staff reviewed Section 3.5 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's

review confirmed that the information in the application and incorporated by reference addresses the required information relating to missile protection of safety-related SSCs. The results of the NRC staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER for the reference COL application (VEGP, Units 3 and 4) were equally applicable to the Turkey Point Units 6 and 7 COL application, the staff undertook the following reviews:

- The staff compared the VEGP COL FSAR, Revision 5, to the Turkey Point Units 6 and 7 COL FSAR. In performing this comparison, the staff considered changes made to the Turkey Point Units 6 and 7 COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff completed its review and finds the evaluation performed for the standard content to be directly applicable to the Turkey Point Units 6 and 7 COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. Section 1.2.3 of this SER provides an explanation of why the standard content material from the SER for the reference COL application (VEGP) contains evaluation material from the SER for the BLN, Units 3 and 4, COL application.

The staff reviewed the following information in the Turkey Point Units 6 and 7 COL FSAR:

AP1000 COL Information Items

- PTN COL 3.3-1 and PTN COL 3.5-1

The NRC staff reviewed the COL Information Item PTN COL 3.5-1 and PTN COL 3.3-1 related to missiles generated by natural phenomenon under Section 3.5.1.4 of the Turkey Point Units 6 and 7 COL FSAR. This information was provided under Section 3.5.2 of the Turkey Point Units 6 and 7 COL FSAR and is reviewed under Section 3.5.2 of this report.

The NRC staff reviewed the COL Information Item PTN COL 3.5-1 and PTN COL 3.3-1 related to missiles generated by events near the site included under Section 3.5.1.5 of the Turkey Point Units 6 and 7 COL FSAR. The applicant provided site-specific information to resolve the COL information items. The applicant described and evaluated the potential missile generation events near the site in FSAR Section 2.2.3 and concluded that the explosion overpressure effects did not exceed the 1-psi (7-kPa) criterion of RG 1.91. Therefore, the applicant found that no further evaluation of postulated missiles is required, as the effect of postulated missiles will be less than those associated with the overpressure levels considered in RG 1.91.

The applicant evaluated potential aircraft hazards following the approach and methodology outlined in NUREG-0800, Section 3.5.1.6, "Aircraft Hazards," and determined the effects of an aircraft crash on safety-related structures in the site. The probability of whether aircraft accidents resulting in radiological consequences would be greater than the 10 CFR Part 100 exposure guidelines was determined by the applicant based on the following:

> One airport, Homestead Air Reserve Base, located approximately 7.66 km (4.76 miles) from the Turkey Point Units 6 and 7, and one federal airway (V3) passing within 3.2 km (two miles) of the Turkey Point Units 6 and 7.

The applicant addressed the COL Information Item PTN COL 3.5-1 in COL FSAR, Section 3.5.1.6, "Aircraft Hazards," based on the discussion in COL FSAR Section 2.2.2.7. The applicant determined a total aircraft impact probability of 3.86×10^{-6} per year. Since the details of the total aircraft impact probability determination are not provided, the staff could not fully review and perform the confirmatory calculations. Therefore, the staff requested additional information (RAI 5414, Question 03.05.01.06) from the applicant for the details of assumptions, data, and calculations. In a letter dated August 24, 2011, the applicant provided the response with details in determining the aircraft crash probability. The applicant provided a revision to FSAR Section 2.2.2.7, and staff confirmed the incorporation of this revised information in FSAR Revision 3. However, the staff found it was not reflected in FSAR Section 3.5.1.6. It was incorporated later into FSAR Revision 5, Section 3.5.1.6, and the staff confirmed this. Because the aircraft crash probability exceeded the acceptance criterion of 1×10^{-7} per year, an evaluation to demonstrate that the CDF associated with the aircraft impacts is less than 1×10^{-8} per year was performed in FSAR Section 19.58.2.3.1. Therefore, the applicant concluded, based on the determined CDF, that aircraft hazards pose no undue risk to the health and safety of the public.

The staff reviewed the applicant's response to RAI 5414, Question 03.05.01.06, and performed independent calculations using conservative total flight data within 5 mi of the plant obtained from the Federal Aviation Administration. The staff determined a total aircraft accident probability of about 5.26×10^{-7} per year by using an average crash rate of 3×10^{-9} per aircraft-mile, which is less than the acceptance criteria of 10^{-6} per year in NUREG-0800, Section 3.5.1.6.

On the basis of the confirmatory analysis and the review of the applicant's assumptions and data used for the estimation of aircraft accident probability, the staff concludes that aircraft hazards have no undue risk to the Turkey Point Units 6 and 7 operation nor to the health and safety of the public and that the relevant requirements of 10 CFR 100.20, "Factors To Be Considered when Evaluating Sites," are met. This conclusion is based on the staff's independent verification of the applicant's assessment of aircraft hazards at the site that resulted in a probability less than an order of magnitude of 10^{-7} per year for an accident having radiological consequences in excess of the exposure guidelines provided in 10 CFR 50.34(a)(1).

The following portion of this technical evaluation section is reproduced from Section 3.5.1.4 of the VEGP SER:

Supplemental Information

- *STD SUP 3.5-1*

The NRC staff reviewed the standard supplementary information (STD SUP 3.5-1) on the probability of turbine missiles from another AP1000 plant in close proximity affecting SSCs. The applicant proposes to add to the AP1000 DCD, Section 3.5.1.3, a statement that the potential for a turbine missile from another AP1000 plant in close proximity is less than $1x10^{-5}$ per year, and that the reinforced concrete shield building and auxiliary building walls, roofs, and floors satisfies the guidance of RG 1.115 for two AP1000 plants side-by-side.

It should be noted that AP1000 DCD, Section 1.2.2 refers to Figure 1.2 2 of the AP1000 DCD for the building structure orientation with respect to the turbine building and the nuclear island. Figure 1.2 2 illustrates the AP1000 plant as a single unit. Section 1.2.1.3.1 of the AP1000 DCD also states that the turbine orientation minimizes potential interaction between turbine missiles and safety-related structures and components. In addition, Section 3.5.1.3 of the AP1000 DCD states that the turbine generator is located north of the nuclear island with its shaft oriented north-south so that safety-related systems are located outside the high-velocity, low trajectory missile strike zone. With this information, the AP1000 design is considered to favorably orient the turbine building with respect to safety-related SSCs as defined in RG 1.115. However, since BLN Units 3 and 4 will be side-by-side, the staff notes that each turbine generator may not be oriented favorably with respect to the other plant's safety-related SSCs (i.e., BLN Unit 3 turbine generator not favorably orientated to BLN Unit 4 safety-related SSCs, and vice versa).

In Revision 1 of the BLN COL FSAR, the applicant revised STD SUP 3.5-1 to state that when two or more AP1000 units are situated side-by-side, the turbine generators are orientated unfavorably with respect to the other nuclear island which contains safety-related SSCs. The BLN site has two AP1000 units situated side-by-side. Therefore, the staff notes that to meet the guidance of RG 1.115 and Section 3.5.1.3 of NUREG-0800, for an unfavorable turbine generator orientation, the probability of generating a turbine missile must be equal to or less than $1x10^{-5}$ per year. As stated in the BLN COL FSAR, Section 3.5.1.3, the probability of generating a missile for the AP1000 turbine generator is less than $1x10^{-5}$ per year as calculated in the applicable bounding turbine missile analysis topical report referenced in the AP1000 DCD, Sections 3.5.1.3 and 10.2.8. The staff has not completed its review of the DCD with respect to this issue. Therefore, the staff is unable to make final determination. This is ***Open Item 1-1****.*

- *STD SUP 3.5-2*

STD SUP 3.5-2 to BLN COL, Section 3.5.1.3 states, "The turbine system maintenance and inspection program is discussed in Section 10.2.3.6." This statement refers to Section 10.2.3.6 of the BLN COL, for information concerning the turbine maintenance and inspection program. The staff's review of the

turbine maintenance and inspection program is included in Section 10.2.3 [sic 10.2] *of this SER.*

Resolution of the Standard Content Evaluation Concerning Open Item 1-1 for Turbine Missiles

The NRC staff identified a statement in the text reproduced above from Section 3.5.1.4 of the BLN SER that requires clarification for the VEGP COL application. The BLN SER states that the review of the AP1000 DCD with respect to the probability of generating a turbine missile was not completed and, therefore, identified it as Open Item 1-1. The results of the NRC staff's technical evaluation of the AP1000 DC amendment application are documented in NUREG-1793 and its supplements, and include the final staff conclusions on the issue of probability of a missile striking a safety-related component.

Therefore, the staff finds that the probability of generating a turbine missile meets the guidance in Section 3.5.1.3 of NUREG-0800 and the requirements of GDC 4, since the probability of a missile striking a safety-related component is acceptably low. As an additional conservative measure, the shield building and auxiliary building walls, roofs, and floors provide some inherent protection of the safety-related components, but are not credited in preventing turbine missile strikes of safety-related components. As a result, Open Item 1-1, as it relates to the probability of a missile striking a safety-related component, is closed for the VEGP application review.

- PTN SUP 3.5-1

The applicant provided supplemental information by stating that the potential for turbine missiles from Units 1 through 5 has been considered and that the guidance of RG 1.115 is satisfied based on orientation and distance. Therefore, the applicant stated that there is no potential for turbine missiles from Units 1 through 5 to impact Turkey Point Units 6 and 7. The NRC staff reviewed and evaluated this information and finds that the potential turbine orientation and placement provides a high degree of confidence that low-trajectory missiles resulting from turbine failures will not damage essential systems. Therefore, the staff considers the applicant's conclusions acceptable.

3.5.1.5 *Post-Combined License Activities*

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

3.5.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR is acceptable and meets the regulatory guidance in Sections 3.5.1.1 through 3.5.1.6 of NUREG-0800. The staff based its conclusion on the following:

- PTN COL 3.3-1 and PTN COL 3.5-1 are acceptable because they meet the acceptance criteria provided in Sections 3.5.1.5 and 3.5.1.6 of NUREG-0800.

- STD SUP 3.5-1 is acceptable because the turbine missile evaluation for co-located AP1000 units meets the guidance of NUREG-0800, Section 3.5.1.3; therefore, it ensures that the requirements of GDC 4 are met for protecting safety-related SSCs against the effects of turbine missiles.

- STD SUP 3.5-2 provides information on the turbine maintenance and inspection program. The staff's review of the turbine maintenance and inspection program is included in Section 10.2 of this SER.

- PTN SUP 3.5-1 is acceptable because the protection of safety-related SSCs from turbine missiles meets the acceptance criteria defined in NUREG-0800, Section 3.5.1.

3.5.2 Protection from Externally Generated Missiles

3.5.2.1 *Introduction*

Systems required for safe shutdown are protected from the effects of missiles. Protection from external missiles, including those generated by natural phenomena, is provided by the external walls and roof of the seismic Category I NI structures. The external walls and roofs are reinforced concrete. The structural design requirements for the shield building and auxiliary building are outlined in AP1000 DCD, Section 3.8.4. Openings through these walls are evaluated on a case-by-case basis to provide confidence that a missile passing through the opening would not prevent safe shutdown and would not result in an offsite release exceeding the limits defined in 10 CFR Part 100.

3.5.2.2 *Summary of Application*

Section 3.5.2 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.5.2, "Protection from Externally Generated Missiles," of the AP1000 DCD, Revision 19.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.5.2, the applicant provided the following:

AP1000 COL Information Item

- PTN COL 3.5-1

The applicant provided additional information in Turkey Point Units 6 and 7 COL FSAR, Sections 3.5.1.4 and 3.5.2 to resolve COL Information Item PTN COL 3.5-1. COL FSAR, Section 3.5.2 identifies the horizontal and vertical velocities of design-basis missiles generated by site-specific hurricane winds.

Supplemental Information

- PTN SUP 3.3-1

The applicant provided supplemental information by adding Table 3.5-201 to AP1000 DCD, Section 3.5. This supplemental information provides a summary of the site-specific hurricane-generated missile parameters and compares them to AP1000 DCD, Tier 1, Table 5.0-1 tornado-generated missile parameters.

3.5.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations for protection from externally generated missiles are given in Sections 3.5.1.4, Revision 4, and 3.5.2, Revision 3, of NUREG-0800.

The regulatory basis for acceptance of PTN COL 3.5-1 is based on the development of site-specific parameters compared to the DCD missile parameters. The design of AP1000 safety-related structures for protection against missiles using acceptable procedures must meet the requirements of 10 CFR Part 50, Appendix A, GDC 2 and GDC 4.

Additional regulatory guidance related to the review of the issues in this SER section are given in RG 1.221.

3.5.2.4 Technical Evaluation

The NRC staff reviewed Section 3.5 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to missile protection of safety-related SSCs. The results of the NRC staff's evaluation of the information incorporated by reference in the PTN COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER for the reference COL application (VEGP, Units 3 and 4) were equally applicable to the Turkey Point Units 6 and 7 COL application, the staff undertook the following reviews:

- The staff compared the VEGP COL FSAR, Revision 5, to the Turkey Point Units 6 and 7 COL FSAR. In performing this comparison, the staff considered changes made to the Turkey Point Units 6 and 7 COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

AP1000 COL Information Item

- PTN COL 3.5-1

PTN COL 3.5-1 requests COL applicants to evaluate whether the site characteristics for wind and tornadoes satisfy the AP1000 site parameters for wind and tornado conditions. If there are exceedances, they must be discussed and shown to be acceptable. In Section 3.5.2 of the Turkey Point Units 6 and 7 COL FSAR, the applicant provided additional information to address this COL information item.

The staff reviewed the information contained in the Turkey Point Units 6 and 7 COL FSAR, Section 3.5.2. The review evaluated the applicant's assessment of possible hazards attributed to missiles generated by extreme winds (such as hurricanes and tornados) identified in FSAR Section 3.5.

RG 1.221 provides new guidance that the NRC staff considers acceptable for use in selecting the design-basis hurricane wind speed and hurricane-generated missiles that a new nuclear power plant should be designed to withstand to prevent undue risk to public health and safety. In response to RAI 6251, Question 02.03.01-3, the applicant addressed hurricane-generated missiles in Turkey Point Units 6 and 7 COL FSAR, Section 3.5-1 and provided hurricane missile spectra and associated velocities based on RG 1.221, and a discussion on whether the individual missile velocities are bounded by the AP1000 DCD. Subsequently, the last bullet of Turkey Point Units 6 and 7 COL FSAR, Section 3.5.2 discussing the automobile missile was revised in response to RAI 6544, Question 3.05.03-34.

The applicant concludes in Turkey Point Units 6 and 7 COL FSAR, Section 3.5.2 that the AP1000 DCD design-basis tornado missile vertical velocities of the automobile, 8-in. (275-lb) artillery shell, and the 1-in. steel sphere bound similar missiles subject to the site-specific hurricane wind of 260 mph. However, the site-specific hurricane winds result in horizontal missile velocities that exceed the AP1000 DCD tornado missile velocities for all three potential missiles. As a result, the applicant evaluated the impact of the site-specific hurricane-generated missiles on the exterior walls of the NI and concluded the Turkey Point Units 6 and 7 NI is adequately protected against the hurricane-generated missile spectra of RG 1.221. The staff's evaluation of the wind and missile loading and structural engineering aspects of RAI 6251, Question 02.03.01-3 and RAI 6544, Question 03.05.03-34 is in Section 3.3.2 of this SER.

In addition, the applicant provided PTN SUP 3.3-1, Table 3.5-201, which compares the site-specific hurricane-generated missile spectra and associated velocities to AP1000 DCD, Tier 1, Table 5.0-1 tornado-generated missile parameters.

The staff reviewed the additional and supplemental information provided by the applicant and verified that the methodologies used to calculate the site-specific hurricane missile spectra and associated velocities are consistent with Figure 2, Table 1, and Table 2 of RG 1.221. On the basis of its review, the staff concludes that the information in Turkey Point Units 6 and 7

COL FSAR, Section 3.5.2 associated with PTN COL 3.5-1 and PTN SUP 3.3-1 adequately addresses COL Information Item 3.5-1 and is acceptable because the site-specific hurricane missile parameters conform to the guidance of RG 1.221.

3.5.2.5 *Post-Combined License Activities*

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

3.5.2.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR is acceptable and meets the requirements of GDC 2 and GDC 4 with respect to missiles and environmental effects. The staff based its conclusion on the following:

- PTN COL 3.5-1 and STD SUP 3.3-1 are acceptable because they meet the acceptance criteria provided in Sections 3.5.1.4 and 3.5.2 of NUREG-0800, and conform to RG 1.221.

3.5.3 Barrier Design Procedures

Missile barriers and protective structures are designed to withstand and absorb missile impact loads to prevent damage to safety-related systems or components. Formulae used for missile penetration calculations into steel or concrete barriers are the Modified National Defense Research Committee formula for concrete and either the Ballistic Research Laboratory or Stanford formulae for steel as documented in AP1000 DCD, Section 3.5.3.

Section 3.5 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.5.3, "Barrier Design Procedures," of the AP1000 DCD, Revision 19, without any departures or supplements. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] On the basis of its review, the staff confirms that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

3.6 Protection against Dynamic Effects Associated with the Postulated Rupture of Piping

3.6.1 Introduction

The design basis and criteria are described to demonstrate that safety-related systems are protected from pipe ruptures. This section also evaluates design bases for locating postulated breaks and cracks in high- and moderate-energy piping systems inside and outside the

containment; the procedures used to define the jet thrust reaction at the break location; the procedures used to define the jet impingement loading on adjacent essential SSCs; pipe whip restraint design; and the protective assembly design. Pipe breaks in several high-energy systems, including the reactor coolant loop and surge line, are replaced by small leakage cracks when the leak-before-break (LBB) criteria are applied. Jet impingement and pipe whip effects are not evaluated for these small leakage cracks.

Mechanistic pipe break evaluations (also referred to as LBB) demonstrate that, for piping lines meeting the criteria, sudden catastrophic failure of the pipe is not credible. The evaluations demonstrate that piping that satisfies the criteria leaks at a detectable rate from postulated flaws prior to growth of the flaw to a size that would fail due to applied loads resulting from normal conditions, anticipated transients, and a postulated SSE.

3.6.2 Summary of Application

Section 3.6 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.6 of the AP1000 DCD, Revision 19. Section 3.6 of the DCD includes Section 3.6.4.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.6.4, the applicant provided the following:

AP1000 COL Information Items

- STD COL 3.6-1

The applicant provided additional information in STD COL 3.6-1 to address COL Information Item 3.6-1. Specifically, the applicant stated that a pipe rupture hazard analysis is part of the piping design. It is used to identify postulated break locations and layout changes, support design, whip restraint design, and jet shield design. The applicant further stated that the final design of these activities will be completed prior to fabrication and installation of the piping and connected components.

- STD COL 3.6-4

The applicant provided additional information in STD COL 3.6-4 to address COL Information Item 3.6-4, regarding LBB inspections.

License Condition

- Part 10, License Condition 2, Item 3.6-1

The applicant has proposed a license condition addressing the completion schedule of the as-designed pipe rupture hazards analysis.

Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC)

This license condition is the same as that proposed by the VEGP in its application, that proposed ITAAC requires the completion of an as-designed pipe rupture hazards analysis to demonstrate that SSCs required to be functional during and following a postulated pipe failure

are protected against or qualified to withstand the dynamic and environmental effects resulting from postulated failures in high- and moderate-energy piping.

3.6.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations (GDC 4 of Appendix A to 10 CFR Part 50) for the piping design against pipe breaks, pipe break locations and characteristics in safety-related piping, and LBB evaluation procedures are given in Sections 3.6.1, Revision 3; 3.6.2, Revision 2; and 3.6.3, Revision 1, of NUREG-0800.

The regulatory basis for terms or conditions of the combined licenses is established in 10 CFR 52.79(d)(3). Specifically, it states that any requirements and restrictions set forth in the referenced design certification rule (DCR) that could not be satisfied by the time of issuance of the combined license, must be set forth as terms or conditions of the combined license.

3.6.4 Technical Evaluation

The NRC staff reviewed Section 3.6 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the piping design against pipe break, pipe break locations and characteristics in safety-related piping, and LBB evaluation procedures. The results of the NRC staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER for the reference COL application (VEGP, Units 3 and 4) were equally applicable to the Turkey Point Units 6 and 7 COL application, the staff undertook the following reviews:

- The staff compared the VEGP COL FSAR, Revision 5, to the Turkey Point Units 6 and 7 COL FSAR. In performing this comparison, the staff considered changes made to the Turkey Point Units 6 and 7 COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff completed its review and finds the evaluation performed for the standard content to be directly applicable to the Turkey Point Units 6 and 7 COL application. This standard content

material is identified in this SER by use of italicized, double-indented formatting. Section 1.2.3 of this SER provides an explanation of why the standard content material from the SER for the reference COL application (VEGP) contains evaluation material from the SER for the BLN, Units 3 and 4, COL application. The one confirmatory item in the standard content material retains the number assigned in the VEGP SER.

AP1000 COL Information Items

The following portion of this technical evaluation section is reproduced from Section 3.6.4 of the VEGP SER:

- *STD COL 3.6-1*

The staff notes that there are two different actions to be addressed: 1) the COL holder item addresses the as-designed pipe rupture hazard analysis report; and 2) the ITAAC addresses as-built reconciliation of the pipe rupture hazard analysis report. The ITAAC has a stated schedule, prior to fuel load, and a regulatory requirement that the ITAAC schedule be provided one year after the license is granted.

Based on the review of the information included in the BLN COL FSAR, it is unclear to the staff when the as-designed pipe rupture hazard analysis report will be completed by the applicant. As identified in 10 CFR 52.79(d)(3), the applicant should supply the NRC with a schedule for completion of detailed engineering information, in this case, the as-designed pipe rupture hazard analysis report. The applicant is requested to revise the implementation milestone for the License Condition to address the as-designed pipe rupture hazard analysis report (as opposed to as-built reconciliation) to allow coordination of activities with the NRC construction inspection program following the issuance of the COL such that the analysis would be made available to verify the design was completed in accordance with the regulations and DCD prior to fabrication and installation of the piping and connected components. In RAI 3.6.2-1, the staff requested the applicant provide a description pertaining to the closure milestone of the as-designed pipe rupture hazard analysis activities.

The applicant responded to RAI 3.6.2-1, however, based on its review of the applicant's response, the staff determined that it is not acceptable. Specifically, RAI 3.6.2-1 requested that the applicant address the implementation milestone of the as-designed pipe rupture hazard analysis report. However, the applicant's RAI response addressed the as-built rather than the as-designed aspect. Therefore, RAI 3.6.2-1 remains unresolved and will be tracked as ***Open Item 3.6-1.***

- *STD COL 3.6-4*

The BLN COL FSAR replaced the first paragraph of Section 3.6.4.4 of AP1000 DCD with the following text:

> *Alloy 690 is not used in leak-before-break [LBB] piping. No additional or augmented inspections are required beyond the inservice inspection [ISI] program for leak-before-break [LBB] piping. An as-built verification of the leak-before-break piping is required to verify that no change was introduced that would invalidate the conclusion reached in this subsection.*

Based upon its review of the replaced Section 3.6.4.4, the staff determined that additional information was needed by the COL applicant to address whether Alloy 690 material is being used in the BLN-specific LBB piping systems. Accordingly, the staff issued several RAIs.

In RAI 3.6.3-1, the staff noted that it was unclear why Alloy 690 was not used in LBB piping applications. If Alloy 690 base material and Alloy 52/152 weld material was not being used, the staff asked the applicant to identify what material was being used for the piping.

In RAI 3.6.3-2, the staff asked if another base material was being used other than Alloy 690/52/152, then the applicant should provide its reasons for using this material in LBB piping applications based upon operating experience, and provide justification as to why no augmented inspection plans and evaluation criteria were considered necessary. Additionally, the staff requested that the applicant provide a discussion which supports the use of an alternative material and discuss why concerns for potential PWSCC [primary water stress-corrosion cracking] should not be considered a factor.

In RAI 3.6.3-3, for piping requiring dissimilar metal welds, the applicant was requested to address that if Alloy 52/152 is not being used for the weld material, then they should identify the weld material and provide justification for its use. In addition, the applicant should provide a discussion which supports the use of an alternative weld material and why concerns regarding the potential for PWSCC should not be considered a factor. The staff noted that there are currently ASME Code cases being developed for dissimilar-metal welds due to PWSCC concerns.

In its response to these RAIs, the applicant provided additional information to clarify the material that is used for LBB piping systems. The applicant stated that there is some limited use of Alloy 690 base material as safe ends in components connected to LBB piping, and there is some limited use of Alloy 52/152 weld material associated with these safe ends. However, the applicant noted that the base material for most of the LBB piping is 316LN stainless steel material. The applicant further stated that the material used in the AP1000 LBB piping is the same material currently used for LBB piping in operating nuclear power plants. Alloy 690 and Alloy 600 are not used as base material for LBB piping in the AP1000 design and are not commonly used in the LBB piping in current operating nuclear power plants. The applicant also stated that even though the material used in the LBB piping for the AP1000 design do not presently require an augmented ISI program, if ASME Code cases are developed and approved to address PWSCC concerns for dissimilar metal welds used in the AP1000 DCD, they will be evaluated and implemented.

The staff notes that in a final rule to amend 10 CFR 50.55a (73 FR [Federal Register] 52730) issued on September 10, 2008, a new requirement was added for licensees to augment their ISI program to use ASME Code Case N-722 for ISI of Alloy 600/182/82 materials to address PWSCC concerns. The applicant stated that there will be no Alloy 600/182/82 material used for new reactor construction of AP1000 plants. The staff notes that the final rule did not impose any additional requirements for augmented ISI of Alloy 690/152/52 materials. Based on the applicant's response discussed above and its commitment to evaluate and implement ASME Code cases that are developed and approved for augmented inspections of Alloy 690/152/52 material to address PWSCC concerns, the staff concludes the applicant's changes to COL Information Item 3.6-4 is consistent with current industry practice and NRC regulations as amended in 10 CFR 50.55a and is thus, acceptable.

Resolution of Standard Content Open Item 3.6-1

To address Open Item 3.6-1 in the BLN SER with open items, the VEGP applicant proposed in its letter dated April 23, 2010, an ITAAC for as-designed pipe rupture hazards analysis in ITAAC Table 3.8-# [where # is the next sequential number] and a revision to the proposed License Condition 2, Item 3.6-1 in Part 10 of the VEGP COL application. In addition, the applicant proposed to revise VEGP COL FSAR Section 3.6.4.1 and to add VEGP COL FSAR Section 14.3.3.# [where # is the next sequential number] related to pipe rupture hazards analysis.

Specifically, the proposed ITAAC includes a post-COL requirement related to the completion of the as-designed pipe rupture hazards analysis report. The proposed VEGP COL FSAR Section 3.6.4.1 states that the completed as-designed pipe rupture hazards analysis will be in accordance with the criteria outlined in AP1000 DCD Sections 3.6.1.3.2 and 3.6.2.5. The applicant stated that the completed as-designed pipe rupture hazards analysis report will be completed prior to installation of the piping and connected components and will be made available to the NRC staff. The applicant's proposed license condition that will require completion of the as-designed pipe rupture hazards analysis report prior to installation of the piping and connected components in their final location is proposed License Condition 2, Item 3.6-1. In the proposed VEGP COL FSAR Section 14.3.3.#, [where # is the next sequential number] the applicant stated that the as-designed pipe rupture hazards analysis completed for the first standard AP1000 plant will be available to subsequent standard AP1000 plants under the "one issue, one review, one position" approach for closure.

The staff reviewed the applicant's April 23, 2010, response to BLN open items for Chapter 3, and has determined that the use of a plant-specific ITAAC to verify that the as-design pipe rupture hazards evaluation has been performed in accordance with the criteria outlined in AP1000 DCD Sections 3.6.1.3.2 and 3.6.2.5 is acceptable. The applicant's proposed license condition requiring completion of the as-designed pipe rupture hazards analysis report prior to installation of the piping and connected components in their final location,

through the above discussed ITAAC, will allow the staff sufficient time to review the as-design pipe rupture hazards evaluation in a timely matter in order to identify and address any design issues. Therefore, the staff finds the response acceptable and concludes that Standard Content Open Item 3.6-1 has been satisfactorily resolved. The incorporation of the planned VEGP COL FSAR changes will be tracked as ***Confirmatory Item 3.6-1****.*

Resolution of Standard Content Confirmatory Item 3.6-1

Confirmatory Item 3.6-1 is an applicant commitment to revise its FSAR Section 3.6.4.1 and, Section 14.3.3.2, to verify the incorporation of the as-designed pipe rupture hazard analysis and add an ITAAC (Table 3.8-1) for the as-designed pipe rupture hazard analysis. The staff verified that the VEGP COL FSAR and part 10 of the application (ITAAC Table 3 .8-1) were appropriately updated. As a result, Confirmatory Item 3.6-1 is now closed.

3.6.5 Post-Combined License Activities

The license condition language in this section has been clarified from previously considered language. In a letter dated April 8, 2016 (ADAMS Accession No. ML16103A507), the applicant did not identify any concerns with the clarified license condition language. The changes do not affect the staff's above analysis of the conditions, and therefore, for the reasons discussed in the technical evaluation section above, the staff finds the following ITAAC and license condition related to pipe rupture hazards analysis acceptable:

- The licensee shall perform and satisfy the pipe rupture hazards analysis ITAAC defined in SER Table 3-1, "Pipe Rupture Hazards Analysis ITAAC."

Table 3-1 Pipe Rupture Hazards Analysis ITAAC

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
SSCs that are required to be functional during and following a design-basis event shall be protected against or qualified to withstand the dynamic and environmental effects associated with analyses of postulated failures in high- and moderate-energy piping.	Inspection of the as-designed pipe rupture hazard analysis report will be conducted. The report documents the analyses to determine where protection features are necessary to mitigate the consequence of a pipe break. Pipe break events involving high-energy fluid systems are analyzed for the effects of pipe whip, jet impingement, flooding, room pressurization, and temperature effects. Pipe break events involving moderate-energy fluid systems are analyzed for wetting from spray, flooding, and other environmental effects, as appropriate.	An as-designed pipe rupture hazard analysis report exists and concludes that the analysis performed for high- and moderate-energy piping confirms the protection of systems, structures, and components required to be functional during and following a design-basis event.

- License Condition (3-1) - Before commencing installation of individual piping segments and connected components in their final locations, the licensee shall complete the as-designed pipe rupture hazards analysis for compartments (rooms) containing those

segments in accordance with the criteria outlined in the AP1000 DCD, Revision 19, Sections 3.6.1.3.2 and 3.6.2.5, and shall inform the Director of NRO, or the Director's designee, in writing, upon the completion of this analysis and the availability of the as-designed pipe rupture hazards analysis reports.

3.6.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR is acceptable and meets the requirements of GDC 4 of Appendix A to 10 CFR Part 50. The staff based its conclusion on the following:

- STD COL 3.6-1 is acceptable because the applicant's proposed resolution to COL Information Item 3.6-1 in Turkey Point Units 6 and 7 COL FSAR, Section 3.6.4.1 meets the relevant guidelines of NUREG-0800, Sections 3.6.1 and 3.6.2, and 10 CFR 52.79(d)(3) and is, thus, acceptable. Conformance with these guidelines provides an acceptable basis for satisfying, in part, the requirements of GDC 4 of Appendix A to 10 CFR Part 50.

- STD COL 3.6-4 is acceptable because the applicant's proposed resolution to COL Information Item 3.6-4 in Section 3.6.4.4 of the Turkey Point Units 6 and 7 COL FSAR meets the relevant guidelines of NUREG-0800, Section 3.6.3, and RG 1.206, Section C.III.1, Chapter 3, C.I.3.6.3 and is, thus, acceptable. Conformance with these guidelines provides an acceptable basis for satisfying, in part, the requirements of GDC 4 of Appendix A to 10 CFR Part 50.

3.7 Seismic Design

Seismic design of the AP1000 seismic Category I and II structures, systems, equipment, and components are based on the SSE which is defined as the certified seismic design response spectra (CSDRS) in the DCD. The operating-basis earthquake (OBE) has been eliminated as a design requirement for the AP1000. Low-level seismic effects are included in the design of certain equipment potentially sensitive to a number of low-level events based on a percentage of the responses calculated for the SSE.

Criteria for evaluating the need to shut down the plant following an earthquake are established. For the purposes of the shutdown criteria, the OBE for shutdown is considered to be one-third of the SSE.

Seismic Category I SSCs are designed to withstand the effects of the SSE event and to maintain the specified design functions. Seismic Category II and NS structures are designed or physically arranged (or both) so that the SSE could not cause unacceptable structural interaction with or failure of seismic Category I SSCs.

3.7.1 Seismic Design Parameters

3.7.1.1 *Introduction*

The input seismic design ground motion response spectra (GMRS) for the SSE in the freefield at plant grade is addressed. The horizontal and vertical design GMRS for the AP1000 were developed based on the response spectra in Revision 1 of RG 1.60, "Design Response Spectra for Seismic Design of Nuclear Power Plants," with consideration of high-frequency amplification effects.

The bases for the seismic design of safety-related SSCs and equipment include the following:

- design GMRS
- design ground motion time histories
- percentage of critical damping values
- supporting media for seismic Category I structures
- COL action items

3.7.1.2 *Summary of Application*

Section 3.7 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.7, of the AP1000 DCD, Revision 19. Section 3.7 of the DCD includes Section 3.7.1.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.7, the applicant provided the following:

Supplemental Information

- PTN SUP 3.7-1

The applicant provided supplemental information in PTN SUP 3.7-1 by adding Section 3.7.1.1.1 to the Turkey Point Units 6 and 7 COL FSAR, which addresses site-specific foundation input response spectra (FIRS), SSE motion, strain-compatible soil property profiles, and acceleration time histories for soil-structure interaction (SSI) input.

- PTN SUP 3JJ-1

The applicant provided supplemental information in PTN SUP 3JJ-1, which addresses the development of strain-compatible soil profiles and the seismic input motions used in soil-structure interaction analyses that support the information provided in PTN SUP 3.7-1.

- PTN SUP 3KK-1

The applicant provided supplemental information in PTN SUP 3KK-1, which addresses the site-specific soil-structure interaction analyses that were performed as part of the seismic evaluation to support the information provided in PTN SUP 3.7-1. The staff evaluation is included in the SER Section 3.7.2.

3.7.1.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations (GDC 2 of Appendix A to 10 CFR Part 50; Appendix S, "Earthquake Engineering Criteria for Nuclear Power Plants" to 10 CFR Part 50; and 10 CFR 100.23, "Geologic and Seismic Siting Criteria") for the seismic design parameters are given in Section 3.7.1, Revision 4, of NUREG-0800. Supplemental guidance is provided in DC/COL-ISG-017, "Ensuring Hazard Consistent Seismic Input for Site Response and Soil Structure Interaction Analysis."

3.7.1.4 *Technical Evaluation*

The NRC staff reviewed Section 3.7 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to seismic design parameters. The results of the NRC staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

The staff reviewed the following information in the Turkey Point Units 6 and 7 COL FSAR:

Supplemental Information

- PTN SUP 3.7-1
- PTN SUP 3JJ-1

In PTN SUP 3.7-1, the applicant addressed site-specific FIRS, site-specific SSE motion, strain-compatible soil property profiles, and acceleration time histories for SSI input. The applicant described that the NI is supported on 10.7 m (35 ft) of lean concrete fill over limestone formations at the site as described in Turkey Point Units 6 and 7 COL FSAR, Section 2.5.4.5. The Turkey Point site-specific seismic evaluation considers the effect of the lean concrete fill on both the site response and SSI analyses as described in Appendices 3JJ and 3KK of the Turkey Point Units 6 and 7 COL FSAR.

In FSAR Section 3.7.1, the applicant developed a FIRS using the site-specific probabilistic seismic hazard assessment (PSHA) results described in FSAR Section 2.5.2 and geologic and geophysical information presented in FSAR Section 2.5.4. The applicant developed two separate site profiles for calculating FIRS: a near-field profile located beneath the NI and a far-field profile located away from the NI (FAR). These profiles are identical with the exception that the applicant developed the NI profile assuming that lean concrete fill replaces 19 ft (5.8 m) of structural fill present in the FAR profile and the FAR profile includes structural fill up to elevation +25.5 ft to raise the site grade elevation to finished grade.

The FIRS is calculated similar to the performance-based GMRS described in SER Section 2.5.2.4.5 with the exception that, although the GMRS is calculated at the

competent rock layer elevation −10.7 m (−35 ft), the FIRS is calculated at the elevation corresponding to the bottom of the NI foundation, which is −4.9 m (−16 ft). Since PSHA results provide seismic hazard curves calculated for hard rock located about 10,000 ft below the ground surface, transformation of seismic energy from the hard rock elevation beneath the site to the base of the foundation is required to accommodate the effects of local rock and soil properties beneath the NI.

This transformation is done using site response calculations. Site response calculations require estimation of physical parameters of rocks and soils residing between the foundation and the location where hard rock conditions are observed. As explained above, in its FIRS calculations, the applicant used two site profiles: the NI profile and the FAR profile. Site response calculations also require input ground motions to be propagated from the generic rock elevation, located about 10,000 ft below the ground surface, to the base of the foundation. The applicant used the controlling earthquakes' response spectra described in FSAR Section 2.5.2 as input ground motions and calculated site response functions using a Random Vibration Theory methodology. Using these two site profiles, the applicant developed a FIRS for both the NI and the FAR profiles and enveloped the result to establish the site FIRS (Figure 3-1 below).

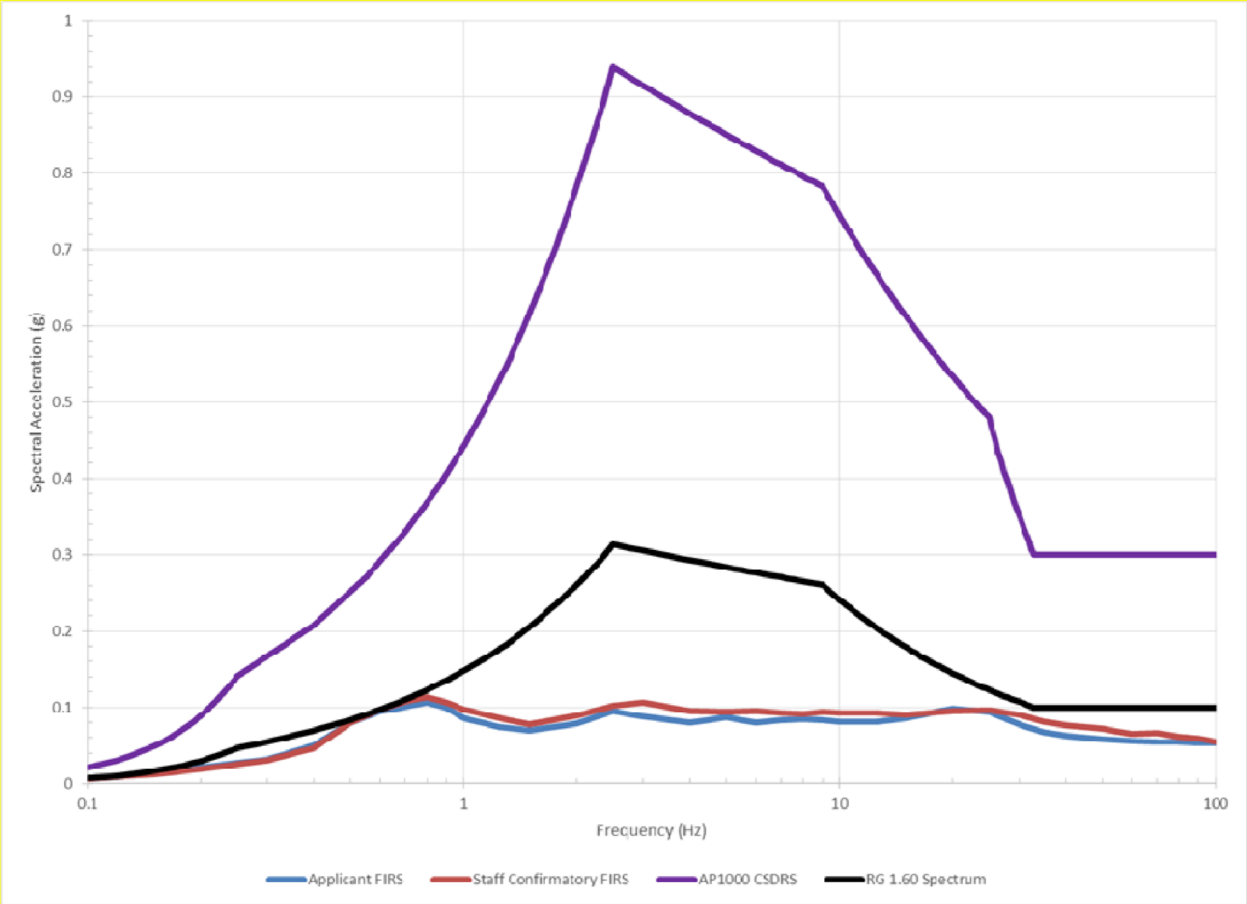

Figure 3-1 Comparison of applicant's horizontal FIRS with staff FIRS
Also shown are AP1000 CSDRS and the RG 1.60 spectrum anchored at 0.1g.

NRC Site Response Confirmatory Analysis

The staff conducted confirmatory FIRS calculations based on information provided in the FSAR and guidance in RG 1.208, "A Performance-Based Approach To Define the Site-Specific Earthquake Ground Motion," and NUREG-CR/6728, "Technical Basis for Revision of Regulatory Guidance on Design Ground Motions: Hazard- and Risk-Consistent Ground Motion Spectra Guidelines." SER Section 2.5.2.4.4 describes the staff's assessment of the PSHA results and the site-specific profiles used as input into the FIRS calculations.

The staff used only the site profile developed for the NI along with the same input response spectra used by the applicant. The staff used only the profile for the NI because the site response for NI structures can reasonably be expected to be consistent with the geologic profile located under the structures. However, the staff notes that the applicant's use of a NI and a FAR profile is conservative because the applicant considers the envelope of the two FIRS results to be the site FIRS. The applicant compared the FIRS at the base of the NI and at the AP1000 CSDRS at plant grade in Figure 3.7-202. The CSDRS for the AP1000 certified design is specified at plant grade. The staff notes that the horizontal design response spectra (DRS) at the surface (which is the same as the performance-based surface response spectrum (PBSRS) defined in ISG-017) shown in Figures 2.1-9 through 2.1-14 of Letter L-2015-085, Attachment 2, dated April 2, 2015, are significantly lower than the CSDRS which is also applied at the surface.

Figure 3-1 compares the applicant's FIRS result with that calculated by the staff, the AP1000 certified design response spectra, and the RG 1.60 response spectra anchored at 0.1g Turkey Point site-specific ground motion applied at the FIRS elevation in the SSI analyses. Overall, the FIRS results are similar, with minor differences attributable to differences in approach and randomization parameters.

The vertical FIRS is obtained by scaling the horizontal FIRS by vertical to horizontal (V/H) ratios from RG 1.60. The horizontal and vertical FIRS were compared to the AP1000 CSDRS and show that the CSDRS envelopes the FIRS. In RAI 4975, Question 03.07.01-12, the staff asked why V/H ratios selected were from RG 1.60 as opposed to V/H ratios from the generic database for the characteristic events associated with the site-specific PSHA.

The applicant's response, dated October 27, 2010, indicates that there are insufficient data in central and eastern United States (CEUS) to derive CEUS rock V/H ratios directly from empirical records. The guidance provided by NUREG/CR-6728, Appendix J, for CEUS deep soil sites with low peak rock acceleration allows the selection of RG 1.60 V/H ratios derived from western U.S. sites and modified for application to CEUS sites when sufficient empirical records do not exist. The staff finds the applicant's basis for selecting RG 1.60 V/H ratios acceptable.

In its review of SSE motions, the staff indicated in RAI 6432, Question 03.07.01-15, that the response spectra at the foundation level have zero period acceleration values less than the 0.1g required at the foundation depth by Appendix S to 10 CFR Part 50 and Sections 3.0 and 5.4 of DC/COL-ISG-017. The staff requested the applicant to provide a discussion as to how the results meet the requirements for minimum seismic input at the foundation level.

The applicant provided a response on April 2, 2015, which addresses the required minimum seismic input. The applicant stated that the horizontal and vertical SSE motions incorporate a scaling of the motion that is sufficient to achieve at least 0.1g horizontal peak ground acceleration at the bottom of the NI basemat required by Appendix S to 10 CFR Part 50 and

DC/COL-ISG-017. The applicant provided revised site-specific design response spectra at the foundation level comprised of the envelope of the Turkey Point site-specific FIRS and the amplified RG 1.60 spectra scaled to 0.1g to develop the SSE motion meeting the minimum seismic input. Acceleration time histories were matched to the DRS described above and were used in the SSI analysis. The applicant compared the site-specific floor response spectra (FRS) to the envelopes of the AP1000 FRS computed from the CSDRS and hard rock high-frequency (HRHF) at each of the six key NI locations in Section 6.0 of Appendix KK. The site-specific FRS are enveloped by the enveloped FRS from the AP1000 CSDRS and HRHF FRS at each of the six key NI locations.

The staff evaluated the response and found that the use of the amplified RG 1.60 spectra scaled to 0.1g addressed the minimum seismic input in accordance with 10 CFR Part 50, Appendix S, and DC/COL-ISG-017. This motion meets the minimum required seismic input and envelopes the site-specific FIRS.

The response to RAI 6432, Question 03.07.01-15, also includes analyses to address a supplemental site evaluation and the impact of grouted rock properties on the results of the SSI analyses. In the initial analysis, the applicant provided soil profiles and time histories used as input for the SSI analysis. The best estimate (BE), lower bound (LB), and the upper bound (UB) NI and FAR soil profiles were developed by propagating rock motions through each set of 60 simulated profiles and computing the response at the foundation elevation horizon.

These rock motions were iteratively modified until the 5-percent damped mean acceleration response spectra (ARS) matched the 5-percent damped site-specific DRS described above SSE.

The applicant stated that the SSI analysis uses the UB, BE, and LB soil profiles (Figures 3JJ-216, -217, and -218 for the NI site conditions and Figures 3JJ-219, -220, and -221 for FAR site conditions) along with the corresponding acceleration time histories applied at the FIRS horizon. The envelope of the surface ARS corresponding to the SSI input spectra to the UB, BE, and LB soil profiles envelop the corresponding DRS: surface (FSAR Appendix KK, Figures 2.1-9 through 2.1-14). Note that the “DRS: surface” is the same as the PBSRS as defined in ISG-017.

The applicant performed supplemental subsurface investigations at the Turkey Point Units 6 and 7 site that resulted in changes to the geotechnical site characterization. The changes resulted in an updated analysis. In the updated analysis, the applicant used a simplified process to update the soil profiles and include the grouted near surface rock layer in the evaluation. The staff review of the response to RAI 6432, Question 03.07.01-15, identified the following questions that were addressed during an audit from June 22 through June 25, 2015.

- The justification of a simplified approach to evaluating the impact of updated soil properties

The staff reviewed calculation results of individual amplification functions from the simplified process that used LB, BE, and UB soil profiles. These individual amplification functions were compared to smoothed functions developed by taking the average of the three soil column results. A consistent process using three similar profiles was performed for the original soil profiles and the updated profiles in order to make an appropriate comparison of differences between responses of the original and updated profiles. Since the original site response

analysis results are based on the average response of 60 profiles, which provide smoother ARS and ARS amplification functions, the results of the sensitivity analysis, using three soil columns, are averaged and smoothed, as shown in Figures 3JJ-251 and 3JJ-252. This process was used to emulate, in a simplified manner, the original analysis approach that considered 60 realizations of the site columns to represent the full range of variation of dynamic soil properties.

Comparison of the individual amplification functions for each soil case between original and updated profiles show similar changes in the individual amplification functions as seen in the mean amplification functions. This comparison demonstrates that the use of the differences between the mean amplification functions adequately captures the expected change in site response that would result from the more rigorous approach of using 60 realizations of the site columns. This review adequately addresses the staff's question.

- The ability of the lean concrete fill to transfer shear on a vertical plane at the toe of the RC foundation

The staff reviewed bearing capacity calculations for the NI at its supporting soil interface and confirmed that the capacity of the 10.7 m (35 ft) thick lean concrete fill resting on underlying rock is adequate to resist bearing demand. The October 29, 2015, response to RAI 7811, Question 02.05.04-26, additionally includes a description of analyses that determine the magnitude of stresses (including tensile) in the lean concrete due to the postulated presence of void space beneath the NI. The maximum size of these hypothesized void spaces is a 20-ft diameter sphere based on the grouting program description in Section 2.5.4.6.2. The analysis of the effect of the hypothesized voids conservatively considers them to be a 20-ft-diameter cylinder with a horizontal orientation that is placed in locations judged to provide the most severe demands on the NI foundation. These analyses demonstrate that stress levels are sufficiently low to prevent collapse of the void space and specified material strengths for the lean concrete are not exceeded. The compressive stress demands under the NI foundation are compared to the ultimate bearing capacity for the fill concrete material placed between the foundation and the top of rock in Table 2.5.4-226 of Letter L-2015-199, Attachment 1. The maximum compressive stresses shown are 77 ksf which is significantly less than the capacity of 184 ksf.

The incorporation of the response to RAI 7811, Question 02.05.04-26 into the FSAR is being tracked as a Confirmatory Item 3.7.1-1 pending the applicant's update of the FSAR.

Resolution of Turkey Point Confirmatory Item 3.7.1-1

Confirmatory Item 3.7.1-1 is an applicant commitment to revise its FSAR Sections 2.5.4.4.5.5, 2.5.4.5.1.2, 2.5.4.6.2, 2.5.4.6.2.1, 2.5.4.10.8, 2.5.4.12, 2.5.4.13, 14.3.3.5 and 14.3.3.6; regarding the ability of the lean concrete fill to transfer shear on a vertical plane at the toe of the RC foundation. The staff verified that the Turkey Point Units 6 and 7 COL FSAR, Revision 8 was appropriately revised. As a result, Confirmatory Item 3.7.1-1 is now closed.

- The staff requested a comparison of the surface motion enveloped response spectrum to the individual site responses computed for the horizontal H1 and H2 motions.

Comparisons of the propagated amplified RG 1.60 motion to the surface, using LB, BE, and UB strain-compatible profiles to the site-specific PBSRS, were provided. Sensitivity analyses were performed that show that the profile, which includes the updated geotechnical information, is very similar to the original BE profile. Additionally, the site response amplification functions compare closely. Based on these observations, the updated profile will not significantly change the computed seismic demands. This response adequately addresses the staff's question.

The staff issued RAI 6432, Question 03.07.01-17, to address the correlation coefficient required by Section 3.7.1 of the SRP for statistically independent time histories. The staff noted the zero-lag cross correlation criterion provided by the applicant did not meet the SRP criteria.

The applicant provided a response, dated July 20, 2012, which states that the time histories are statistically independent based on their correlation values being less than 0.16 as required by the SRP. The applicant updated the FSAR to include Table 3JJ-208 and remove text that incorrectly described the required correlation values. The staff confirmed that these are the appropriate correlation values in accordance with SRP Section 3.7.1.

Further, to determine the adequacy of the selected time histories, the staff issued RAI 4975, Question 03.07.01-13, to gather additional information on the selection of the TAP024 record selected from the Chi-Chi seismic event. The staff noted the applicant statement that seed records were selected from the database given in NUREG/CR-6728 for the LF deaggregation results for magnitudes greater than 7 and distances greater than 500 km. However, the TAP024 record was indicated to be about 100 km from the recording station.

The applicant's response, dated April 2, 2015, states that a lack of empirical strong ground motion time histories in the CEUS significantly limits the availability of candidate time histories for large magnitude earthquakes at large distances. The largest magnitude and distance bin in the NUREG/CR-6728 database is one for events with magnitudes greater than 7 and distances between 100 and 200 km. The candidate time histories were selected from this bin.

The staff evaluated the response to RAI 4975, Question 03.07.01-13, and the applicant provided digitized seed and fit time histories. The staff confirmed that the digitized seed and fit time histories contain sufficient energy over the response frequencies of interest and are therefore acceptable.

A site-specific SSI analysis was performed to compare the Turkey Point site-specific response with the AP1000 generic seismic response. The applicant developed an SSI model to calculate the FRS for the Turkey Point site-specific soil profile and foundation geometry. Three directions of ground motion were considered in developing the site-specific FRS consistent with the approach used in developing the AP1000 FRS. The SSI model incorporated the effects of the lean concrete fill beneath the NI, site soil profiles, and the SSE foundation level response spectra meeting the 0.1g minimum peak ground acceleration. For the SSI analysis of the NI, the BE, LB, and UB soil profiles were considered. The applicant demonstrated that the FRS considering the Turkey Point site-specific soil profiles, foundation geometry, and site-specific ground motion is enveloped by the AP1000 CSDRS FRS at the key AP1000 NI locations.

3.7.1.5 *Post-Combined License Activities*

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

3.7.1.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that, the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR is acceptable and meets the requirements of 10 CFR Part 50, Appendix A, Appendix S, and other staff guidance. The staff based its conclusion on the following:

- PTN SUP 3.7-1 is acceptable because the applicant addressed the relevant information that meets the guidance in Section 3.7.1 of NUREG-0800. In conclusion, the applicant has provided sufficient information for satisfying the applicable requirements of 10 CFR Part 50, Appendix A, GDC 2, Appendix S, and 10 CFR Part 100.23.

3.7.2 Seismic System Analysis

3.7.2.1 *Introduction*

Seismic analysis methods and acceptance criteria for all seismic Category I SSCs are described. It includes a review of basic assumptions, procedures for modeling, seismic analysis methods, development of in-structure response spectrum envelopes, consideration of torsional effects, evaluation of overturning and sliding of seismic Category I structures, and determination of composite damping. The effects of SSI on the seismic responses of the NI structures are included in the review scope because the Turkey Point Units 6 and 7 site has a shear wave velocity less than 8000 ft/s at foundation level. The review also covered design criteria and procedures for evaluating the interaction of NS Category I structures with seismic Category I structures and the effects of parameter variations on FRS.

Specifically, the criteria and methods for the seismic analysis of safety-related SSCs and equipment include the following:

- seismic analysis methods
- natural frequencies and response loads
- procedures used for analytical modeling
- SSI
- development of FRS
- three components of earthquake motion
- combination of modal responses
- interaction of NS Category II structures with seismic Category I SSCs
- effects of parameter variations on FRS

- use of constant vertical static factors
- method used to account for torsional effects
- methods for seismic analysis of dams
- determination of seismic Category I structures overturning moments
- analysis procedure for damping

3.7.2.2 *Summary of Application*

Section 3.7 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.7 of the AP1000 DCD, Revision 19. Section 3.7 of the DCD includes Section 3.7.2.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.7.2, the applicant provided the following:

Supplemental Information

- PTN SUP 3.7-2

The applicant provided supplemental information in PTN SUP 3.7 2 to Section 3.7.2.8.3 in the Turkey Point Units 6 and 7 COL FSAR, which addresses the seismic analyses of the seismic Category II adjacent structures, specifically postulated void conditions underneath the category II and non-seismic structures.

- PTN SUP 3KK-1

The applicant provided supplemental information in PTN SUP 3KK-1 which addresses the site-specific soil-structure interaction analyses that were performed as part of the seismic evaluation to support the information provided in PTN SUP 3.7-1. The supplement also addresses the seismic analyses of the seismic Category I Turkey Point NI and seismic Category II adjacent structures.

AP1000 COL Information Items

- PTN COL 3.7-1

The applicant provided additional information to the end of AP1000 DCD, Section 3.7.2.12 in PTN COL 3.7-1 regarding the existence of dams near the site.

License Condition

- Part 10, License Condition 2, Item 3.7-3

The applicant has proposed a license condition requiring a seismic interaction review for as-built information. This review is performed in parallel with the seismic margin evaluation. The review is based on as-procured data, as well as the as-constructed condition. The as-built seismic interaction review is to be completed prior to fuel load.

- Part 10, License Condition 2, Item 3.7-4

The applicant has proposed a license condition requiring a seismic analysis for detail design changes, such as those due to as-procured or as-built changes in component mass, center of gravity, and support configuration based on as-procured equipment information. The reconciliation of seismic analysis of NI structures will be complete prior to fuel load.

3.7.2.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations for the seismic system analysis are given in Section 3.7.2, Revision 4, of NUREG-0800.

3.7.2.4 *Technical Evaluation*

The NRC staff reviewed Section 3.7 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to seismic system analysis. The results of the NRC staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER for the reference COL application (VEGP, Units 3 and 4) were equally applicable to the Turkey Point Units 6 and 7 COL application, the staff undertook the following reviews:

- The staff compared the VEGP COL FSAR, Revision 5, to the Turkey Point Units 6 and 7 COL FSAR. In performing this comparison, the staff considered changes made to the Turkey Point Units 6 and 7 COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff completed its review and finds the evaluation performed for the standard content to be directly applicable to the Turkey Point Units 6 and 7 COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting.

The staff reviewed the information in the Turkey Point Units 6 and 7 COL FSAR and noted that the AP1000 DCD, (Revision 19), Section 2.5.2.3 addresses the site-specific seismic evaluation

that should be performed by the combined license applicant if the site-specific design response spectra exceed the CSDRS or if site soil conditions are outside the range evaluated for AP1000 DC.

The staff reviewed the following information in the Turkey Point Units 6 and 7 COL FSAR:

- PTN SUP 3.7-2
- PTN SUP 3KK-1

PTN SUP 3KK-1 addresses the site-specific seismic modeling and analysis of the seismic Category I Turkey Point NI and seismic Category II building structures (turbine building first bay and annex building). The purpose of the site-specific analysis is to demonstrate the acceptability of the AP1000 plant at the Turkey Point site. The Turkey Point site-specific analyses use the finite element models of the structures from the AP1000 DCD analyses and change only the soil properties and local model of the soils (including lean concrete fill) surrounding the embedded foundation of the NI.

The acceptability of the AP1000 plant is demonstrated by considering the Turkey Point site-specific soil parameters and comparing FRS and relative displacements between adjacent structures to the FRS and separation gaps specified in the AP1000 certified design.

The staff's review focused on the adequacy of the site conditions used for the seismic analysis. The site-specific seismic analysis for Turkey Point Units 6 and 7 addresses site-specific conditions that, although the site-specific GMRS (located at elevation −35 ft) is less than the CSDRS (located at plant grade, elevation 25.5 ft), have soil parameters that are outside the range evaluated for the AP1000 DC.

The applicant's site-specific SSI analysis of these structures considers the lean concrete fill below the NI, the best estimate, lower bound, and upper bound site soil profiles, and the SSE foundation level response spectra meeting the minimum seismicity requirement of 10 CFR Part 50, Appendix S, and DC/COL-ISG-017. The site-specific SSI analysis also includes the grouted limestone layers beneath the NI. A comparison of the site-specific three-dimensional (3D) SSI analysis results to the AP1000 certified seismic design response spectra FRS shows that the site-specific Turkey Point FRS are enveloped by the FRS from the AP1000 certified design CSDRS.

Two-dimensional (2D) coarse and fine models were created and parametric SSI analyses performed for evaluation of model frequency filtering, model mesh size limitations, and influence of the location of the bottom boundary in the SSI site model. The coarse model is representative of the meshing and layer thicknesses associated with the 3D model and has mesh passing frequencies for the layers that range from about 9 Hz to 474 Hz. This model represents the embedded portion of the 3D model. The fine model mesh passing frequency representing the same embedded portion of the 3D model range from about 49 Hz to 474 Hz. Response spectra ratios (bump factors) are computed using comparisons of the fine to coarse model results to account for potential filtering that occurs in the coarser models. These bump factors, limited to be always greater than or equal to 1.0, are used to scale up the results of the 3D SSI analyses in order to account for potential unconservatism in the computed responses due to the filtering effects caused by the necessary coarseness of the 3D model.

The effect of the postulated presence of 20-ft diameter voids beneath the NI are analyzed to assess their potential impact on the stability of the overlying soils and the structure foundations as described in SER Section 3.7.1. In addition, void spaces are postulated to occur beneath the adjacent Category II structures and evaluated in a similar manner as the voids postulated under the NI. These analyses consider the foundation pressures generated by both static and seismic demands.

The staff reviewed the application and generated several questions (RAI 4975, Questions 03.07.01-1, 03.07.01-11, 03.07.01-6) related to the modeling of the lean concrete fill beneath the NI and the side fill placed above the lean concrete to the sides of the NI.

In RAI 4975, Question 03.07.01-1, the staff requested the applicant explain the adequacy of the assumed uniform site conditions used in the 3D SSI analyses instead of modeling soil properties that reflect the presence of the lean concrete fill and backfill materials placed adjacent to the NI foundation. The staff was concerned about the impact of the supporting concrete/side fill on the computed responses.

The applicant's response to RAI 4975, Question 03.07.01-1, as described in Revision 7 of TPG-1000-SR-802, dated August, 2015, states that the use of uniform site conditions is justified by a comparison of the Turkey Point site-specific FRS responses and the CSDRS FRS envelopes at the six key locations and FRS from a 2D parametric sensitivity analysis of the site-specific geological configuration and backfill condition. The applicant demonstrated that the effects of the lean concrete fill and backfill soil are minimal.

In RAI 4975, Question 03.07.01-11, the staff requested that the applicant address the assumptions used in the FAR and NEAR (NI) soil profiles with respect to the horizontal extent of soils used for SASSI calculations.

The applicant's response to RAI 4975, Question 03.07.01-11, dated October 27, 2010, states that the NEAR (NI) soil profile was included in the SASSI model of the structure and the FAR soil profile was modeled as infinite soil layers that surround the NI structural model.

In RAI 4975, Question 03.07.01-6, the staff requested information on details of the SSI analysis, specifically details on the lean concrete fill and the fill to the side of the NI used in the 2D model of the NI.

As described in Revision 7 of TPG-1000-SR-802, dated August, 2015, the applicant included the lean concrete fill and fill adjacent to the NI embedded structure (backfill) in the model as part of the model of the structure. The applicant provided information on the lean concrete fill and backfill properties in Figures 3.1-2 and 4.3-1 of the report, and information on the soil and backfill material properties is provided in Tables 3-1 and 3-2.

The staff evaluated the responses to RAI 4975, Questions 03.07.01-1, 03.07.01-6, and 03.07.01-11. The staff examined how the 2D models were used to select the input parameters for the 3D SASSI model as described in Revision 7 of TPG-1000-SR-802. The staff found that the descriptions of the modeling assumptions used to develop the 2D models represent the expected site-specific soil conditions. The results of the 2D SSI analysis and corresponding sensitivity studies were useful in identifying important parameters to the SSI response of the structures, such as (1) the effects of using a uniform representation of the side soils while neglecting the presence of the fill materials in the 3D model, (2) coupling of the NEAR (NI) and

FAR soil columns within the 3D representation of the SSI system, (3) filtering effects of the layer passing frequencies and mesh density, and (4) effect of the location of bottom boundary in the SASSI model of the freefield site.

The 2D studies provide justification for neglecting the effects of items (1) and (2) in the 3D SSI modeling. Items (3) and (4) are accommodated by scaling up the 3D results to account for the effects not explicitly considered in the 3D analyses. The staff reviewed the analyses process used by the applicant, including consideration of sensitivity studies using 2D SSI models, to develop site-specific FRS for comparison to the FRS provided in the AP1000 DCD. On the basis of its review, the staff finds that the applicant has adequately demonstrated that the site-specific seismic demands are enveloped by the design demands used in the AP1000 DCD.

The staff issued RAI 6432, Question 03.07.01-16, to address the potential for numerical problems found when using high Poisson's ratios in SSI analysis. The staff noted that the irregular shape of the transfer functions indicated potential numerical problems with the solution.

The applicant provided the results for a series of verification problems using 2D models and demonstrated that the computed SSI responses are not sensitive to Poisson's ratios near the range of Poisson's ratio (0.48) for the set of soil parameters used in the 3D analyses and associated with the Turkey Point Units 6 and 7 site.

Additionally, the staff had concerns about the bearing capacity and the method used to model the lean concrete fill. In RAI 6432, Question 03.07.01-14, the staff asked the applicant to justify whether the lean concrete fill would remain uncracked under dynamic loading. The staff noted that the extension of the lean concrete 9.1 m (30 ft) to the sides of the NI could crack, affecting stiffness and radiation damping in the SSI problem, thereby decreasing SSI frequency and increasing the amplitude of seismic response.

The staff evaluated the response to this RAI and reviewed bearing capacity calculations during an audit June 22–25, 2015. The staff confirms that the bearing capacity of the lean concrete fill resting on grouted underlying rock is adequate to resist bearing demand. Analyses performed in support of RAI 7811, Question 02.05.04-26, determined that the stress levels in the lean concrete fill are acceptably low. A complete discussion of this issue is included in SER Section 3.7.1.

To ensure that the seismic Category II structures will not interact with seismic Category I structures, the applicant also provided relative displacement results in Appendix F to the AP1000 Turkey Point Site Specific Seismic Evaluation Report, Table F.2-1, between the NI and the turbine and annex buildings at the foundation and top of the structures. The applicant calculated displacement results using site-specific 2D NS and EW models. The results show that the maximum relative displacement at the foundation mat between the NI and adjacent structures, enveloping the BE and BE sensitivity cases, was 0.127 cm (0.050 in.). The maximum relative displacement at the top of the structures was 0.442 cm (0.174 in.). These relative displacements are less than the 54-mm (2.0-in.) gap at the foundation and 108 cm (42 in) at the top of the adjacent structures required per the AP1000 DCD.

During the audit, the staff identified an additional concern with the limited grouting under the seismic Category II structures adjacent to the NI. In response to the audit concern, the applicant performed additional analysis, including the seismic Category II structures, which include postulated voids beneath the seismic Category II structures. This analysis is analogous

to that described in SER Section 3.7.1 for determining the stresses in the lean concrete due to postulated voids, except the voids are assumed to be under seismic Category II structures.

The evaluations of displacements of the structures and their responses to postulated void spaces beneath seismic Category II structures demonstrates that the seismic Category II structures will not interact with seismic Category I structures.

The relative displacements described above are developed using the amplified RG 1.60 scaled to 0.1g, as input ground motion at the foundation level for the NI and PBSRS for the adjacent structures. Since the gaps between buildings should accommodate displacements associated with the performance goals for the facility, the staff evaluated the potential for displacements associated with the performance goal level ground motions. This evaluation conservatively scales the displacements shown in Table 6.4-1 of L-2015-085 by the ratio of the 1E-5 GMRS to the 1E-4 GMRS (approximately 2) shown in Figure 2.1-1. The resulting total relative displacements remain significantly less than the provided seismic gaps.

The following portion of this technical evaluation section is reproduced from Section 3.7.2.4 of the VEGP SER:

> *License Conditions*
>
> - *Part 10, License Condition 2, Item 3.7-3*
>
> *The applicant has proposed a license condition requiring a seismic interaction review by the licensee for as-built information. This review is performed in parallel with the seismic margin evaluation. The review is based on as-procured data, as well as the as-constructed condition. The as-built seismic interaction review is to be completed prior to fuel load. The staff has reviewed and approved this review methodology in Section 3.7.5.3 in the AP1000 DCD. Therefore, the staff finds the proposed License Condition 2 acceptable.*
>
> - *Part 10, License Condition 2, Item 3.7-4*
>
> *The applicant has proposed a license condition requiring a seismic analysis for detail design changes, such as those due to as-procured or as-built changes in component mass, center of gravity, and support configuration based on as-procured equipment information. The reconciliation of seismic analysis of NI structures will be performed by the licensee and will be complete prior to fuel load.*
>
> *Conducting the seismic interaction review and the seismic analysis for detail design changes based on as-procured data, as well as the as-constructed condition, does not alter the methods of seismic evaluation required to ensure the as-built design parameters are consistent with the standard design and have been reviewed by the staff as part of STD COL 3.7-4, as well as the information incorporated by reference from the AP1000 DCD. In addition, the NRC staff understands and agrees with the need to have as-procured data and the as-constructed condition in order to properly conduct these analyses.*

3.7.2.5 *Post-Combined License Activities*

The license condition language in this section has been clarified from previously considered language. In a letter dated April 8, 2016 (ADAMS Accession No. ML16103A507), the applicant did not identify any concerns with the clarified license condition language. The changes do not affect the staff's above analysis of the conditions, and therefore, for the reasons discussed in the technical evaluation section above, the staff finds the following license conditions acceptable:

- License Condition (3-2) – Before initial fuel load, the licensee shall update the seismic interaction analysis in AP1000 DCD, Revision 19, Section 3.7.5.3 to reflect as-built information, which must be based on as-procured data, as well as the as-constructed condition.

- License Condition (3-3) – Before initial fuel load, the licensee shall reconcile the seismic analyses described in Section 3.7.2 of the AP1000 DCD, Revision 19, to account for detailed design changes, including, but not limited to, those due to as-procured or as-built changes in component mass, center of gravity, and support configuration based on as-procured equipment information.

3.7.2.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR is acceptable and meets the requirements of 10 CFR Part 50, Appendix A, Appendix S, and other staff guidance. The staff based its conclusion on the following:

- PTN SUP 3.7-1 is acceptable because the applicant addressed the relevant information that meets the guidance in Section 3.7.1 of NUREG-0800. In conclusion, the applicant has provided sufficient information for satisfying 10 CFR Part 50, Appendix A, GDC 2; 10 CFR Part 50, Appendix S; and 10 CFR 100.23.

3.7.3 Seismic Subsystem Analysis

Seismic input motion, seismic analysis methods, and modeling procedure used for the analysis and design of AP1000 SC-I subsystems are described. In particular, this review focused on such subsystems as the miscellaneous steel platforms, steel frame structures, tanks, cable trays and supports, heating, ventilation, and air conditioning (HVAC) ductwork and supports, and conduit and supports.

Specifically, the criteria and methods for the seismic analysis of safety-related SSCs and equipment include the following:

- seismic analysis methods
- determination of number of earthquake cycles
- procedures used for modeling
- basis for selection of frequencies
- equivalent static load method of analysis
- three components of earthquake motion
- combination of modal responses
- analysis procedure for piping
- vertical static factors
- torsional effect of eccentric mass
- seismic Category I buried piping systems and tunnels
- interaction of other systems with seismic Category I systems
- seismic analysis of reactor internals
- analysis procedure for damping
- analysis of seismic Category I tanks
- time history analysis of piping systems

Section 3.7 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.7.3, "Seismic Subsystem Analysis," of Revision 19 of the AP1000 DCD.

In addition, in Turkey Point COL FSAR, Section 3.7 the applicant provided the following:

Departure

- PTN DEP 6.4-2

The applicant provided additional information in Table 3.7.3-1R of the Turkey Point Units 6 and 7 COL FSAR about PTN DEP 6.4-2 related to design changes affecting how the temperature and humidity in the main control room are maintained within the limits for reliable human performance. This information, as well as related PTN DEP 6.4-2 information appearing in other chapters of the FSAR, is reviewed in Section 21.3 of this SER.

The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] On the basis of its review, the staff confirms that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

3.7.4 Seismic Instrumentation

3.7.4.1 *Introduction*

Installation of instrumentation that is capable of adequately measuring the effects of an earthquake at the plant site is addressed. The criteria for the seismic instrumentation include the following:

- comparison with RG 1.12, "Nuclear Power Plant Instrumentation for Earthquakes," Revision 2

- location and description of instrumentation
- control room operator notification
- comparison of measured and predicted responses
- tests and inspections

3.7.4.2 *Summary of Application*

Section 3.7 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.7 of the AP1000 DCD, Revision 19. Section 3.7 of the DCD includes Section 3.7.4.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.7.4, the applicant provided the following:

AP1000 COL Information Items

- STD COL 3.7-2 and PTN COL 3.7-2

The applicant provided additional information in STD COL 3.7-2 and PTN COL 3.7-2 in Section 3.7.4.4 to resolve COL Information Item 3.7-2 (COL Action Item 3.7.5-2) on post-earthquake procedures to compare measured and predicted ground motions. In PTN COL 3.7-2, the applicant also stated that post-earthquake operating procedures utilize the guidance of Electric Power Research Institute (EPRI) Reports NP-5930, "A Criterion for Determining Exceedance of the Operating Basis Earthquake"; TR-100082, "Standardization of the Cumulative Absolute Velocity"; and NP-6695, "Guidelines for Nuclear Plant Response to an Earthquake"; as modified and endorsed by the NRC in RG 1.166, "Pre-Earthquake Planning and Immediate Nuclear Power Plant Operator Postearthquake Actions," and RG 1.167, "Restart of a Nuclear Power Plant Shut Down by a Seismic Event." A response spectrum checkup to 10 Hz will be based on the foundation instrument. The cumulative absolute velocity (CAV) will be calculated based on the recorded motions at the freefield instrument. If the OBE ground motion is exceeded or significant plant damage occurs, the plant must be shut down in an orderly manner.

In STD COL 3.7-2, the applicant stated that the procedures address measurement of the post-seismic event gaps between the new fuel rack and walls of the new fuel storage pit, between the individual spent fuel racks, and from the spent fuel racks to the spent fuel pool walls.

- STD COL 3.7-5

The applicant provided additional information in STD COL 3.7-5 in Section 3.7.4.2.1 to resolve COL Information Item 3.7-5 (COL Action Item 3.7.5-4) on freefield triaxial acceleration sensors. In STD COL 3.7-5, the applicant stated that a freefield sensor will be located and installed to record the ground surface motion representative of the site. It will be located such that the effects associated with surface features, buildings, and components on the recorded ground motion will be insignificant.

Supplemental Information

- STD SUP 3.7-1

The applicant provided supplemental information in Turkey Point Units 6 and 7 COL FSAR, Section 3.7.4.1 to address the guidance in RG 1.12 by stating that administrative procedures define the maintenance and repair of the seismic instrumentation to keep the maximum number of instruments inservice during plant operation and shutdown.

- STD SUP 3.7-2

The applicant provided supplemental information in Turkey Point Units 6 and 7 COL FSAR, Section 3.7.4.5 to address the test and inspection requirements for the acceleration sensors. In this section, the applicant stated that installation and acceptance testing of the triaxial acceleration sensors described in AP1000 DCD, Section 3.7.4.2.1 is completed prior to initial startup. Installation and acceptance testing of the time-history analyzer described in AP1000 DCD, Section 3.7.4.2.2 is completed prior to initial startup.

Interface Requirements

AP1000 DCD, Table 1.8-1, Items 3.3 and 3.12, refer to interfaces associated with DCD Section 3.7.4. The interface requirements for NRC review (associated with DCD Section 3.7.4.2) include an onsite implementation of the site seismic sensor locations and trigger values, and development of procedures by the COL applicant for earthquake responses from the seismic instrumentation.

3.7.4.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations for seismic instrumentation are given in Section 3.7.4, Revision 3, of NUREG-0800.

The regulatory guidance documents for STD COL 3.7-2, PTN COL 3.7-2, and STD COL 3.7-5 are RG 1.166, RG 1.167, RG 1.12, and Appendix S to 10 CFR Part 50 that provide for installation of freefield triaxial acceleration sensors and establishment of post-earthquake procedures to compare measured and predicted responses.

3.7.4.4 *Technical Evaluation*

The NRC staff reviewed Section 3.7.4 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information related to seismic instrumentation. The results of the NRC

staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER for the reference COL application (VEGP, Units 3 and 4) were equally applicable to the Turkey Point Units 6 and 7 COL application, the staff undertook the following reviews:

- The staff compared the VEGP COL FSAR, Revision 5, to the Turkey Point Units 6 and 7 COL FSAR. In performing this comparison, the staff considered changes made to the Turkey Point Units 6 and 7 COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff completed its review and finds the evaluation performed for the standard content to be directly applicable to the Turkey Point Units 6 and 7 COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting.

The staff compared STD COL 3.7-2, PTN COL 3.7-2, and STD COL 3.7-5 in the Turkey Point Units 6 and 7 COL FSAR to STD COL 3.7-2, VEGP COL 3.7-2, and VEGP COL 3.7-5 in the VEGP COL FSAR, respectively. The staff concludes that the information added to the applications for these COL items is sufficiently similar so that the evaluations performed in VEGP SER Section 3.7.4 for VEGP COL 3.7-2 and VEGP COL 3.7-5 are directly applicable to STD COL 3.7-2 and STD COL 3.7-5, respectively. The one notable difference between the VEGP and Turkey Point Units 6 and 7 applications for these COL items is the specification in VEGP COL 3.7-5 that the freefield sensor is located on the ground surface of the engineering backfill. In the Turkey Point Units 6 and 7 COL FSAR, the exact location of the triaxial ground surface acceleration freefield sensor is not specified, but will be installed using NRC-approved methodology and will use the same trigger value. The staff concludes that this minor difference does not negatively affect the conclusions reached previously by the staff.

The following portion of this technical evaluation section is reproduced from Section 3.7.4.4 of the VEGP SER:

AP1000 COL Information Items

- *STD COL 3.7-2*

  As a result of the review in Sections 9.1.1.2 and 9.1.2.2 of the AP1000 DCD, STD COL 3.7-2 in Section 3.7.4.4 of the VEGP COL FSAR was identified to clarify the measurement of the post-seismic event gaps between the new fuel rack and walls of the new fuel storage pit, between the individual spent fuel racks, and from the spent fuel racks to the spent fuel pool wall. In a letter dated October 15, 2010, the applicant committed to specify the site-specific procedures, following the guidance of EPRI Reports NP-5930, TR-10082, and NP-6695, for: 1) checking the gaps between the new fuel rack and walls of the new fuel storage pit, between the individual spent fuel racks, and from the spent fuel racks to the spent fuel pool walls following an earthquake; and 2) to take, if needed, appropriate corrective actions in the event of an earthquake such as repositioning the racks or analysis of the as-found condition. The staff considered the applicant response to be acceptable based on the applicant's commitment to use the post-earthquake procedures described in Section 3.7.5.2 of the AP1000 DCD, which comply with the requirements of Appendix S to 10 CFR Part 50. Therefore, the NRC staff considers STD COL 3.7-2 to be resolved. The incorporation of the planned VEGP COL FSAR changes will be tracked as ***Confirmatory Item 3.7-2****.*

  Resolution of Standard Content Confirmatory Item 3.7-2

  Confirmatory Item 3.7-2 is an applicant commitment to revise its FSAR to adjust the left margin annotations related to STD COL 3.7-2. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.7-2 is now closed.

- *VEGP COL 3.7-2*

  The NRC staff reviewed VEGP COL 3.7-2 related to COL Information Item 3.7-2 (COL Action Item 3.7.5-2) included under Section 3.7.4.4 of the VEGP COL FSAR.

  The applicant provided additional information in VEGP COL 3.7-2 to resolve COL Information Item 3.7-2. COL Information Item 3.7-2 states:

  > *Combined License applicants referencing the AP1000 certified design will prepare site-specific procedures for activities following an earthquake. These procedures will be used to accurately determine both the response spectrum and the cumulative absolute velocity of the recorded earthquake ground motion from the seismic instrumentation system. The procedures and the data from the seismic instrumentation system will provide sufficient information to guide the operator on a timely basis to determine if the level of earthquake ground motion requiring shutdown has been exceeded. The procedures will follow the guidance of EPRI*

> *Reports NP-5930, TR-100082, and NP-6695, as modified by the NRC staff.*

The commitment was also captured as COL Action Item 3.7.5-2 in Appendix F of NUREG-1793, which states:

> *The COL applicant will specify site-specific procedures for activities following an earthquake and those procedures will follow the guidance of Reports NP-5930, TR-100082, and NP-6695 promulgated by the Electric Power Research Institute (EPRI).*

In VEGP COL 3.7-2, the applicant stated the following:

> *Post-earthquake operating procedures utilize the guidance of EPRI Reports NP-5930, TR-100082, and NP-6695, as modified and endorsed by the NRC in Regulatory Guides 1.166 and 1.167. A response spectrum check up to 10Hz will be based on the foundation instrument. The cumulative absolute velocity will be calculated based on the recorded motions at the free field instrument. If the operating basis earthquake ground motion is exceeded or significant plant damage occurs, the plant must be shutdown in an orderly manner.*

The NRC staff reviewed the resolution to VEGP COL 3.7-2 related to comparison of measured and predicted seismic responses included under Section 3.7.4.4 of the VEGP COL FSAR. The applicant committed to specify site-specific procedures, which follow the guidance of EPRI Reports NP-5930, TR-10082, and NP-6695, for activities following an earthquake, which were endorsed by RGs 1.166 and 1.167. In RAI 3.7.4-1, issued to the BLN applicant, the staff asked the applicant to clarify if CAV will be used as one of the criteria to determine if a power plant should be shutdown should the OBE ground motion be exceeded or significant plant damage occurs. The BLN applicant responded by stating "As indicated in FSAR Subsection 3.7.4.4, use of the guidance of Regulatory Guide 1.166 and NP-5930 signifies that CAV is to be used as one of the post-earthquake criteria for determining whether the plant should be shutdown. In addition, BLN COL FSAR Appendix 1AA indicates conformance to the guidance of Regulatory Guide 1.166." The staff considered the applicant's response to be adequate because the BLN applicant confirmed that it will use the recommended criteria from the RG 1.166 to determine a potential plant shutdown, and the staff concludes that this RAI is closed. Furthermore, the BLN response to RAI 3.7.4-4 was endorsed as standard for VEGP by SNC letter dated December 17, 2008.

Based on the VEPG applicant's commitment to use the procedures accepted by NRC for post-earthquake activities and the clarification on the use of CAV in RAI 3.7.4-1, the NRC staff concludes that the applicant provided adequate information regarding the post earthquake activities and procedures to determine if a power plant needs to be shutdown and considers VEGP COL 3.7-2 resolved.

- *VEGP COL 3.7-5*

The applicant provided additional information in VEGP COL 3.7-5 to resolve COL Information Item 3.7-5 (COL Action Item 3.7.5-4) included under Section 3.7.4.2.1 of the VEGP COL FSAR. COL Information Item 3.7-5 states:

> *The Combined License applicant will determine the location for the free-field acceleration sensor as described in [DCD] Subsection 3.7.4.2.1.*

The commitment was also captured as COL Action Item 3.7.5-4 in Appendix F of NUREG-1793, which states:

> *The COL applicant will determine the location for the free-field acceleration sensor.*

In VEGP COL 3.7-5, the applicant stated the following:

> *A free-field sensor will be located and installed to record the ground surface motion representative of the site. To be representative of this site in regards to seismic response of structures, systems, and components, the free-field sensor is located on the ground surface of the engineered backfill. The backfill directly supports the Nuclear Island and the adjacent structures and extends out from these structures a significant distance. The free field sensor is located where the backfill vertically extends from the top of the Blue Bluff Marl to the ground surface, but horizontally at a distance where possible effects on recorded ground motion associated with surface features, buildings, and components would be minimized. The trigger value is initially set at 0.01g.*

The NRC staff reviewed the resolution to VEGP COL 3.7-5 related to triaxial acceleration sensors included under Section 3.7.4.2.1 of the VEGP COL FSAR. The applicant used the guidance in RGs 1.166 and 1.167 and supplemented information in the DCD with appropriate content, as required by Appendix S to 10 CFR Part 50. The applicant also committed to determining the location of the free field acceleration sensor and installing the sensor in a protected area. Based on the applicant's commitment to determine the location of the free-field acceleration sensor and the description of the location provided in STD COL 3.7-5, the staff concludes that the applicant presented sufficient information on the description and locations of field triaxial acceleration sensors and considers VEGP COL 3.7-5 resolved.

Supplemental information

- *STD SUP 3.7-1*

The applicant added the following supplemental information at the end of VEGP COL FSAR Section 3.7.4.1 to address RG 1.12:

> *Administrative procedures define the maintenance and repair of the seismic instrumentation to keep the maximum number of instruments inservice during plant operation and shutdown in accordance with Regulatory Guide 1.12.*

The NRC staff reviewed the resolution to STD SUP 3.7-1 using the guidance in RG 1.12 and in Appendix S to 10 CFR Part 50. Because of the equivalence of the applicant's proposed resolution to the administrative procedures, maintenance and repair plans of RG 1.12, the staff concludes the applicant has adequately resolved STD SUP 3.7-1.

- *STD SUP 3.7-2*

The applicant added the following supplemental information at the end of VEGP COL FSAR Section 3.7.4.4 to address comparison of measured and predicted responses:

> *Installation and acceptance testing of the triaxial acceleration sensors described in DCD Subsection 3.7.4.2.1 is completed prior to initial startup. Installation and acceptance testing of the time-history analyzer described in DCD Subsection 3.7.4.2.2 is completed prior to initial startup.*

The NRC staff reviewed the resolution to STD SUP 3.7-2, related to the timing of installation and acceptance testing of the triaxial acceleration sensors described in DCD Section 3.7.4.2.1 for the VEGP site. Because of the equivalence of the proposed resolution of STD SUP 3.7-2 to the general operability guidance for seismic equipment addressed in RG 1.12, RG 1.166 and RG 1.167, the staff concludes the applicant adequately resolved STD SUP 3.7-2.

3.7.4.5 *Post-Combined License Activities*

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

3.7.4.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. On the basis of its review, the staff confirms that the applicant has addressed the required information relating to seismic instrumentation, and there is no outstanding information expected to be addressed in the Turkey Point Units 6 and 7 COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL application is acceptable and meets the requirements of Appendix S to 10 CFR Part 50 and complies with the guidance provided in RGs 1.166, 1.167, and 1.12. The staff based its conclusions on the following:

- STD COL 3.7-2 and PTN COL 3.7-2 are acceptable because the applicant is committed to use the procedures endorsed by RGs 1.166 and 1.167 and because the applicant has provided sufficient information for satisfying the requirements of Appendix S to 10 CFR Part 50 by committing to address the measurement of the post-seismic event gaps between the new fuel rack and walls of the fuel storage pit and to take appropriate corrective actions.

- STD COL 3.7-5 is acceptable because the applicant has provided sufficient information for satisfying the requirement of Appendix S to 10 CFR Part 50 by committing to determining the location of the freefield acceleration sensor and installing the sensor in the protected area.

- STD SUP 3.7-1 is acceptable because the applicant is committed to follow RG 1.12, to include developing administrative procedures to define the maintenance and repairing of the seismic instrumentation in order to keep the maximum number of instruments inservice during plant operation and shutdown.

- STD SUP 3.7-2 is acceptable because the applicant has provided sufficient information for satisfying the requirement of Appendix S to 10 CFR Part 50 by committing to complete installation and acceptance testing of the seismic instrumentation prior to initial startup.

3.8 Design Of Category I Structures

3.8.1 Concrete Containment

This section is not applicable to the Turkey Point Units 6 and 7 design, because AP1000 uses a steel containment.

3.8.2 Steel Containment

The steel containment in the AP1000 DCD provides the following information:

- description of the containment
- applicable codes, standard, and specifications
- loads and load combinations
- design and analysis procedures
- structural acceptance criteria
- materials, quality control, and special construction techniques
- in-service testing (IST) and inspection requirements

Section 3.8.2 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.8.2, “Steel Containment,” of Revision 19 of the AP1000 DCD.

In addition, in the Turkey Point Units 6 and 7 COL FSAR, the applicant provided the following:

Departures

- PTN DEP 6.3-1 and PTN DEP 3.2-1

The applicant provided additional information about PTN DEP 6.3-1 and PTN DEP 3.2-1 in Section 3.8.2 of the FSAR related to design modifications to the condensate return portion of the Passive Core Cooling System and quantifying the duration that the passive residual heat removal heat exchanger can maintain safe shutdown conditions, respectively. This information, as well as related PTN DEP 3.2-1 and PTN DEP 6.3-1 information appearing in other chapters of the FSAR, is reviewed in Section 21.1 of this report.

The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements. Section 21.1 of this report evaluates the departures from the DCD provided in PTN DEP 6.3-1 and PTN DEP 3.2-1.

3.8.3 Concrete and Steel Internal Structures of Steel or Concrete Containment

3.8.3.1 *Introduction*

Structures inside the containment are not part of the containment pressure boundary. They support the reactor coolant system components and related piping systems and equipment inside the containment. They also provide radiation shielding. The containment internal structures consist of the primary shield wall, reactor cavity, secondary shield walls, in-containment refueling water storage tank, refueling cavity walls, operating floor, intermediate floors, and various platforms.

The containment internal structures are constructed by reinforced concrete and structural steel. At the lower elevations, conventional concrete and reinforcing steel are used, except that permanent steel forms are used in some areas in lieu of removable forms based on constructability considerations. These steel form modules (liners) consist of steel plates reinforced with steel angle stiffeners and tee sections. The angles and the tee sections are on the concrete side of the plate. Welded studs, or similar embedded steel elements, are attached to the back of the permanent steel form where surface attachments to the plate transfer loads into the concrete. Where these surface attachments are seismic Category I, the portion of the steel form module transferring the load into the concrete is classified as seismic Category I.

3.8.3.2 *Summary of Application*

Section 3.8 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.8 of the AP1000 DCD, Revision 19. Section 3.8 of the DCD includes Section 3.8.3.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.8.3, the applicant provided the following:

AP1000 COL Information Items

- STD COL 3.8-5

The applicant provided additional information related to in-service testing and inspection requirements. This information is reviewed in Section 3.8.5 of this SER.

The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] The NRC staff's review confirmed that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

3.8.4 Other Seismic Category I Structures

3.8.4.1 *Introduction*

The AP1000 DCD defines other seismic Category I structures as the shield building, the auxiliary building, the containment air baffle, Category I cable tray supports, and Category I HVAC supports.

The criteria for other Category I structures include the following:

- description of the structures
- applicable codes, standards, and specifications
- loads and load combinations
- design and analysis procedures
- structural acceptance criteria
- materials, quality control, and special construction techniques
- IST and inspection requirements
- construction inspection

3.8.4.2 *Summary of Application*

Section 3.8 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.8 of the AP1000 DCD, Revision 19. Section 3.8 of the DCD includes Section 3.8.4.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.8.4, the applicant provided the following:

AP1000 COL Information Items

- STD COL 3.8-5

The applicant provided additional information related to testing and in-service inspection requirements. This information is reviewed in Section 3.8.5 of this SER.

3.8.5 Foundations

3.8.5.1 *Introduction*

The foundation for the NI structures consists of the containment building, the shield building, and the auxiliary building, on a common 6-ft-thick, cast-in-place, reinforced, concrete basemat foundation.

Adjoining buildings, such as the radwaste building, turbine building, and annex building are structurally separated from the NI structures by a 2-in. gap at and below the grade. A 4-in. minimum gap is provided above grade. This provides space to prevent interaction between the NI structures and the adjacent structures during a seismic event.

This provides the required factor of safety (FS) against lateral movement under the most stringent loading conditions.

The criteria for the design of foundations include the following:

- description of the foundations
- applicable codes, standards, and specifications
- loads and load combinations
- design and analysis procedures
- standard acceptance criteria
- materials, quality control, and special construction techniques
- IST and inspection requirements
- construction inspection

3.8.5.2 *Summary of Application*

Section 3.8 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.8 of the AP1000 DCD, Revision 19. Section 3.8 of the DCD includes Section 3.8.5.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.8.5, the applicant provided the following:

Supplemental Information

- PTN SUP 3.8-1

The applicant provided supplemental information by adding additional text that states that the depth of overburden and depth of embedment are given in Section 2.5.4.

- PTN COL 2.5-7
- PTN COL 2.5-13

The applicant provided information in PTN COL 2.5-7and PTN COL 2.5-13 addressing the specifications and control of the materials beneath the NI foundation for Turkey Point Units 6 and 7.

- PTN COL 2.5-10

The applicant provided information in PTN COL 2.5-10 addressing the static stability and bearing capacity of the foundation for Turkey Point Units 6 and 7.

- PTN COL 2.5-12
- PTN COL 2.5-16

The applicant provided information in PTN COL 2.5-12 and PTN COL 2.5-16 addressing the settlements of the NI for Turkey Point Units 6 and 7.

AP1000 COL Information Items

- PTN COL 2.5-17

The applicant provided information addressing the type of waterproofing system to be used for the below-grade exterior walls exposed to flood and to groundwater under the seismic Category I structures.

- STD COL 3.8-5

The applicant incorporated the material proposed in the August 17, 2010, letter from the VEGP applicant that proposed STD COL 3.8-5, adding new Sections 3.8.3.7, 3.8.4.7, and 3.8.5.7 to the FSAR. The applicant provided information in STD COL 3.8-5, addressing the construction inspection program related to seismic Category I and II structures.

- STD COL 3.8-6

In Turkey Point Units 6 and 7, the applicant incorporated the October 1, 2010, letter from the VEGP applicant that proposed STD COL 3.8-6, adding a new Section 3.8.6.6 to the FSAR. The applicant provided information in STD COL 3.8-6, addressing the construction procedure program related to safety-related Category I structures.

License Condition

- Part 10, License Condition 6

In its letter dated April 20, 2011 the applicant endorsed the October 1, 2010, letter from the VEGP applicant that proposed to add another line item to proposed License Condition 6, addressing the availability to NRC inspectors of the schedule for the implementation of construction and inspection procedures related to concrete activities.

ITAAC

In Appendix B to Part 10 of the Turkey Point Units 6 and 7 COL application, the applicant proposed ITAAC requiring that the mudmat-waterproofing-mudmat interface beneath the NI basemat have a coefficient of friction to resist sliding of greater than or equal to 0.55.

3.8.5.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations (GDC 1, GDC 2, GDC 4, and GDC 5, "Sharing of Structures, Systems, and Components," of Appendix A to 10 CFR Part 50; 10 CFR 50.55a; and Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50) for the foundations are given in Section 3.8.5, Revision 4, of NUREG-0800.

3.8.5.4 *Technical Evaluation*

The NRC staff reviewed Section 3.8.5 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to foundations. The results of the NRC staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER for the reference COL application (VEGP, Units 3 and 4) were equally applicable to the Turkey Point Units 6 and 7 COL application, the staff undertook the following reviews:

- The staff compared the VEGP COL FSAR, Revision 5, to the Turkey Point Units 6 and 7 COL FSAR. In performing this comparison, the staff considered changes made to the Turkey Point Units 6 and 7 COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff completed its review and finds the evaluation performed for the standard content to be directly applicable to the Turkey Point Units 6 and 7 COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting.

The staff reviewed the following information in the Turkey Point Units 6 and 7 COL FSAR:

Supplemental Information

- PTN SUP 3.8-1

In Turkey Point Units 6 and 7 COL FSAR, Section 3.8.5.1, "Description of the Foundations," the applicant cited Subsection 2.5.4, "Stability of Subsurface Materials and Foundations," which describes the depth of overburden and embedment of the Turkey Point Units 6 and 7 foundation. A foundation is a structural element that connects the superstructure and the supporting medium, such as soils or rocks. The purpose of the foundation is to hold the superstructure in place and to transmit all the loads from the superstructure to the underlying soils or rocks. The NI foundation basemat will be supported by lean concrete, unreinforced concrete with a lower ratio of cement to aggregate than structural concrete, which is underlain by continuous rock stratum—Key Largo Limestone. The lean concrete will be placed from elevation −35 ft North American Vertical Datum of 1988 (NAVD 88) to elevation −16 ft NAVD 88 resulting in an approximately19-ft-thick concrete subbasemat.

- PTN COL 2.5-7
- PTN COL 2.5-13

Section 2.5.4.5.1.2, "Power Block and Site Grade Raising," of the FSAR provides a description of the methods and procedures used for the verification and quality control of the fill concrete that will be used to bring the subgrade elevation up to the NI foundation elevation within the foundation support zone of the NI for the Turkey Point Units 6 and 7. The applicant intends to use lean concrete fill, with a compressive strength of 1,500 psi, rather than soil fill. The applicant stated that concrete fill provides a uniform base with well-defined material properties. The applicant analyzed and modeled the concrete fill for the Turkey Point Units 6 and 7 site using the concrete compressive strength of 1,500 psi for static and dynamic loads and concluded that the concrete fill with a compressive strength of 1,500 psi is adequate for the Turkey Point Units 6 and 7 site. The methods and procedures used for the verification and quality control of the fill concrete are further discussed in Section 2.5.4 of this SER.

In the review of the standard supplemental information in Turkey Point Units 6 and 7 COL FSAR, Section 2.5.4, the staff determined that the applicant did not provide sufficient information for the site characteristics of the fill concrete that will be used to bring the subgrade elevation up to the NI foundation elevation. In RAI 4975, Question 03.07.01-3, the applicant was requested to address the potential for cracking of the lean concrete to be placed beneath the NI.

In the applicant's revised response to RAI 4975, Question 03.07.01-3, dated December 11, 2014, the applicant stated that a thermal control plan will be developed during detailed design to minimize thermal cracking of the concrete fill. The applicant indicated that the thermal control plan will follow the guidance prescribed in American Concrete Institute (ACI) 207.1R, "Guide to Mass Concrete." The applicant further stated that the required activities for reducing thermal cracking of the lean concrete will include controls on cementitious material content, precooling of aggregates and mixing water, and construction scheduling and procedures. A thermal control plan considering the geometry of Turkey Point Units 6 and 7 fill concrete with a compressive strength of 1,500 psi, total volume of the fill concrete placement,

and rate of concrete production, will be prepared to make sure that the recommended temperature limit will not be exceeded.

The staff reviewed the applicant's response and noted that the applicant is committed to using the guidance in ACI 207.1R for reducing the risk of cracking of the concrete fill beneath the NI. The staff finds the applicant's response to RAI 4975, Question 03.07.01-3, to be acceptable because the applicant has demonstrated through a thermal control plan that the risk of cracking the concrete fill beneath the NI is minimal. As such, RAI 4975, Question 03.07.01-3, is resolved.

As stated above, the applicant provided a description of a thermal control plan for reducing thermal cracking of the lean concrete fill beneath the NI but did not describe the design and construction approach (i.e., quality control of backfill materials, fill-concrete mix design, field observations, procurement of test specimens, and operation of a quality-control sampling and testing program) for the lean concrete fill to attain the required fill mechanical properties. In RAI 7815, Question 03.08.05-3, the staff requested the applicant to describe in sufficient detail the design and construction approaches of the lean concrete fill in Section 2.5.4.1.2 of the FSAR.

In the applicant response to RAI 7815, Question 03.08.05-3, dated April 19, 2015, the applicant stated that the mechanical properties of the lean concrete fill will be consistent with the properties used for the design analyses and the mechanical properties will be achieved by selecting an appropriate mix design, performing verification testing during construction, and following industry guidance for construction and placement methods. The selection of the lean concrete mix design will be made at the detailed design stage of the project. Section 2.5.4.4.5, "Geophysical Exploration for Possible Dissolution Features," of this SER further discusses the concrete mix design and the design and construction of the concrete fill.

Construction and testing of the lean concrete will follow the guidance in ACI 207.1R. Testing of materials and lean concrete fill during construction will verify that the as-placed concrete properties are consistent with the properties established during the mix design. At a minimum, the construction verification and testing includes: verification of manufacturer's certifications for cementitious materials; aggregate testing for gradation, moisture content, and specific gravity; fresh concrete testing of slump and placement temperature; and hardened concrete testing of compressive strength. The lean concrete will be batched onsite and placed in a series of successive layers and lifts. The layer thickness is determined prior to construction based on the maximum aggregate size of concrete mix.

Concrete consolidation is achieved for each layer by internal vibration from driven vibrators. To ensure proper consolidation, the vibrators will penetrate the lower layer for approximately 2 to 4 in. and are maintained in a nearly vertical position at each penetration during vibration. The horizontal lift joint surface will be prepared between lifts to ensure bond between joints. Before placement of the next lift, surface film and contamination will be removed to expose fresh, clean mortar, and aggregate surface by means of sandblasting or high-pressure water jet. The lean concrete will be water-cured between lift placements.

The staff reviewed the applicant response to RAI 7815, Question 03.08.05-3, and concludes that the applicant's design and construction approaches of the lean concrete are acceptable because they are consistent with industry practices. The applicant is committed to using industry practices by selecting an appropriate mix design, performing verification testing during

construction, and following industry guidance for construction and placement methods for the design of the concrete fill. The staff verified that the Turkey Point Units 6 and 7 COL FSAR was appropriately revised to address the design and construction of the lean concrete beneath the NI.

- PTN COL 2.5-10

Section 2.5.4.10 provides a description of the static and dynamic bearing capacity of the NI foundation. The applicant provided information that describes the static and dynamic capacities of the foundation materials (fill concrete, granular fill, etc.), the basis for the capacities, and a comparison to the relevant AP1000 DCD site parameters for "Rock; Rock and Soil; and Soil" in Turkey Point Units 6 and 7 FSAR, Table 2.5.4-217, "Summary of Bearing Capacity."

Table 2.5.4-217 shows the computed results of the allowable static and dynamic bearing capacities for Turkey Point Units 6 and 7 of the Turkey Point NI structures. In the case of static bearing capacity, a minimum FS of 3 is used to evaluate the allowable static bearing capacity of the NI structures. The computed allowable static bearing capacity of 39 kips per square foot (ksf) exceeds the average bearing demand of 8.9 ksf over the footprint of the NI at its excavation depth. For the dynamic bearing capacity calculation, an FS of 2 is applied against the design load combination, which includes the normal loads plus the SSE load for evaluating the required allowable dynamic bearing capacity of the Turkey Point Units 6 and 7 NI structures. The applicant stated that, because the AP1000 certified seismic design response spectra has a peak ground acceleration of 0.3g, which is much higher than anticipated at the Turkey Point Units 6 and 7 site (0.1g), the required dynamic bearing capacity in the AP1000 DCD is greater than the maximum dynamic loading that would be experienced at the Turkey Point Units 6 and 7 site. The site-specific computed allowable dynamic bearing capacity of 41 kips exceeds the maximum bearing demand of 35 ksf.

The staff reviewed the applicant's description of the bearing demands on the Turkey Point Units 6 and 7 NI structures' foundation and finds PTN COL 2.5-10 to be acceptable because the applicant has demonstrated that (1) the site-specific bearing demands are bounded by the limit in the AP1000 DCD and (2) the foundation for the Turkey Point Units 6 and 7 NI is capable of withstanding the bearing demand from the AP1000 NI.

- PTN COL 2.5-12
- PTN COL 2.5-16

Section 2.5.4.10.3 of the FSAR provides a description of the post-construction settlement results for Turkey Point Units 6 and 7. The results indicate that the Turkey Point Units 6 and 7 NI structures are founded on rock of the Key Largo Limestone and fill concrete which does not incur sufficient settlement to impact the safety function of the structures. The settlement analyses consist of a hand calculation that uses stress distributions appropriate for layered systems as well as a three-dimensional finite element computer model, PLAXIS 3D Foundation (PLAXIS 3D). The settlement of the Turkey Point Units 6 and 7 NI structures founded on rock or fill concrete is calculated to be less than 0.3 in. Table 2.5.4-224, "Comparison of Limits of Acceptable Settlement without Additional Evaluation," shows that the maximum estimated differential settlement for the NI foundation is 0.26 in. (0.26 in. for the lower bound hand calculation, 0.23 in. for the LB PLAXIS 3D calculation, 0.22 in. for the best estimate hand

calculation, and 0.20 in. for the BE PLAXIS 3D calculation), which is less than the AP1000 DCD's allowable settlement of 0.5 in.

For the adjacent seismic Category II structures, the results indicate that the mat foundation will settle less than 2.8 in. (2.7 in. for the lower bound hand calculation, 2.2 in. for the LB PLAXIS 3D calculation, 2.0 in. for the best estimate hand calculation, and 1.6 in. for the BE PLAXIS 3D calculation), which is less than the criterion of 3-in. differential settlement relative to the settlement of the NI established in the DCD. DCD Table 2.5-1, "Limits of Acceptable Settlement without Additional Evaluation," provides guidance to the COL on predictions of absolute and differential settlement that are acceptable without further evaluation.

The staff reviewed the information in Section 2.5.4.10.3 of the FSAR and concludes that the amount of post-construction differential and absolute settlement for the seismic Categories I and II structures described in Section 2.5.4.10.3 of the FSAR is bounded by the acceptable values stated in the DCD and therefore acceptable. As such, the staff considers PTN COL 2.5-12 and PTN COL 2.5-16 to be acceptable.

AP1000 COL Information Items

- PTN COL 2.5-17

SRP Section 3.8.5 requires confirmation that the NI remains stable under design-basis demands. AP1000 DCD, Section 3.4.1.1.1.1, "Waterproofing," states that (1) the waterproof membrane between the mudmat must provide adequate shear strength to transfer horizontal shear caused by seismic loading and (2) the function of the membrane is seismic Category I. In this regard, Section 3.4.1.1.1 of the AP1000 DCD provides a requirement for the COL applicant to identify a waterproofing system and to demonstrate a friction coefficient greater than or equal to 0.55 with all horizontal concrete surfaces.

The staff reviewed Section 14.3.3.4, "Waterproofing Membrane ITAAC," of the FSAR, and noticed that the applicant provided a brief description of the waterproofing membrane ITAAC. The applicant stated, "Site-specific ITAAC for the waterproof membrane will be developed to verify by testing that the mudmat-waterproofing-mudmat interface beneath the NI basemat has a minimum coefficient of friction [COF] to resist sliding of 0.55." To ensure that the COF of 0.55 is met, the staff issued RAI 7815, Question 03.08.05-04, requesting the applicant provide in Appendix B to Part 10 of the FSAR an ITAAC table that describes the design commitment; the inspection, testing, or analyses to be performed; and the as-built design criteria of the waterproofing membrane.

In its response to RAI 7815, Question 03.08.05-04, dated April 16, 2015, the applicant stated that the chosen mudmat waterproofing system, a sheet-type high density polyethylene, for the Turkey Point nuclear station is one of the acceptable alternatives described in Subsection 3.4.1.1.1.1 of the AP1000 DCD and will be demonstrated to produce a friction coefficient of 0.55 or greater with the mudmat's horizontal concrete surface.

The staff reviewed the applicant's response to RAI 7815, Question 03.08.05-04, and finds the response to be acceptable because the applicant is committed to (1) use one of the three waterproofing membrane systems identified in the standard AP1000 design and (2) demonstrate that the waterproofing membrane meets the waterproofing and friction

requirements of greater than or equal to 0.55 as specified in Section 3.4.1.1.1.1 of the AP1000 DCD.

The staff verified that the Turkey Point Units 6 and 7 COL FSAR was appropriately revised to address the design commitment, ITAAC, and acceptance criteria for the waterproof membrane.

The following portion of this technical evaluation section is reproduced from Section 3.8.5.4 of the VEGP SER:

- *STD COL 3.8-5*

In a letter dated August 17, 2010, the applicant proposed STD COL 3.8-5, adding a new Section 3.8.3.7, 3.8.4.7, and 3.8.5.7 to the VEGP COL FSAR, addressing the construction inspection program related to seismic Category I and II structures. The construction inspection program will be consistent with the maintenance rule (10 CFR 50.65) and guidance in RG 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," in addressing maintenance requirements for the seismic Category I and seismic Category II structures. The staff concludes that the applicant has provided an acceptable construction inspection program that meets the requirement described in Section 3.8.4.8 of the AP1000 DCD. Therefore, the NRC staff considers STD COL 3.8-5 to be resolved. The incorporation of the planned VEGP COL FSAR changes will be tracked as ***Confirmatory Item 3.8-2****.*

Resolution of Standard Content Confirmatory Item 3.8-2

Confirmatory Item 3.8-2 is an applicant commitment to revise its FSAR Table 1.8-202, Table 1.9-201, Appendix 1AA, Section 3.8.3.7, Section 3.8.4.7, Section 3.8.5.7, Section 3.8.6.5, and Section 17.6 to address STD COL 3.8-5. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.8-2 is now closed.

- *STD COL 3.8-6*

In a letter dated October 1, 2010, the applicant proposed STD COL 3.8-6, adding a new Section 3.8.6.6 to the VEGP COL FSAR, addressing the construction procedure program related to safety-related Category I structures. The construction procedures program addresses the pre- and post-concrete placement, and use of construction mock-ups for the SC modules. The staff concludes that the applicant has provided an acceptable construction procedures program that meets the requirement described in Section 3.8.4.8 of the AP1000 DCD. Therefore, the NRC staff considers STD COL 3.8-6 to be resolved. The incorporation of the planned VEGP COL FSAR changes will be tracked as ***Confirmatory Item 3.8-3****.*

Resolution of Standard Content Confirmatory Item 3.8-3

Confirmatory Item 3.8-3 is an applicant commitment to revise its FSAR Table 1.8-202 and Section 3.8.6.6 to address STD COL 3.8-6. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.8-3 is now closed.

The following portion of this technical evaluation section is reproduced from Section 3.8.5.4 of the VEGP SER:

License Condition

- *Part 10, License Condition 6*

In its letter dated October 1, 2010, the applicant proposed to add another line item to proposed License Condition 6, addressing the availability to NRC inspectors of the schedule for the implementation of construction and inspection procedures related to concrete activities. Specifically, the applicant has proposed to add a new standard item to proposed License Condition 6 to read (where # is the next appropriate letter):

#. the implementation of construction and inspection procedures for concrete filled steel plate modules activities before and after concrete placement, use of construction mock-ups, and inspection of modules before and after concrete placement as discussed in DCD Subsection 3.8.4.8.

The applicant's proposed new standard item related to concrete construction and inspection procedures will allow the staff sufficient time to inspect the procedures. Therefore, the staff finds the addition of this line item to proposed License Condition 6 acceptable.

Evaluation of Additional Information Submitted by Applicant

In a letter dated May 6, 2011, the applicant revised the proposed license condition regarding the implementation of construction and inspection procedures for steel concrete composite (SC) construction activities for seismic Category I nuclear island modules (including shield building SC). The staff found these changes acceptable because they clarified the applicant commitment regarding construction procedure.

3.8.5.5 *Post-Combined License Activities*

The license condition language in this section has been clarified from previously considered language. In a letter dated April 8, 2016 (ADAMS Accession No. ML16103A507), the applicant did not identify any concerns with the clarified license condition language. The changes do not affect the staff's above analysis of the conditions and therefore, for the reasons discussed in the technical evaluation section above, the staff finds the following ITAAC and license condition acceptable:

- The licensee shall perform and satisfy the waterproofing membrane ITAAC in SER Table 3-2.

- License Condition (3-4) – No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO, or the Director's designee, a schedule for implementation of the construction and inspection procedures for steel concrete composite (SC) construction activities for seismic Category I NI modules. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until each this license condition has been fully implemented. The schedule shall identify the completion of or implementation of the construction and inspection procedures for steel concrete composite (SC) construction activities for seismic Category I NI modules (including shield building SC modules) described in AP1000 DCD, Revision 19, Section 3.8.4.8.

3.8.5.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. On the basis of its review, the staff confirms that the applicant has addressed the required information relating to foundations, and there is no outstanding information expected to be addressed in the Turkey Point Units 6 and 7 COL FSAR related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR is acceptable and meets the requirements of GDC 1, 2, 4, and 5 to 10 CFR Part 50, Appendix A. The staff based its conclusion on the following:

- STD SUP 3.8-1 is acceptable because the applicant addressed the relevant information that meets the guidance in Section 3.8.5 of NUREG-0800 and specifically addressed PTN COL 2.5-7, PTN COL 2.5-13, PTN COL 2.5-10, PTN COL 2.5-12, PTN COL 2.5-13, and PTN COL 2.5-16. In conclusion, the applicant has provided sufficient information for satisfying 10 CFR Part 50, Appendix A, GDC 1, 2, 4, and 5.

- PTN COL 2.5-17 is acceptable because the applicant committed to (1) use one of the three waterproofing-membrane systems identified in Subsection 3.4.1.1.1.1 of the AP1000 standard design and which were reviewed and accepted by the staff and (2) demonstrate that the waterproofing membrane meets the waterproofing and COF requirements of greater than or equal to 0.55 as specified in Section 3.4.1.1.1.1 of the AP1000 DCD.

Table 3-2 Waterproof Membrane ITAAC

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
The friction coefficient to resist sliding is ≥0.55.	Testing will be performed to confirm that the mudmat-waterproofing-mudmat interface beneath the NI basemat has a coefficient of friction to resist sliding of ≥0.55.	A report exists and documents that the as-built waterproof system (mudmat-waterproofing-mudmat interface) has a coefficient of friction of ≥0.55 as demonstrated through material qualification testing.

3.9 Mechanical Systems and Components

Structural integrity and functional capability of various safety-related mechanical components are described. The design is not limited to ASME Code components and supports, but is extended to other components such as control rod drive mechanisms (CRDMs), certain reactor internals, and any safety-related piping designed to industry standards other than the ASME Code. The design includes issues as load combinations, allowable stresses, methods of analysis, summary of results, and preoperational testing. The evaluation of this section is focused on determining whether there is adequate assurance of a mechanical component performing its safety-related function under all postulated combinations of normal operating conditions, system operating transients, postulated pipe breaks, and seismic events.

3.9.1 Special Topics for Mechanical Components

In Section 3.9.1, "Special Topics for Mechanical Components," design transients and methods of analysis are described for all seismic Category I components, component supports, core support (CS) structures, and reactor internals designated as Classes 1, 2, 3, and CS under ASME Code, Section III, and those not covered by the ASME Code. Also included are the assumptions and procedures used for the inclusion of transients in the design and fatigue evaluation of ASME Code Class 1 and CS components and the computer programs used in the design and analysis of seismic Category I components and their supports, as well as experimental and inelastic analytical techniques.

Section 3.9 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference, with no departures or supplements, Section 3.9.1, "Special Topics for Mechanical Components," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] On the basis of its review, the staff confirms that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

3.9.2 Dynamic Testing and Analysis of Systems, Structures, and Components

The criteria, testing procedures, and dynamic analyses employed to ensure the structural and functional integrity of piping systems, mechanical equipment, reactor internals, and their supports (including supports for conduit and cable trays, and ventilation ducts) under vibratory loadings, are addressed in this section. The loadings include those due to fluid flow (and especially loading caused by adverse flow conditions, such as flow instabilities over standoff pipes and branch lines in the steam system) and postulated seismic events.

Section 3.9 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference, with no departures or supplements, Section 3.9.2, "Dynamic Testing and Analysis of Systems, Structures and Components," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] On the basis of its review, the staff confirms that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

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

3.9.3.1 *Introduction*

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

The criteria for the SSC design include the following considerations:

- loading combinations, design transients, and stress limits
- pump and valve operability assurance
- design and installation criteria of Class 1, 2, and 3 pressure-relieving devices
- component and piping supports

3.9.3.2 *Summary of Application*

Section 3.9 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.9 of the AP1000 DCD, Revision 19. Section 3.9 of the DCD includes Section 3.9.3.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.9.3, the applicant provided the following:

Departure

- PTN DEP 6.4-2

The applicant provided additional information in Table 3.9-12R of the Turkey Point Units 6 and 7 COL FSAR about PTN DEP 6.4-2 related to design changes affecting how the temperature and humidity in the main control room are maintained within the limits for reliable human performance. This information, as well as related PTN DEP 6.4-2 information appearing in other chapters of the FSAR, is reviewed in Section 21.3 of this SER.

AP1000 COL Information Items

- STD COL 3.9-2

The applicant provided additional information in STD COL 3.9-2 to address COL Information Item 3.9-2, which states that “Reconciliation of the as-built piping (verification of the thermal cycling and stratification loadings considered in the stress analysis discussed in [DCD] Subsection 3.9.3.1.2) is completed by the COL holder after the construction of the piping systems and prior to fuel load.” Evaluation of this particular COL information item is provided in Section 3.12 of this SER.

- STD COL 3.9-3

The applicant provided additional information in STD COL 3.9-3 to address COL Information Item 3.9-3 (COL Action Item 3.9.8-1), which describes snubber design and testing, snubber installation requirements, and snubber preservice and inservice examination and testing.

- STD COL 3.9-5

The applicant provided additional information in STD COL 3.9-5 to address COL Information Item 3.9-5 (COL Action Item 3.12.5.10-1), which addresses pressurizer surge line monitoring. Evaluation of this particular COL information item is provided in Section 3.12 of this SER.

- STD COL 3.9-7

The applicant incorporated the information provided in the letter dated April 23, 2010, from the VEGP applicant, that proposed to add STD COL 3.9-7 to the FSAR. This COL item provides additional information on the process to be used to complete the piping design and to complete the ITAAC added to verify the design. Evaluation of this particular COL Information item is provided in Section 3.12 of this SER.

Supplemental Information

- STD SUP 3.9-3

The applicant provided supplemental information in STD SUP 3.9-3 to describe snubber design and testing and snubber installation requirements.

3.9.3.3 *Regulatory Basis*

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations for the ASME Code Class 1, 2, and 3 components, component supports, and CS structures are given in Section 3.9.3, Revision 3, of NUREG-0800.

3.9.3.4 *Technical Evaluation*

The NRC staff reviewed Section 3.9.3 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the functional design of ASME Code Class 1, 2, and 3 components and component supports and CS structures. The results of the NRC staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review

in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER for the reference COL application (VEGP, Units 3 and 4) were equally applicable to the Turkey Point Units 6 and 7 COL application, the staff undertook the following reviews:

- The staff compared the VEGP COL FSAR, Revision 5, to the Turkey Point Units 6 and 7 COL FSAR. In performing this comparison, the staff considered changes made to the Turkey Point Units 6 and 7 COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff completed its review and finds the evaluation performed for the standard content to be directly applicable to the Turkey Point Units 6 and 7 COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. Section 1.2.3 of this SER provides an explanation of why the standard content material from the SER for the reference COL application (VEGP) contains evaluation material from the SER for the BLN, Units 3 and 4, COL application.

The following portion of this technical evaluation section is reproduced from Section 3.9.3.4 of the VEGP SER:

AP1000 COL Information Items

- *STD COL 3.9-3 and STD SUP 3.9-3*

AP1000 DCD, Section 3.9.8.3, "Snubber Operability Testing," states that COL applicants referencing the AP1000 design will develop a program to verify operability of essential snubbers as outlined in Section 3.9.3.4.3, "Snubbers Used as Component and Piping Supports," and Section 3.9.3.4.4, "Inspection, Testing, Repair and/or Replacement of Snubbers." In the BLN COL FSAR, the applicant states in Section 3.9.8.3, "Snubber Operability Testing," that STD COL 3.9-3 is addressed in BLN COL FSAR Section 3.9.3.4.4, which incorporates by reference AP1000 DCD Section 3.9.3.4.4, with supplemental snubber information added to the end of the existing Section 3.9.3.4.4.

As indicated in the BLN COL FSAR, STD COL 3.9-3 contains a wide range of supplemental information on snubber design and testing requirements, snubber installation requirements, and snubber preservice and inservice examination and testing. It was not clear to the staff, however, whether STD COL 3.9-3 had provided the required information called for by AP1000 DCD, Section 3.9.8.3. In RAI 3.9.3-1, the staff requested that the applicant address the following: (1) clarify what was meant by "snubber operability testing" when the applicant prepared the COL information; (2) discuss whether the entire STD COL 3.9-3 represents BLN's plant-specific, updated snubber requirements, not already covered in AP1000 DCD, Section 3.9.3; (3) clarify whether all or part of

STD COL 3.9-3 is related to snubber operability testing; (4) for the portions of STD COL 3.9-3 which are not related to snubber operability testing, explain why they are included as part of the COL item; (5) discuss all the pertinent codes and standards on which STD COL 3.9-3 is based to assure snubber operability; and (6) discuss the need to modify the content and the physical placement of STD COL 3.9-3 in the BLN COL FSAR.

In its response, the applicant explained that information presented in BLN COL FSAR Section 3.9.3.4.4 regarding snubber testing includes information specific to qualification and installation tests and examinations for snubbers included in the inservice testing (IST) program and preservice examination and testing programs; and information specifically related to snubber inservice examination and testing. The applicant acknowledges, therefore, that not all information added by STD COL 3.9-3 is related specifically to snubber "operability testing." The applicant also noted that BLN COL FSAR Section 3.9.3.4.4 has been subjected to a revision responding to a separate staff RAI on snubber IST programs. Details of the applicant's responses to the RAI are provided in the following:

(1) For the purpose of STD COL 3.9-3, operability testing encompasses the preservice and inservice examinations and testing required by the ASME Code for Operation and Maintenance (OM) for Nuclear Power Plants (ASME OM Code), Subsection ISTD, "Preservice and Inservice Examination and Testing of Dynamic Restraints (Snubbers) in Light-Water Reactor Nuclear Power Plants" as described in BLN COL FSAR Section 3.9.3.4.4.c and Section 3.9.3.4.4.d (as revised in applicant's response to RAI 3.9.6-3).

(2) In order to provide a complete description of the snubber operability testing program, that is, the preservice and IST programs for snubbers, additional information was provided in BLN COL FSAR Section 3.9.3.4.4 as indicated in the applicant's letter to the NRC in response to RAI 3.9.6-3. Previously, only snubber preservice examination and testing had been described in BLN COL FSAR Section 3.9.3.4.4.c.

(3) As noted above, some of the information provided in the original BLN COL FSAR Section 3.9.3.4.4 relates to snubber qualification testing and examinations and snubber installation verification requirements. These activities are considered precursors to the snubber operability testing that will be conducted in accordance with the ASME OM Code, Subsection ISTD.

(4) The information not specifically related to STD COL 3.9-3 operability testing, i.e., Sections 3.9.3.4.4.a and 3.9.3.4.4.b, should have been labeled as standard supplemental information, using the left margin annotation STD SUP 3.9-3.

(5) Snubber operability testing is to be conducted during implementation of the preservice and ISI and testing programs in accordance with the

requirements of the ASME OM Code, Subsection ISTD. As indicated in the first paragraph of BLN COL FSAR Section 3.9.3.4.4, the description of the program provided in the BLN COL FSAR is based on the 2001 Edition through the 2003 Addenda of the ASME OM Code. However, the initial IST program for snubbers will incorporate the latest Edition and Addenda of the ASME OM Code approved in 10 CFR 50.55a(f) on the date 12 months before initial fuel load.

(6) BLN COL FSAR Section 3.9.3.4.4 will be revised as indicated in the Application Revision section of this response to segregate the snubber operability testing from the remaining portions of the section (i.e., the snubber design and qualification testing, and the snubber installation requirements) and to include the appropriate left margin annotation. In addition, to maintain consistency, to the extent possible, with other industry COL applications, Section 3.9.3.4.4.a is revised to clarify and expand on snubber qualification examination and testing. Finally, minor editorial changes are made to the Section 3.9.3.4.4.c changes provided in the applicant's letter to the NRC in response to RAI 3.9.6-3. Additionally, changes will be made to the introductory (roadmap) paragraph for BLN COL FSAR Section 3.9.3.4.4 indicating it is a new subsection to follow DCD Section 3.9.3.4.3.

The staff found that above responses provided by the applicant to be adequate in clarifying that the information for snubber operability testing originally provided in STD COL 3.9-3 was primarily intended for preservice and inservice examination and testing. The staff also found that the supplemental information provided under a new STD SUP 3.9-3, for snubber design and qualification testing, and the snubber installation requirements includes a better description for snubber design and qualification testing, and is more consistent with other industry COL applications. The staff confirmed that Revision 1 has incorporated all the changes as required. RAI 3.9.3-1 is closed.

Clarification of BLN SER Standard Content

Based on the staff's review of the standard content, there were two minor changes of an editorial nature that were found not to affect the staff's conclusion. The first paragraph discussed in Item (5) above was moved in the final VEGP COL FSAR such that it is appropriately included with the write up specific to STD COL 3.9-3. The introductory (roadmap) paragraph was not changed as described following Item (6) above because the AP1000 DCD was modified to include a paragraph numbered "3.9.3.4.4." As a result, the new text was added to an existing section as opposed to being a standalone section.

Resolution of Difference Between FSARs

In Section 3.9.3.4.4 of the BLN COL FSAR, the BLN applicant stated that a list of snubbers on systems which experience sufficient thermal movement to measure cold to hot position, is included as part of the testing program after piping analysis has been completed. In Section 3.9.3 of the VEGP COL FSAR, the VEGP applicant provides Table 3.9-201 with this list of snubbers. The addition of

a list of snubbers on systems which experience sufficient thermal movement to measure cold to hot position to the VEGP COL FSAR is acceptable to the staff.

3.9.3.5 *Post-Combined License Activities*

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

3.9.3.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR is acceptable and meets the requirements of 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." The staff based its conclusion on the following:

- PTN DEP 6.4-2, related to design changes affecting how the temperature and humidity in the main control room are maintained within the limits for reliable human performance, is reviewed and found acceptable by the staff in Section 21.3 of this SER.

- STD COL 3.9-3 and STD SUP 3.9-3 are acceptable because the applicant addressed the relevant information that meets the guidance in Section 3.9.3 of NUREG-0800. In conclusion, the applicant has provided sufficient information for satisfying 10 CFR Part 50, Appendix A, GDC 1 and 4.

3.9.4 Control Rod Drive System

The control rod drive system (CRDS) consists of the control rods and the related mechanical components that provide the means for mechanical movement. As discussed in GDC 26, "Reactivity Control System Redundancy and Capability," and GDC 27, "Combined Reactivity Control Systems Capability," the CRDS provides one of the independent reactivity control systems. The rods and the drive mechanism are capable of reliably controlling reactivity changes either under conditions of anticipated operational occurrences, or under postulated accident conditions. A positive means for inserting the rods is always maintained to ensure appropriate margin for malfunction, such as stuck rods. Because the CRDS is a safety-related system and portions of the CRDS are a part of the RCPB, the system is designed, fabricated, and tested to quality standards commensurate with the safety-related functions to be performed. This provides an extremely high probability of accomplishing the safety-related functions either in the event of anticipated operational occurrences or in withstanding the effects of postulated accidents and natural phenomena such as earthquakes, as discussed in GDC 1; GDC 2; GDC 14, "Reactor Coolant Pressure Boundary"; GDC 29, "Protection against Anticipated Operational Occurrences"; and 10 CFR 50.55a, "Codes and Standards."

Section 3.9 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference, with no departures or supplements, Section 3.9.4, "Control Rod Drive System (CRDS)," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] On the basis of its review, the staff confirms that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

3.9.5 Reactor Pressure Vessel Internals

AP1000 reactor internals consist of two major assemblies—the lower internals and the upper internals. The reactor internals provide the protection, alignment, and support for the core, control rods, and gray rods to provide safe and reliable reactor operation. In addition, the reactor internals help to accomplish the following: direct the main coolant flow to and from the fuel assemblies; absorb control rod dynamic loads, fuel assembly loads, and other loads and transmit these loads to the reactor vessel; support instrumentation within the reactor vessel; provide protection for the reactor vessel against excessive radiation exposure from the core; and position and support reactor vessel radiation surveillance specimens.

Section 3.9 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference, with no departures or supplements, Section 3.9.5, "Reactor Pressure Vessel Internals," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] On the basis of its review, the staff confirms that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

3.9.6 Inservice Testing of Pumps and Valves (Related to RG 1.206, Section C.III.1, Chapter 3, C.I.3.9.6, "Functional Design, Qualification, and Inservice Testing Programs for Pumps, Valves, and Dynamic Restraints")

3.9.6.1 *Introduction*

In this section, the NRC staff describes its review of the functional design, qualification, and inservice testing (IST) programs for pumps, valves, and dynamic restraints as required by the NRC regulations in 10 CFR Part 52 and 10 CFR 50.55, "Conditions of construction permits, early site permits, combined licenses, and manufacturing licenses," for Turkey Point Units 6 and 7. RG 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)," discusses the Commission's position provided in SECY-05-0197, "Review of Operational Programs in a Combined License Application and General Emergency Planning Inspections, Tests, Analyses, and Acceptance Criteria," that operational programs should be fully described in COL applications to avoid the need to specify ITAAC for those programs. The applicant relies on the Turkey Point Units 6 and 7 COL FSAR with its incorporation by reference of the AP1000 DCD and supplemental information to fully describe the IST and motor-operated valve (MOV) testing operational programs in support of the COL application for Turkey Point Units 6 and 7.

3.9.6.2 *Summary of Application*

Section 3.9 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.9 of the AP1000 DCD, Revision 19. Section 3.9 of the DCD includes Section 3.9.6.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.9.6, the applicant provided the following:

Departure

- PTN DEP 6.4-2

The applicant provided additional information in Table 3.9-16R of the Turkey Point Units 6 and 7 COL FSAR about PTN DEP 6.4-2 related to design changes affecting how the temperature and humidity in the main control room are maintained within the limits for reliable human performance. This information, as well as related PTN DEP 6.4-2 information appearing in other chapters of the FSAR, is reviewed in Section 21.3 of this SER.

AP1000 COL Information Item

- STD COL 3.9-4

The applicant provided additional information in several sections of Turkey Point Units 6 and 7 COL FSAR, Section 3.9.6 in response to STD COL 3.9-4 to supplement the AP1000 DCD provisions to fully describe the IST and MOV testing programs for Turkey Point Units 6 and 7. For example, the Turkey Point Units 6 and 7 COL FSAR supplements the provisions in the AP1000 DCD with respect to the Edition and Addenda of the ASME Code for Operation and Maintenance of Nuclear Power Plants (OM Code) applicable to the description of the IST program for Turkey Point Units 6 and 7, determination of the MOV testing frequency, operability testing of power-operated valves (POVs) other than MOVs, performance of check valve exercise tests, and plans to apply alternatives to the ASME OM Code. Under STD COL 3.9-3, the applicant supplemented the AP1000 DCD provisions for design, installation, preservice examination and testing, and inservice examination and testing of dynamic restraints (snubbers) in Turkey Point Units 6 and 7 COL FSAR, Section 3.9.3.4.4, "Inspection, Testing, Repair, and/or Replacement of Snubbers."

The AP1000 DCD addresses the functional design and qualification of mechanical equipment to be used at an AP1000 nuclear power plant in several DCD sections. For example, Section 3.9.3.2, "Pump and Valve Operability Assurance," states that criteria are developed to assess the functional capability of required components to operate. Section 3.9.3.2.2, "Valve Operability," indicates that operational tests will be performed to verify that valves open and close prior to installation. This section also specifies cold hydro tests, hot functional tests, periodic ISIs, and periodic inservice operations to be performed in situ to verify the functional capability of the valves. Section 5.4.8, "Valves," includes provisions regarding design and qualification, and preoperational testing of valves within the scope of those systems, and refers to these activities for other safety-related valves. Section 5.4.8.3, "Design Evaluations," specifies that the requirements for qualification testing of power-operated active valves are based on ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants." Section 5.4.9, "Reactor Coolant System Pressure Relief Devices,"

includes provisions for design, testing, and inspection of relief devices in the reactor coolant system. Section 5.4.10, "Component Supports," includes provisions for design, testing, and inspection of component supports in the reactor coolant system. The Turkey Point Units 6 and 7 COL FSAR incorporates by reference these specific sections in the AP1000 DCD.

With respect to flow-induced vibration (FIV) of plant components, AP1000 DCD, Section 3.9.2, "Dynamic Testing and Analysis," describes tests to confirm that piping, components, restraints, and supports have been designed to withstand the dynamic effects of steady-state FIV and anticipated operational transient conditions. Section 14.2.9.1.7, "Expansion, Vibration and Dynamic Effects Testing," states that the purpose of the expansion, vibration, and dynamic effects testing is to verify that the safety-related, high-energy piping and components are properly installed and supported such that, in addition to other factors, vibrations caused by steady-state or dynamic effects do not result in excessive stress or fatigue to safety-related plant systems. The Turkey Point Units 6 and 7 COL FSAR incorporates by reference these sections in the AP1000 DCD.

AP1000 DCD, Section 3.9.3.4.4, "Inspection, Testing, Repair, and/or Replacement of Snubbers," specifies that a program for inservice examination and testing of dynamic supports (snubbers) to be used in the AP1000 reactor will be prepared in accordance with the requirements of the ASME OM Code, Subsection ISTD, "Preservice and Inservice Examination and Testing of Dynamic Restraints (Snubbers) in Light-Water Reactor Nuclear Power Plants." Section 3.9.3.4.4 indicates that details of the snubber inservice examination and testing program, including test schedules and frequencies, will be reported in the ISI and testing plan included in the IST Program required by Section 3.9.8.3, "Snubber Operability Testing." Section 3.9.8.3 states that COL applicants referencing the AP1000 design will develop a program to verify operability of essential snubbers. The Turkey Point Units 6 and 7 COL FSAR provides supplemental information for Section 3.9.3.4.4 regarding snubbers. For example, Turkey Point Units 6 and 7 COL FSAR, Section 3.9.3.4.4 includes provisions for snubber design and testing with specifications that snubber qualification and production testing will satisfy the applicable sections of the ASME Boiler and Pressure Vessel Code (BPV Code), the ASME OM Code, and ASME Standard QME-1-2007. Turkey Point Units 6 and 7 COL FSAR, Section 3.9.3.4.4 also describes the inservice examination and testing of safety-related snubbers in accordance with the requirements of the ASME OM Code, Subsection ISTD. The description includes specifications for initial and subsequent examination intervals, visual examination attributes, IST methods and intervals, establishment of snubber test groups, response to examination and test results, snubber repair and replacement, post-maintenance examination and testing, and establishment and monitoring of snubber service life. Turkey Point Units 6 and 7 COL FSAR, Table 3.9-201, "Safety Related Snubbers," provides a list of safety-related snubbers to be installed at Turkey Point Units 6 and 7, including the snubber identification number and the associated system or component.

AP1000 DCD, Section 3.9.6, "Inservice Testing of Pumps and Valves," provides a general description of the IST Program to be developed for AP1000 reactors. Table 3.9-16, "Valve Inservice Test Requirements," in AP1000 DCD, lists valves within the scope of the IST Program provided in support of the AP1000 DC, and indicates the valve tag number, valve and actuator type, safety-related missions, safety functions, ASME Code Class and IST Category, and IST type and frequency. Turkey Point Units 6 and 7 COL FSAR, Section 3.9.6 incorporates by reference AP1000 DCD, Section 3.9.6, with supplemental information in several areas. For example, the applicant stated that the description of the IST Program for Turkey Point Units 6 and 7 is based on the ASME OM Code, 2001 Edition through 2003 Addenda. The applicant

also indicated that the initial IST Program will incorporate the latest Edition and Addenda of the ASME OM Code approved in 10 CFR 50.55a(f) on the date 12 months before initial fuel load. In the Turkey Point Units 6 and 7 COL FSAR, the applicant describes the periodic testing program for POVs other than MOVs that incorporates lessons learned based on nuclear power plant operating experience and research programs for MOV performance. The applicant also indicated its plan to apply Revision 1 to ASME OM Code Case OMN-1, "Alternative Rules for the Preservice and Inservice Testing of Certain Electric Motor-Operated Valve Assemblies in Light Water Reactor Power Plants," as an alternative to the quarterly MOV stroke-time testing provisions in the ASME OM Code, and to satisfy the supplemental requirements specified in 10 CFR 50.55a(b)(3)(ii) to ensure that MOVs continue to be capable of performing their design-basis safety functions. The Turkey Point Units 6 and 7 COL FSAR does not identify any additional plant-specific valves to be included in the IST Program beyond those listed in AP1000 DCD, Table 3.9-16.

License Conditions

- Part 10, License Condition 3, Items G2 and G5

The applicant proposed a license condition providing the implementation milestones for the Preservice Testing Program and MOV Testing Program.

- Part 10, License Condition 6

The applicant proposed a license condition to provide a schedule to support the NRC's inspection of operational programs including the Preservice Testing Program and MOV Testing Program.

3.9.6.3 *Regulatory Basis*

The regulatory basis of the design-related information incorporated by reference is addressed in NUREG-1793 and its supplements.

The regulatory basis for the NRC staff's review of the Turkey Point Units 6 and 7 COL FSAR is provided in 10 CFR Parts 50 and 52. Specifically, the NRC regulations in 10 CFR 52.79(a) require that the COL application include information at a level sufficient to enable the Commission to reach a final conclusion on all safety matters that must be resolved by the Commission before COL issuance. For example, paragraph (4)(i) in 10 CFR 52.79(a) requires that a COL application include the design of the facility with specific reference to the GDC in Appendix A to 10 CFR Part 50, which establish the necessary design, fabrication, construction, testing, and performance requirements for SSCs that provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the public. Paragraph (11) in 10 CFR 52.79(a) requires that a COL application provide a description of the programs and their implementation necessary to ensure that the systems and components meet the requirements of the ASME BPV Code and the ASME OM Code in accordance with 10 CFR 50.55a. Paragraph (29)(i) in 10 CFR 52.79(a) requires that a COL application provide plans for conduct of normal operations, including maintenance, surveillance, and periodic testing of SSCs. Paragraph (37) in 10 CFR 52.79(a) requires that a COL application provide the information necessary to demonstrate how operating experience insights have been incorporated into the plant design.

RG 1.206 provides guidance for a COL applicant in preparing and submitting its COL application in accordance with the NRC regulations. For example, Section C.IV.4 in RG 1.206 discusses the requirement in 10 CFR 52.79(a) for descriptions of operational programs that need to be included in the FSAR for a COL application to allow a reasonable assurance finding of acceptability. In particular, a COL applicant should fully describe the IST, MOV testing, and other operational programs as defined in Commission Paper SECY-05-0197 to avoid the need for ITAAC for the implementation of those programs. The term "fully described" for an operational program should be understood to mean that the program is clearly and sufficiently described in terms of scope and level of detail to allow a reasonable assurance finding of acceptability. Further, operational programs should be described at a functional level and an increasing level of detail where implementation choices could materially and negatively affect the program effectiveness and acceptability. The Commission approved the use of a license condition for operational program implementation milestones that are fully described or referenced in the FSAR as discussed in the staff requirements memorandum (SRM) for SECY-05-0197, dated February 22, 2006.

The NRC staff followed Section 3.9.6, Revision 3, of NUREG-0800 in its review of the Turkey Point Units 6 and 7 COL application. The staff also compared the Turkey Point Units 6 and 7 COL FSAR information with the guidance provided in RG 1.206. Appendix 1AA, "Conformance with Regulatory Guides," of the Turkey Point Units 6 and 7 FSAR, indicates that the COL application conforms to RG 1.206 without exceptions related to the IST Program. In addition, Table 1.9-202, "Conformance with SRP Acceptance Criteria," in the Turkey Point Units 6 and 7 COL FSAR indicates that the COL application conforms to NUREG-0800, Section 3.9.6.

3.9.6.4 *Technical Evaluation*

The NRC staff reviewed Section 3.9.6 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to functional design, qualification, and IST programs for pumps, valves, and dynamic restraints. The results of the NRC staff's evaluation of the design-related information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements. The results of the staff's review of the material in the AP1000 DCD related to the IST operational program for pumps, valves, and dynamic restraints are in this SER section.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER for the reference COL application (VEGP, Units 3 and 4) were equally applicable to the Turkey Point Units 6 and 7 COL application, the staff undertook the following reviews:

- The staff compared the VEGP COL FSAR, Revision 5, to the Turkey Point Units 6 and 7 COL FSAR. In performing this comparison, the staff considered changes made to the Turkey Point Units 6 and 7 COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff completed its review and finds the evaluation performed for the standard content to be directly applicable to the Turkey Point Units 6 and 7 COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting. The confirmatory items in the standard content material retain the numbers assigned in the VEGP SER.

The following portion of this technical evaluation section is reproduced from Section 3.9.6.4 of the VEGP SER:

> *In its letter dated December 17, 2008, Southern Nuclear Operating Company (SNC) listed the RAIs prepared by the NRC staff on the BLN Units 3 and 4 COL application. In that letter, SNC endorsed the responses*, including proposed changes to the FSAR, *submitted by the Tennessee Valley Authority (TVA) on 16 RAIs related to the functional design, qualification, and IST programs for pumps, valves, and dynamic restraints as applicable to the VEGP COL application. In letters dated December 14, 2009, and January 12, March 1, and May 14, 2010, SNC described its plans to resolve open items identified in the "SER with open items* on the standard content information*" prepared by the NRC staff on the description of the functional design, qualification, and IST programs for pumps, valves, and dynamic restraints in the BLN Units 3 and 4 COL application. The NRC staff has reviewed the SNC letters and Revision 2 to the VEGP COL FSAR to determine whether the description of the functional design, qualification, and IST programs for pumps, valves, and dynamic restraints in the VEGP COL application with its incorporation by reference of the AP1000 DCD meets the regulatory requirements to provide reasonable assurance that those components at VEGP will be capable of performing their safety functions if these programs are developed and implemented consistent with the description in the VEGP COL FSAR and AP1000 DCD.*
>
> *The staff reviewed the information in the VEGP COL FSAR, and the staff's review of the standard content open item is provided.*
>
> *<u>AP1000 COL Information Item</u>*
>
> - *STD COL 3.9-4*
>
> *The NRC staff reviewed STD COL 3.9-4 related to COL Information Item 3.9-4 included in AP1000 DCD Tier 2, Section 3.9.8.4. COL Information Item 3.9-4 states:*
>
> > *Combined License applicants referencing the AP1000 design will develop an inservice test program in conformance with the valve inservice test requirements outlined in subsection 3.9.6 and Table 3.9-16. For power-actuated valves, the requirements for*

> *operability testing shall be based on subsection 3.9.6.2.2. This program will include provisions for nonintrusive check valve testing methods and the program for valve disassembly and inspection outlined in subsection 3.9.6.2.3. The Combined License applicant will complete an evaluation as identified in subsection 3.9.6.2.2 to determine the frequency of power-operated valve operability testing.*

The information item for COL applicants to develop an IST Program was specified as COL Action Item 3.9.6.4-1 in Appendix F of NUREG-1793, which states:

> *The COL applicant will provide an inservice test (IST) program that complies with the inservice testing requirements for valves.*

In STD COL 3.9-4, the applicant states that this COL item is addressed in Sections 3.9.6, 3.9.6.2.2, 3.9.6.2.3, 3.9.6.2.4, 3.9.6.2.5, and 3.9.6.3 for the VEGP COL application.

In this section of the SER, the NRC staff describes its review of the VEGP COL FSAR with the incorporation by reference of the AP1000 DCD for an acceptable description of the functional design, qualification, and IST programs, including the MOV Testing Program, for VEGP Units 3 and 4 to provide reasonable assurance that the safety-related components within the scope of the VEGP IST Program will be capable of performing their safety functions in accordance with the NRC regulations and the ASME Code requirements.

AP1000 DCD Tier 2, Section 3.9.6.1, "Inservice Testing of Pumps," specifies that the AP1000 reactor design does not include pumps with safety functions with the exception of the coastdown of the reactor coolant pumps. As determined in NUREG-1793, the NRC staff considers the IST Program scope for the AP1000 design with respect to pumps to be acceptable. Therefore, the NRC staff did not include pumps in the review of the IST Program for safety-related components at VEGP Units 3 and 4.

VEGP COL FSAR Section 3.9.6 states that the description of the IST Program for VEGP Units 3 and 4 is based on the ASME OM Code, 2001 Edition through 2003 Addenda, and that the limitations and modifications set forth in 10 CFR 50.55a will be incorporated. The NRC regulations in 10 CFR 50.55a incorporate by reference the ASME OM Code, 2001 Edition through 2003 Addenda, with certain limitations and modifications. Therefore, the NRC staff considers the application of the ASME OM Code, 2001 Edition through 2003 Addenda, as incorporated by reference in the NRC regulations with applicable limitations and modifications, to be acceptable for the VEGP IST Program description in support of the VEGP COL application. As specified in 10 CFR 50.55a, a COL licensee is required to incorporate in its IST Program the latest Edition and Addenda of the ASME OM Code approved in 10 CFR 50.55a(f) on the date 12 months before initial fuel load.

The VEGP COL FSAR incorporates by reference AP1000 DCD Tier 2, Table 3.9-16, "Valve Inservice Test Requirements," that includes the valve type, safety-related missions, safety functions, the ASME Code IST category, and IST type and frequency. The NRC staff considers this table to be sufficient in describing the IST Program in support of the VEGP COL application. Following the issuance of the VEGP COL, the guidance in NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," can be used to develop the VEGP IST Program, including the specific information to be included in the IST Program documentation and tables for NRC inspection.

On March 26 and 27, 2008, the NRC staff held a public meeting to discuss the NRC's review of the description of the functional design, qualification, and IST programs for pumps, valves, and dynamic restraints in COL applications referencing the AP1000 certified design and the AP1000 DC amendment application. At the public meeting, Westinghouse stated that it would make information available on the functional design and qualification of safety-related valves and dynamic restraints within the scope of the AP1000 DCD in design and procurement specifications that will be applicable to AP1000 COL applications. On October 14 and 15, 2008, the NRC staff conducted an audit of design and procurement specifications for pumps, valves, and dynamic restraints to be used for the AP1000 reactor at the Westinghouse office in Monroeville, Pennsylvania. In a memorandum dated November 6, 2008, the NRC staff documented the results of the onsite review with specific open items. For example, the staff found that Westinghouse had included ASME Standard QME-1-2007 in its design and procurement specifications for AP1000 components. ASME QME-1-2007 incorporates lessons learned from valve testing and research programs performed by the nuclear industry and the NRC Office of Nuclear Regulatory Research. Also, AP1000 DCD Tier 2 has been revised in Section 5.4.8.3 to specify that the provisions for qualification testing of power-operated active valves will be based on ASME QME-1-2007. In September 2009, the NRC issued RG 1.100, "Seismic Qualification of Electric and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants," Revision 3, which accepts the use of ASME QME-1-2007, with certain staff positions, for the functional design and qualification of safety-related pumps, valves, and dynamic restraints. In a letter dated January 26, 2010, Westinghouse provided its planned response to the audit follow-up items. In a letter dated December 14, 2009, SNC stated, in response to Standard Content Open Item 3.9-1 in the "SER with open items" on the BLN COL application, that it had not identified any specific actions for the VEGP COL application based on the audit open items. The NRC staff discussion of the audit of the design and procurement specifications for pumps, valves, and dynamic restraints to be used for the AP1000 reactor is in the SER on the AP1000 DC amendment application. Therefore, the staff considers Standard Content Open Item 3.9-1 resolved.

The VEGP COL FSAR incorporates by reference AP1000 DCD Tier 2, Section 3.9.3.4, "Component and Piping Supports," and adds a new Section 3.9.3.4.4, "Inspection, Testing, Repair and/or Replacement of Snubbers." VEGP COL FSAR Section 3.9.3.4.4 specifies that snubber design and testing will satisfy the applicable sections of the ASME BPV Code, ASME OM Code, and

ASME QME-1-2007. Further, VEGP COL FSAR Section 3.9.3.4.4 describes the snubber inservice examination and testing program for VEGP Units 3 and 4. For example, the FSAR specifies that the inservice examination and testing of safety-related snubbers will be conducted in accordance with the requirements of the ASME OM Code, Subsection ISTD. The inservice visual examination will be performed to identify physical damage, leakage, corrosion, degradation, indication of binding, misalignment or deformation, and potential defects generic to a particular design. Snubbers will be tested in service to determine operational readiness during each fuel cycle, beginning no sooner than 60 days before the start of the refueling outage. Defined test plan groups will be established and snubbers in each group will be tested each fuel cycle according to an established sampling plan. Unacceptable snubbers will be adjusted, modified, or replaced. Service life for snubbers will be established, monitored, and adjusted in accordance with ASME OM Code, ISTD-6000, "Service Life Monitoring," and ASME OM Code, Appendix F, "Dynamic Restraints (Snubbers) Service Life Monitoring Methods." In addition, VEGP COL FSAR Table 3.9-201 provides a list of safety-related snubbers to be installed at VEGP, including the snubber identification number and the associated system or component. Revision 3 to RG 1.100 accepts with certain conditions the use of ASME QME-1-2007 for the functional design and qualification of dynamic restraints. The NRC staff finds that the provisions in the VEGP COL FSAR, together with the AP1000 DCD, provide an acceptable description of the inservice examination and testing program for dynamic restraints that support a finding that the program, when developed and implemented, will satisfy the 10 CFR 50.55a regulatory requirements.

The VEGP COL FSAR incorporates by reference AP1000 DCD Tier 2, Section 3.9.6.2.2, "Valve Testing," with supplemental information. Table 3.9-16 in AP1000 DCD lists the valves in the IST Program for the AP1000 design. VEGP COL FSAR Section 3.9.6.2.2 includes provisions for (a) the establishment of reference values; (b) the prohibition of preconditioning that undermines the purpose of IST activities; (c) comparison of stroke time to the reference value except for fast-acting valves for which a stroke-time limit of 2 seconds is assigned; (d) determination of valve obturator movement during valve exercise tests; (e) testing of solenoid-operated valves; (f) preoperational testing of check valves; (g) acceptance criteria for check valve tests; (h) use of nonintrusive techniques for check valve tests; (i) test conditions for check valve tests; (j) post-maintenance testing for check valves; (k) check valve disassembly and testing; and (l) re-establishment of reference values following maintenance. The VEGP COL FSAR also includes provisions for valve disassembly and inspection; valve preservice tests; and valve replacement, repair, and maintenance in Sections 3.9.6.2.3 to 3.9.6.2.5. The NRC staff finds that these provisions in the VEGP COL FSAR are consistent with Subsection ISTC of the ASME OM Code incorporated by reference in 10 CFR 50.55a, and therefore, are acceptable.

In its letter dated March 1, 2010, SNC provided its planned response for VEGP to Standard Content Open Item 3.9-2 on POV operability tests discussed in the "SER with open items" on the BLN COL application. The NRC staff review of the response by SNC to the three issues in this open item is discussed below.

First, SNC states in its letter dated March 1, 2010, that TVA had indicated in its response to BLN RAI 3.9.6-8 that the BLN COL FSAR would be revised to indicate that MOV testing will apply the provisions of ASME OM Code Case OMN-1 (Revision 1) and the guidance in the Joint Owners Group (JOG) MOV Periodic Verification Program including the applicable NRC safety evaluation (and its supplement) for periodic verification of the design-basis capability of safety-related MOVs. SNC did not consider additional changes to the VEGP COL FSAR to be necessary. The NRC staff finds that the VEGP COL FSAR with its incorporation by reference of the AP1000 DCD (including the planned DCD changes) will address the use of JOG MOV Periodic Verification Program. As the AP1000 IST Program applies the JOG MOV Periodic Verification Program, SNC will need to confirm that MOVs provided by the valve supplier and their application at VEGP Units 3 and 4 are within the scope of the JOG program. The planned use of ASME OM Code Case OMN-1 (Revision 1) is addressed below in this SER section.

Second, SNC provides in its letter dated March 1, 2010, a planned revision to the VEGP COL FSAR that specifies the use of Revision 1 to ASME OM Code Case OMN-1 as an alternative to the quarterly MOV stroke-time testing provisions in the ASME OM Code. In the letter, SNC notes that RG 1.192, "Operation and Maintenance Code Case Acceptability, ASME OM Code," accepts the use of Revision 0 to ASME OM Code Case OMN-1 with three conditions. SNC considers Revision 1 to ASME OM Code Case OMN-1 to represent a superior alternative to Revision 0 to ASME OM Code Case OMN-1 by addressing the conditions on the use of the Code case specified in RG 1.192. In a telephone discussion on April 13, 2010, the NRC staff requested that SNC address the specific provisions in RG 1.192 in justifying the use of Revision 1 to ASME OM Code Case OMN-1 as an alternative to the MOV stroke-time provisions in the ASME OM Code pursuant to 10 CFR 50.55a(a)(3)(i).

In a letter dated May 14, 2010, SNC modified its response to Standard Content Open Item 3.9-2 to provide a planned revision to the VEGP COL FSAR in Section 3.9.6.3 in support of the request to apply Revision 1 to Code Case OMN-1 as an alternative to the quarterly IST stroke-time provisions in the ASME OM Code. The NRC staff has accepted the application of ASME OM Code Case OMN-1 (Revision 0) in RG 1.192 with certain conditions. In the planned VEGP COL FSAR revision, SNC has addressed those conditions as they apply to the requested use of ASME OM Code Case OMN-1 (Revision 1) at VEGP Units 3 and 4. In particular, the VEGP COL FSAR revision specifies that the IST Program will incorporate the provisions in RG 1.192 by providing that the adequacy of the diagnostic test interval for each MOV will be evaluated and adjusted as necessary, but not later than 5 years or three refueling outages (whichever is longer) from the initial implementation of the Code case. The planned VEGP COL FSAR revision also states that the potential increase in core damage frequency (CDF) and risk associated with extending high-risk MOV test intervals beyond quarterly will be determined to be small and consistent with the intent of the Commission's Safety Goal Policy Statement. The VEGP COL FSAR also specifies this provision as consistent with the conditions specified in RG 1.192 for application of ASME OM Code Case OMN-11, "Risk-Informed Testing of Motor-Operated Valves," which has been incorporated into Revision 1

to ASME OM Code Case OMN-1. The planned VEGP COL FSAR revision specifies that risk insights will be applied using MOV risk ranking methodologies accepted by the NRC on a plant-specific or industry-wide basis, consistent with the conditions in the applicable safety evaluations. The planned VEGP COL FSAR revision also indicates that the benefits for performing any particular test will be balanced against the potential adverse effects placed on the valve or system caused by this testing. The VEGP COL FSAR indicates that use of Revision 1 to ASME OM Code Case OMN-1 will be appropriate for the ASME OM Code 2001 Edition with the 2003 Addenda that is the basis for the description of the VEGP Units 3 and 4 IST Program in support of the COL application. The NRC staff finds that the provisions to be specified in the VEGP COL FSAR for the use of Revision 1 to ASME OM Code Case OMN-1 satisfy the conditions specified in RG 1.192 for the use of Revision 0 to ASME OM Code Case OMN-1. The staff considers Revision 1 in ASME OM Code Case OMN-1 to continue to provide an acceptable technical approach for MOV diagnostic testing as an alternative to quarterly MOV stroke-time testing, and that the changes from Revision 0 to Revision 1 reflect improvements for user application and incorporation of ASME OM Code Case OMN-11. Pursuant to 10 CFR 50.55a(a)(3)(i), the staff authorizes the use of ASME OM Code Case OMN-1 (Revision 1) requested by SNC as an alternative to the quarterly MOV stroke-time testing provisions in the ASME OM Code for VEGP Units 3 and 4 on the basis that the proposed alternative provides an acceptable level of quality and safety and therefore, Standard Content Open Item 3.9-2 is resolved. The incorporation of the planned VEGP COL FSAR changes will be tracked as ***Confirmatory Item 3.9-1****.*

Resolution of Standard Content Confirmatory Item 3.9-1

Confirmatory Item 3.9-1 is an applicant commitment to revise its FSAR Table 1.9-201, Section 3.9.6.3, Section 3.9.6.2.2, and Section 3.9.9, to address IST of valves. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.9-1 is now closed.

Third, SNC in its March 1, 2010, submittal provides several planned changes to the VEGP COL FSAR to clarify the provisions that would be redundant when combined with the valve testing provisions in the AP1000 DCD. The NRC staff considers the proposed changes to the VEGP COL FSAR to be acceptable because these provisions are incorporated by reference as part of the AP1000 DCD. The incorporation of the planned VEGP COL FSAR changes will be tracked as part of ***Confirmatory Item 3.9-2****.*

Resolution of Standard Content Confirmatory Item 3.9-2

Confirmatory Item 3.9-2 is an applicant commitment to revise its FSAR. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.9-2 is now closed.

In light of the weaknesses in the IST provisions in the ASME OM Code for quarterly MOV stroke-time testing, the NRC issued Generic Letter (GL) 96-05, "Periodic Verification of Design-Basis Capability of Safety-Related

Motor-Operated Valves," to request that nuclear power plant licensees establish programs to assure the capability of safety-related MOVs to perform their design-basis functions on a periodic basis. Further, the NRC revised 10 CFR 50.55a to require that nuclear power plant licensees supplement the quarterly MOV stroke-time testing provisions specified in the ASME OM Code with a program to ensure that MOVs continue to be capable of performing their design-basis safety functions. In its letter dated March 1, 2010, SNC provided its response to Standard Content Open Item 3.9-3 related to MOV testing in the "SER with open items" on the BLN COL application. The NRC staff review of the response by SNC to the six issues in this open item is discussed below:

First, SNC notes the planned use of Revision 1 to ASME OM Code Case OMN-1 as part of the IST Program to be developed for VEGP. As discussed above in this SER section, the NRC staff authorized the use of Revision 1 to ASME OM Code Case OMN-1 at VEGP Units 3 and 4.

Second, SNC states that the MOV Testing Program at VEGP will implement the JOG MOV Periodic Verification Program as described in the VEGP COL FSAR and AP1000 DCD. As indicated above, the NRC staff finds that the VEGP COL FSAR with its incorporation by reference of the AP1000 DCD (including the planned DCD changes) will address the use of the JOG MOV Periodic Verification Program. Other necessary changes to the VEGP COL FSAR regarding MOV testing are discussed in this SER section.

Third, SNC indicates that MOV output capability will be determined using the provisions of ASME OM Code Case OMN-1. The NRC staff has reviewed ASME OM Code Case OMN-1 as part of its acceptance in RG 1.192, and has determined that the Code case provides acceptable provisions for diagnostic testing to determine the output capability of MOVs.

Fourth, SNC describes MOV testing using the guidance in the JOG MOV Periodic Verification Program and Revision 1 to ASME OM Code Case OMN-1 to periodically determine the capability of MOVs to perform under design-basis conditions. The NRC staff has reviewed the JOG MOV Periodic Verification Program as part of its acceptance in an NRC safety evaluation dated September 25, 2006 with a supplement dated September 18, 2008, and has reviewed ASME OM Code Case OMN-1 as part of its acceptance in RG 1.192. From those evaluations, the staff has determined that the JOG MOV Periodic Verification Program and ASME OM Code Case OMN-1 will demonstrate continued MOV capability to open and close under design-basis conditions. As discussed above in this SER section, the NRC staff authorized the use of Revision 1 to ASME OM Code Case OMN-1 at VEGP Units 3 and 4.

Fifth, SNC notes that the initial test frequency of POVs will be based on the ASME OM Code or applicable ASME OM Code cases. For example, the VEGP COL FSAR specifies that the IST frequency will be determined as specified by ASME OM Code Case OMN-1. Further, the JOG MOV Periodic Verification Program with the NRC safety evaluation and its supplement includes provisions for MOV test frequencies based on risk ranking and functional margin with a maximum diagnostic test interval of 10 years. The staff considers these

provisions in the VEGP COL FSAR and the AP1000 DCD for POV test frequency to incorporate lessons learned from MOV testing and research programs, and therefore, to be acceptable.

Sixth, SNC describes provisions for successful completion of MOV testing at VEGP in its March 1, 2010, letter, and provides several planned changes to the VEGP COL FSAR. For example, SNC provides a planned FSAR change to specify the use of ASME OM Code Case OMN-1, Revision 1. SNC also plans to revise the FSAR to specify that the design-basis capability testing of MOVs will apply guidance from GL 96-05 and the JOG MOV Periodic Verification Program. SNC will revise the FSAR to note the need to consider degraded voltage, control switch repeatability, and load-sensitive MOV behavior in ensuring that MOVs have adequate capability margin, in addition to the consideration of age-related degradation. SNC provides a proposed addition to the description of the MOV test frequency determination in the FSAR that will specify that maximum torque and/or thrust (as applicable) achieved by the MOV (allowing sufficient margin for diagnostic equipment inaccuracies and control switch repeatability) must not exceed the allowable structural and undervoltage motor capability limits for the individual parts of the MOV. SNC provides a proposed addition to the description of POV operability testing that specifies that successful completion of the preservice testing and IST of MOVs, in addition to MOV testing as required by 10 CFR 50.55a, will demonstrate that the following criteria are met for each valve tested: (i) valve fully opens and/or closes as required by its safety function; (ii) adequate margin exists and includes consideration of diagnostic equipment inaccuracies, degraded voltage, control switch repeatability, load-sensitive MOV behavior, and margin for degradation; and (iii) maximum torque and/or thrust (as applicable) achieved by the MOV (allowing sufficient margin for diagnostic equipment inaccuracies and control switch repeatability) does not exceed the allowable structural and undervoltage motor capability limits for the individual parts of the MOV. In its letter dated May 14, 2010, SNC provided an additional planned revision to the VEGP COL FSAR that clarifies the application of the JOG MOV Periodic Verification Program (including the applicable NRC safety evaluation and its supplement on the JOG program) in response to NRC staff comments provided during the telephone discussion on April 13, 2010. The NRC staff considers the planned changes to the VEGP COL FSAR to resolve Standard Content Open Item 3.9-3. The incorporation of the planned changes to the VEGP COL FSAR will be tracked as ***Confirmatory Item 3.9-3****.*

Resolution of Standard Content Confirmatory Item 3.9-3

Confirmatory Item 3.9-3 is an applicant commitment to revise its FSAR Section 3.9.6.2.2 to address MOV testing. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.9-3 is now closed.

In addition to incorporating by reference AP1000 DCD Tier 2 Section 3.9.6.2.2, the VEGP COL FSAR includes a paragraph titled "Other Power-Operated Valve Operability Tests," that states that POVs other than active MOVs are exercised quarterly in accordance with ASME OM Code, Subsection ISTC, unless justification is provided in the IST Program for testing these valves at other

Code-mandated frequencies. Lessons learned from the resolution of weaknesses in the design, qualification, and testing of MOVs are also applicable to other POVs used at nuclear power plants. In discussing the MOV lessons learned applicable to other POVs in Regulatory Issue Summary (RIS) 2000-03, "Resolution of Generic Safety Issue 158: Performance of Safety-Related Power-Operated Valves Under Design Basis Conditions," the NRC staff determined that the current regulations provide adequate requirements to ensure design-basis capability of safety-related POVs. For example, the staff noted that licensees are required by 10 CFR 50.65 (Maintenance Rule) to monitor the performance of SSCs in a manner sufficient to provide reasonable assurance that the SSCs are capable of fulfilling their intended functions. VEGP COL FSAR Section 3.9.6.2.2 provides a description of operability testing for POVs other than MOVs to be implemented at VEGP. For example, the FSAR states that subsequent to verification of the design-basis capability of POVs as part of the design and qualification program, POVs that perform an active safety function will be tested after installation to ensure valve setup is acceptable to perform their required functions consistent with valve qualification. This testing will document the baseline performance of the valves and will include measurement of critical parameters with consideration of uncertainties associated with the performance of these tests and use of the test results. Additional periodic testing will be performed as part of the air-operated valve (AOV) program based on the JOG AOV program discussed in RIS 2000-03 with specific reference to NRC staff comments on that program. The AOV program will also include the attributes for a successful POV periodic verification program described in RIS 2000-03 by incorporating lessons learned from nuclear power plant operations and research programs as they apply to the periodic testing of AOVs and other POVs in the IST Program. The FSAR specifies AOV program attributes including valve categorization based on safety significance and risk ranking, AOV setpoints based on current vendor information or valve qualification diagnostic testing, periodic static testing to identify potential degradation, use of sufficient diagnostics to collect relevant data to verify that the valve meets functional requirements, specification of test frequency and evaluation based on data trends, post-maintenance procedures to ensure baseline testing will be re-performed as necessary when high-risk valve performance could be affected, inclusion of lessons learned from other valve programs, and retention and periodic evaluation of AOV test documentation.

The NRC staff has reviewed the VEGP COL FSAR, including the incorporation by reference of the AP1000 DCD, to determine whether it addresses the lessons learned from MOV operating experience and research programs in describing the program for the periodic verification of the design-basis capability of POVs other than MOVs. In its letters dated December 14, 2009, and March 1, 2010, SNC provided a response to Standard Content Open Item 3.9-4 related to other POV operability testing in the "SER with open items" on the BLN COL application. In particular, SNC provided planned changes to the VEGP COL FSAR to clarify the potential need for periodic dynamic testing of POVs other than MOVs based on the design qualification results or valve operating experience. The planned FSAR change will also clarify that post-maintenance procedures will be implemented for all safety-related POVs consistent with the QA requirements in 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power

Plants and Fuel Reprocessing Plants," regardless of their specific risk ranking. SNC also provided a proposed change to the VEGP COL FSAR specifying that the attributes of the AOV testing program, to the extent that they apply to and can be implemented on other safety-related POVs (such as electro-hydraulic valves) will be applied to those other POVs. The NRC staff considers that the planned revision to the VEGP COL FSAR, when combined with the AP1000 DCD provisions incorporated by reference, will adequately describe the periodic testing program for POVs other than MOVs to be used at VEGP and resolves Standard Content Open Item 3.9-4. The incorporation of the planned changes to the VEGP COL FSAR will be tracked as ***Confirmatory Item 3.9-4****.*

Resolution of Standard Content Confirmatory Item 3.9-4

Confirmatory Item 3.9-4 is an applicant commitment to revise its FSAR Section 3.9.6.2.2, to address POV testing. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.9-4 is now closed.

The VEGP COL FSAR incorporates by reference AP1000 DCD Tier 2, Section 3.9.6.3, "Relief Requests," with a discussion of the planned use of ASME OM Code Case OMN-1, Revision 1. The applicant stated that use of Revision 1 to ASME OM Code Case OMN-1 will require request for relief, unless it is approved by the NRC in RG 1.192 or incorporated into the ASME OM Code on which the IST Program is based and that Code Edition is incorporated by reference in 10 CFR 50.55a. As discussed above in this SER section, the NRC staff authorized the use of Revision 1 to the ASME OM Code Case OMN-1 at VEGP Units 3 and 4.

AP1000 DCD Tier 2, Section 3.9.2, "Dynamic Testing and Analysis," describes tests to confirm that piping, components, restraints, and supports have been designed to withstand the dynamic effects of steady-state FIV and anticipated operational transient conditions. Section 14.2.9.1.7, "Expansion, Vibration and Dynamic Effects Testing," in AP1000 DCD Tier 2, Chapter 14, "Initial Test Program," states that the purpose of the expansion, vibration and dynamic effects testing is to verify that safety-related, high energy piping and components are properly installed and supported such that, in addition to other factors, vibrations caused by steady-state or dynamic effects do not result in excessive stress or fatigue to safety-related plant systems. Nuclear power plant operating experience has revealed the potential for adverse flow effects from vibration caused by hydrodynamic loads and acoustic resonance on reactor coolant, steam, and feedwater systems. In its letter dated January 12, 2010, SNC provided its response for VEGP to Standard Content Open Item 3.9-5 related to FIV in the "SER with open items" on the BLN COL application. In its response, SNC stated that it intended to use the overall Initial Test Program to demonstrate that the plant has been constructed as designed and the systems perform consistent with design requirements. SNC referenced the provisions in the AP1000 DCD for vibration monitoring and testing to be implemented at VEGP. For example, the applicant notes that AP1000 DCD Tier 2, Section 3.9.2.1, "Piping Vibration, Thermal Expansion and Dynamic Effects," specifies that the preoperational test program for ASME BPV Code, Section III, Class 1, 2, and 3

piping systems simulates actual operating modes to demonstrate that components comprising these systems meet functional design requirements and that piping vibrations are within acceptable levels. SNC indicates that the planned vibration testing program described in AP1000 DCD Tier 2, Sections 14.2.9 and 14.2.10, with the preservice and IST programs described in AP1000 DCD Tier 2, Sections 3.9.3.4.4 and 3.9.6, will confirm component installation in accordance with design requirements, and address the effects of steady-state (flow-induced) and transient vibration to ensure the operability of valves and dynamic restraints in the IST Program. The NRC staff considers the response by SNC clarifies its application of the provisions in the AP1000 DCD to ensure that potential adverse flow effects will be addressed at VEGP. Therefore, the staff considers Standard Content Open Item 3.9-5 to be resolved for the VEGP COL application.

Subsection ISTC-5260, "Explosively Actuated Valves," in the ASME OM Code specifies that at least 20 percent of the charges in explosively actuated valves shall be fired and replaced at least once every 2 years. If a charge fails to fire, the ASME OM Code states that all charges with the same batch number shall be removed, discarded, and replaced with charges from a different batch. In light of the updated design and safety significance of squib valves in new reactors, the need for improved surveillance activities for squib valves is being considered by the nuclear industry, ASME, and U.S. and international nuclear regulators. In RAI 3.9.6-1, the NRC staff requested that SNC describe its plans for addressing the surveillance of squib valves that will provide reasonable assurance of the operational readiness of those valves to perform their safety functions in support of the VEGP COL application. In a letter dated May 27, 2010, SNC submitted a planned revision to VEGP COL FSAR Section 3.9.6 to specify that industry and regulatory guidance will be considered in the development of the IST Program for squib valves. The FSAR will also state that the IST Program for squib valves will incorporate lessons learned from the design and qualification process for these valves such that surveillance activities provide reasonable assurance of the operational readiness of squib valves to perform their safety functions. The NRC staff finds that the planned changes to the VEGP COL FSAR are sufficient to describe the IST Program for squib valves for incorporating the lessons learned from the design and qualification process in developing surveillance activities that will provide reasonable assurance of the operational readiness for squib valves to perform their safety functions. Therefore, the NRC staff considers the planned changes to the VEGP COL FSAR to resolve this RAI acceptable. The incorporation of the planned changes to the VEGP COL FSAR will be tracked as ***Confirmatory Item 3.9-5****.*

Resolution of Standard Content Confirmatory Item 3.9-5

Confirmatory Item 3.9-5 is an applicant commitment to revise its FSAR Section 3.9.6.2.2 to address squib valve testing. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.9-5 is now closed.

Technical Specifications

In its letter dated December 14, 2009, SNC provided a response to an open item related to Part 4, "Technical Specifications," (Standard Content Open Item 3.9-6) in the "SER with open items" on the BLN COL application. In its response, SNC stated that Part 4 of the VEGP COL application will be revised to ensure that Technical Specifications and Technical Specification Bases are consistent with the ASME OM Code, 2001 Edition through the 2003 Addenda. Therefore the NRC staff considers the planned changes to the VEGP COL application in Part 4 to resolve Standard Content Open Item 3.9-6. The incorporation of the planned changes to the VEGP COL FSAR will be tracked as ***Confirmatory Item 3.9-6****.*

Resolution of Standard Content Confirmatory Item 3.9-6

Confirmatory Item 3.9-6 is an applicant commitment to revise its FSAR Section 3.9.6.2.2 to address the ASME OM Code. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.9-6 is now closed.

License Conditions

- *Part 10, License Condition 3, Items G2 and G5*

The applicant proposed a license condition providing the implementation milestones for the Preservice Testing Program and MOV Testing Program.

- *Part 10, License Condition 6*

The applicant proposed a license condition to provide a schedule to support the NRC's inspection of operational programs including the Preservice Testing Program and MOV Testing Program.

These license conditions are consistent with the policy established in SECY-05-0197 and are, thus, acceptable.

Squib Valves

During the uncontested hearing for the VEGP Units 3 and 4 COL application, the Commission discussed issues associated with the IST and inspection program for squib valves to be used to perform safety functions at VEGP Units 3 and 4. Tier 1 of the AP1000 DCD requires squib valves to undergo tests or type tests to demonstrate their operational capability under design conditions. Additionally, the Commission asked the staff questions on this topic after the VEGP and V.C. Summer Nuclear Station (VCSNS) COL uncontested hearings. For these COL applications, the Commission concluded that, although it found that the staff's review of the squib valve issues was rigorous, it had a concern similar to that initially raised by the Advisory Committee on Reactor Safeguards regarding the status of the IST and inspection program for this component. As such, the Commission imposed a license condition for each COL that directs the implementation of a surveillance program for squib valves at VEGP Units 3 and 4

and VCSNS Units 2 and 3, with the specific requirements described in the Commission orders authorizing issuance of the VEGP and VCSNS COLs.

The squib valves subject to the surveillance program license condition under the VEGP and VCSNS COLs are part of the AP1000 certified design, and the same squib valves are specified in the Turkey Point Units 6 and 7 COL application. Therefore, the staff determined that it was appropriate to apply the same surveillance program license condition to the Turkey Point Units 6 and 7 squib valves.

The surveillance program is established to provide reasonable assurance that the Turkey Point Units 6 and 7 squib valves are operational and ready to perform their safety function. The staff-proposed license condition follows the precedent set in the VEGP and VCSNS COLs (ADAMS Accession Nos. ML113540620 and ML113420105) to require such a surveillance program.

3.9.6.5 *Post-Combined License Activities*

The license condition language in this section has been clarified from previously considered language. In a letter dated April 8, 2016 (ADAMS Accession No. ML16103A507), the applicant did not identify any concerns with the clarified license condition language. The changes do not affect the staff's above analysis of the conditions, and therefore, for the reasons discussed in the technical evaluation section above, the staff finds the following license conditions acceptable:

- License Condition (3-5) – Before initial fuel load, the licensee shall implement (1) the Preservice Testing Program and (2) the MOV Testing Program.

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

- License Condition (3-7) – Before initial fuel load, the licensee shall implement a surveillance program for explosively actuated valves (squib valves) that includes the following provisions in addition to the requirements specified in the edition of the ASME OM Code as incorporated by reference in 10 CFR 50.55a.

  a. Preservice Testing

  All explosively actuated valves shall be preservice tested by verifying the operational readiness of the actuation logic and associated electrical circuits for each explosively actuated valve with its pyrotechnic charge removed from the valve. This must include confirmation that sufficient electrical parameters (voltage, current, resistance) are available at the explosively actuated valve from each circuit that is relied upon to actuate the valve. In addition, a sample of at least 20 percent of the pyrotechnic charges in all explosively actuated valves shall be tested in the valve or a qualified test fixture to confirm the capability of each sampled pyrotechnic charge to provide the necessary

motive force to operate the valve to perform its intended function without damage to the valve body or connected piping. The sampling must select at least one explosively actuated valve from each redundant safety train. Corrective action shall be taken to resolve any deficiencies identified in the operational readiness of the actuation logic or associated electrical circuits, or the capability of a pyrotechnic charge. If a charge fails to fire or its capability is not confirmed, all charges with the same batch number shall be removed, discarded, and replaced with charges from a different batch number that has demonstrated successful 20 percent sampling of the charges.

b. Operational Surveillance

Explosively actuated valves shall be subject to the following surveillance activities after commencing plant operation:

(1) At least once every 2 years, each explosively actuated valve shall undergo visual external examination and remote internal examination (including evaluation and removal of fluids or contaminants that may interfere with operation of the valve) to verify the operational readiness of the valve and its actuator. This examination shall also verify the appropriate position of the internal actuating mechanism and proper operation of remote position indicators. Corrective action shall be taken to resolve any deficiencies identified during the examination with post-maintenance testing conducted that satisfies the preservice testing requirements.

(2) At least once every 10 years, each explosively actuated valve shall be disassembled for internal examination of the valve and actuator to verify the operational readiness of the valve assembly and the integrity of individual components and to remove any foreign material, fluid, or corrosion. The examination schedule shall provide for both of the 2 valve designs used for explosively actuated valves at the facility to be included among the explosively actuated valves to be disassembled and examined every 2 years. Corrective action shall be taken to resolve any deficiencies identified during the examination with post-maintenance testing conducted that satisfies the preservice testing requirements.

(3) For explosively actuated valves selected for test sampling every 2 years in accordance with the ASME OM Code, the operational readiness of the actuation logic and associated electrical circuits shall be verified for each sampled explosively actuated valve following removal of its charge. This must include confirmation that sufficient electrical parameters (voltage, current, resistance) are available for each valve actuation circuit. Corrective action shall be taken to resolve any deficiencies identified in the actuation logic or associated electrical circuits.

(4) For explosively actuated valves selected for test sampling every 2 years in accordance with the ASME OM Code, the sampling must select at least 1 explosively actuated valve from each redundant safety train. Each sampled pyrotechnic charge shall be tested in the valve or a qualified test fixture to confirm the capability of the charge to provide the necessary motive force to operate the valve to perform its intended function without damage to the valve body or connected piping. Corrective action shall be taken to resolve any deficiencies identified in the capability of a pyrotechnic charge in accordance with the preservice testing requirements.

This license condition shall expire upon (1) incorporation of the above surveillance provisions for explosively actuated valves into the facility's IST program, or (2) incorporation of IST requirements for explosively actuated valves in new reactors (i.e., plants receiving a construction permit, or COL for construction and operation, after January 1, 2000) to be specified in a future edition of the ASME OM Code as incorporated by reference in 10 CFR 50.55a, including any conditions imposed by the NRC, into the facility's IST program.

3.9.6.6 *Conclusion*

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the design-related information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements. The results of the staff's review of the material in the AP1000 DCD related to the IST operational program for pumps, valves, and dynamic restraints are in this SER section.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR is acceptable and meets the guidance in Section 3.9.6 of NUREG-0800 and in RG 1.206. The staff based its conclusion on the following:

- PTN DEP 6.4-2, related to design changes affecting how the temperature and humidity in the main control room are maintained within the limits for reliable human performance, is reviewed and found acceptable by the staff in Section 21.3 of this SER.

- STD COL 3.9-4, regarding the operational program for pumps, valves, and dynamic restraints is acceptable because the requirements of 10 CFR 52.79(a) are satisfied.

3.9.7 Integrated Head Package

AP1000 DCD, Section 3.9.7, describes the integrated head package (IHP). The IHP combines several components in one assembly to simplify refueling the reactor. The IHP includes a lifting rig, seismic restraints for CRDM, support for reactor head vent piping, cable bridge, power cables, cables for in-core instrumentation, cable supports, and shroud assembly. The IHP provides the ability to rapidly disconnect cables, including the CRDM power cables, digital rod position indication cables, and in-core instrument cables from the components.

Section 3.9 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference, with no departures or supplements, Section 3.9.7, "Integrated Head Package," of Revision 19 of the AP1000 DCD. The NRC staff reviewed the application and checked the referenced DCD to ensure that no issue relating to this section remained for review.[1] On the basis of its review, the staff confirms that there is no outstanding issue related to this section. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

3.10 Seismic and Dynamic Qualification of Mechanical and Electrical Equipment

3.10.1 Introduction

Seismic and dynamic qualification of seismic Category I equipment includes the following types:

- safety-related active mechanical equipment that performs a mechanical motion while accomplishing a system safety-related function (e.g., pumps, valves, and valve operators)
- safety-related, nonactive mechanical equipment whose mechanical motion is not required while accomplishing a system safety-related function, but whose structural integrity must be maintained in order to fulfill its design safety-related function
- safety-related instrumentation and electrical equipment and certain monitoring equipment

Mechanical and electrical equipment (including instrumentation and controls), and where applicable, their supports classified as seismic Category I must demonstrate that they are capable of performing their intended safety-related functions under the full range of normal and accident (including seismic) loadings. This equipment includes devices associated with systems essential to safe shutdown, containment isolation, reactor core cooling, and containment and reactor heat removal, or is otherwise essential in preventing significant release of radioactive material to the environment or in mitigating the consequences of accidents.

The criteria for the seismic and dynamic qualification include the following considerations:

- adequacy of seismic and dynamic qualification input motions
- methods and procedures for qualifying electrical equipment, instrumentation, and mechanical components
- methods and procedures for qualifying supports of electrical equipment, instrumentation, and mechanical components
- documentation

3.10.2 Summary of Application

Section 3.10 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.10 of the AP1000 DCD, Revision 19.

Section 3.10 of the Turkey Point Units 6 and 7 COL FSAR does not include any COL information items or supplemental information related to AP1000 DCD, Section 3.10.

3.10.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations for the seismic and dynamic qualification of mechanical and electrical equipment are given in Section 3.10, Revision 3, of NUREG-0800.

3.10.4 Technical Evaluation

The NRC staff reviewed Section 3.10 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the seismic and dynamic qualification program. The results of the NRC staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER for the reference COL application (VEGP, Units 3 and 4) were equally applicable to the Turkey Point Units 6 and 7 COL application, the staff undertook the following reviews:

- The staff compared the VEGP COL FSAR, Revision 5, to the Turkey Point Units 6 and 7 COL FSAR. In performing this comparison, the staff considered changes made to the Turkey Point Units 6 and 7 COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff completed its review and finds the evaluation performed for the standard content to be directly applicable to the Turkey Point Units 6 and 7 COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting.

The following portion of this technical evaluation section is reproduced from Section 3.10.4 of the VEGP SER:

> *Implementation Program*
>
> *In RAI 3.10-1, dated August 7, 2008, the applicant was requested to provide an implementation program, including milestones and completion dates with appropriate information submitted with sufficient time for staff review and approval prior to installation of the equipment, not prior to fuel loading, in accordance with Section C.I.3.10.4 of RG 1.206.*

In its response, the applicant stated that details of the implementation milestones for the seismic and dynamic qualification program are not currently available, and are not expected to be available until after a detailed construction schedule of the plant has been developed. Appropriate scheduling information will be provided, when available, to the NRC as necessary to support timely completion of their inspection and audit functions. Additionally, seismic and dynamic qualification is the subject of ITAAC, and 10 CFR 52.99(a) does not require that a schedule for implementing ITAAC be provided to the NRC until one year after issuance of the COL.

The NRC staff determined that the applicant's response to RAI 3.10-1 is not adequate because, in accordance with Section C.I.3.10.4 of RG 1.206, if the results of seismic and dynamic qualification is not available at the time of the COL application, the applicant is expected to submit the following before the issuance of the combined license: (1) descriptions of the implementation program such as identification of seismic qualification methods (Testing or Analysis) for each type of equipment; and (2) milestones for when the different aspects of the seismic qualification program will be complete - dates or condition should be such that the NRC staff will be able to audit the qualification results prior to the installation of the equipment (not before fuel loading as part of the ITAAC program). This is ***Open Item 3.10-1.***

Resolution of Open Item 3.10-1

In its responses dated February 5, 2010 and April 2, 2010, the VEGP applicant submitted a table providing the planned methods of seismic qualification for safety-related, seismic Category I equipment types listed in AP1000 DCD, Chapter 3, Table 3.2-3. Furthermore, the applicant stated that the seismic qualification packages will be available to the NRC as necessary to support timely completion of its inspection and audit functions. Because not all packages are expected to be completed within a year of the issuance of the COL (or at the start of construction as defined in 10 CFR 50.10(a), whichever is later), a schedule for the availability of the seismic qualification packages will be included with the schedule information for closure of ITAAC (as required by 10 CFR 52.99(a)). The staff finds the applicant's response acceptable, and Open Item 3.10-1 is closed. The incorporation of the planned changes to the VEGP COL FSAR will be tracked as ***Confirmatory Item 3.10-1****.*

Resolution of Standard Content Confirmatory Item 3.10-1

Confirmatory Item 3.10-1 is an applicant commitment to revise its FSAR to address seismic qualification for Category I equipment. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.10-1 is now closed.

3.10.5 Post-Combined License Activities

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

3.10.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

The staff compared the information in the application to the relevant NRC regulations and the acceptance criteria in Section 3.10 of NUREG-0800. The staff's review confirmed that the applicant has adequately addressed the seismic qualification of equipment in accordance with the requirements of GDC 2, GDC 4, and GDC 14.

3.11 Environmental Qualification of Mechanical and Electrical Equipment

3.11.1 Introduction

The objectives of environmental qualification (EQ) are to reduce the potential for common failure due to specified environmental and seismic events and to demonstrate that equipment within the scope of the EQ Program is capable of performing its intended design safety function under all conditions including environmental stresses resulting from design bases events. The information presented includes identification of the equipment required to be environmentally qualified and, for each item of equipment, the designated functional requirements, definition of the applicable environmental parameters, and documentation of the qualification process employed to demonstrate the required environmental capability. During plant operation, the licensee implements the EQ Program, which specifies the replacement frequencies of affected safety-related equipment in harsh environments, and nonsafety-related equipment whose failure under the postulated environmental conditions could prevent satisfactory performance of the safety functions of the safety-related equipment, and certain post-accident monitoring equipment. The seismic qualification of mechanical and electrical equipment is presented in Section 3.10. The portions of post-accident monitoring equipment required to be environmentally qualified are identified in AP1000 DCD, Table 7.5-1.

RG 1.206 discusses the Commission's position provided in SECY-05-0197, that operational programs should be fully described in COL applications to avoid the need to specify ITAAC for those programs. The applicant relies on the Turkey Point Units 6 and 7 COL application with its incorporation by reference of the AP1000 DCD and supplemental information to fully describe the EQ and other related operational programs in support of the COL application for Turkey Point Units 6 and 7.

3.11.2 Summary of Application

Section 3.11 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Section 3.11 of the AP1000 DCD, Revision 19. Section 3.11 of the AP1000 DCD describes the EQ Program for electrical and mechanical equipment to be used in the AP1000 certified design.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Section 3.11, the applicant provided the following:

Departures

- PTN DEP 3.11-1

The applicant provided additional information about PTN DEP 3.11-1 in Section 3.11.5 of the FSAR, related to the "Environmental Zone" for three spent fuel pool level instruments (SFS-JE-LT 019A, SFS-JE-LT 019B, and SFS JE LT 019C) from AP1000 DCD, Table 3.11-1, "Environmentally Qualified Electrical and Mechanical Equipment," (Sheet 14 of 51) to correct the location of those instruments.

- PTN DEP 6.4-2

The applicant provided additional information in Tables 3.11-1R, 3I.6-2R, and 3I.6-3R and in Figure 3D.5-1R of the Turkey Point Units 6 and 7 COL FSAR about PTN DEP 6.4-2 related to design changes affecting how the temperature and humidity in the main control room are maintained within the limits for reliable human performance. This information, as well as related PTN DEP 6.4-2 information appearing in other chapters of the FSAR, is reviewed in Section 21.3 of this SER.

AP1000 COL Information Item

- STD COL 3.11-1

In Turkey Point Units 6 and 7 COL FSAR, Section 3.11.5, "Combined License Information Item for Equipment Qualification File," the applicant provided additional information to address COL Information Item 3.11-1 (COL Action Item 3.11.2-1) regarding administrative control of the EQ Program for Turkey Point Units 6 and 7.

License Conditions

- Part 10, License Condition 3, Item G1

The applicant proposed a license condition providing the implementation milestone for the EQ Program.

- Part 10, License Condition 6

The applicant proposed a license condition to provide a schedule to support the NRC's inspection of operational programs, including the EQ Program.

3.11.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations for the EQ of mechanical and electrical equipment are given in Section 3.11, Revision 3, of NUREG-0800.

The applicable regulatory requirements for the Operational EQ Program are as follows:

10 CFR 52.79(a)(10) requires that a COL application provide a description of the program, and its implementation, required by 10 CFR 50.49(a) for the EQ of electric equipment important to safety and the list of electric equipment important to safety that is required by 10 CFR 50.49(d).

10 CFR 52.79(a)(29)(i) requires that a COL application provide plans for conduct of normal operations, including maintenance, surveillance, and periodic testing of SSCs.

RG 1.206 provides guidance for a COL applicant in preparing and submitting its COL application in accordance with the NRC regulations. For example, Section C.IV.4 in RG 1.206 discusses the requirement in 10 CFR 52.79(a) for descriptions of operational programs that need to be included in the FSAR for a COL application to allow a reasonable assurance finding of acceptability. In particular, a COL applicant should fully describe EQ and other operational programs as defined in Commission Paper SECY-05-0197 to avoid the need for ITAAC for the implementation of those programs. The term "fully described" for an operational program should be understood to mean that the program is clearly and sufficiently described in terms of scope and level of detail to allow a reasonable assurance finding of acceptability. Further, operational programs should be described at a functional level and an increasing level of detail where implementation choices could materially and negatively affect the program effectiveness and acceptability. The Commission approved the use of a license condition for operational program implementation milestones that are fully described or referenced in the FSAR as discussed in the SRM for SECY-05-0197, dated February 22, 2006.

3.11.4 Technical Evaluation

The NRC staff reviewed Section 3.11 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the EQ of mechanical and electrical equipment. The results of the NRC staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and use this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER for the reference COL application (VEGP, Units 3 and 4) were equally applicable to the Turkey Point Units 6 and 7 COL application, the staff undertook the following reviews:

- The staff compared the VEGP COL FSAR, Revision 5, to the Turkey Point Units 6 and 7 COL FSAR. In performing this comparison, the staff considered changes made to the Turkey Point Units 6 and 7 COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff completed its review and finds the evaluation performed for the standard content to be directly applicable to the Turkey Point Units 6 and 7 COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting.

Departure

- PTN DEP 3.11-1

In Turkey Point Units 6 and 7 COL FSAR, Table 3.11-1R, the applicant included a departure of "Environmental Zone" for three spent fuel pool level instruments (SFS-JE-LT019A, SFS-JE-LT019B, and SFS-JE-LT019C) from AP1000 DCD, Table 3.11-1, "Environmentally Qualified Electrical and Mechanical Equipment," (Sheet 14 of 51) to correct the location of those instruments. This change updates DCD Table 3.11-1 and addresses the spent fuel pool level instruments concern related to the Fukushima Lessons Learned report. All the aforementioned instruments currently shown in an Environmental Zone (number) 11 will change (i.e., SFS-JE-LT019A to Environmental Zone 6, SFS-JE-LT019B to Environmental Zone 7, and SFS-JE-LT019C to Environmental Zone 6) in the proposed DCD Table 3.11-1.

The staff reviewed the departure that corrects the location of three spent fuel pool level instruments (i.e., Environmental Zone from 11 to 6 and 7). The staff finds that the above corrections do not result in any changes in the environmental qualification requirements (i.e., environment, "Function," "Operating Time Required," and "Qualification Program"). Thus, the staff concludes the departure is acceptable.

The following portion of this technical evaluation section is reproduced from Section 3.11.4 of the VEGP SER:

> *AP1000 COL Information Item*
>
> - *STD COL 3.11-1*
>
> *The COL information item for the EQ file in Section 3.11.5 of the AP1000 DCD, states:*
>
> > *Westinghouse Electric Company LLC will act as the agent for the COL holder during the equipment design phase, equipment selection and procurement phase, equipment qualification phase, plant construction phase, and ITAAC inspection phases.*
> >
> > *The COL holder will define the process and procedures for which the equipment qualification files will be accepted from Westinghouse and how the files will be retained and maintained in an auditable format for the period that the equipment is installed and/or stored for future use in the nuclear power plant.*

This commitment was also captured as COL Action Item 3.11.2-1 in the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *Pursuant to 10 CFR 50.49(j), the COL applicant shall keep the list and information in the file current and retain the file in auditable form for the entire period during which the covered item is installed in the nuclear power plant or is stored for the future use to permit verification that each item of electrical equipment important to safety (1) is qualified for its application, and (2) meets its specified performance requirements. To conform with 10 CFR 50.49, electrical equipment for PWRs referencing the AP1000 design should be qualified according to the criteria in Category I of NUREG-0588 and Revision 1 of RG 1.89.*

This commitment was also listed as COL Action Item 3.11.2-1 in Appendix F of the NRC staff's FSER for the AP1000 DCD (NUREG-1793), which states:

> *The COL applicant is responsible for maintaining the equipment qualification file during the equipment selection and procurement phase.*

In STD COL 3.11-1, the applicant describes under "Combined License Information Item for Equipment Qualification File," that the COL holder is responsible for the maintenance of the equipment qualification file. The NRC staff reviewed STD COL 3.11-1 related to equipment qualification file included under Section 3.11.5 of the BLN COL. The NRC staff's evaluation is as follows.

Section 3.11.5 of the BLN COL FSAR states that the COL holder is responsible for the maintenance of the equipment qualification file upon receipt from the reactor vendor. EQ files developed by the reactor vendor are maintained as applicable for equipment and certain post-accident monitoring devices that are subject to a harsh environment. The files are maintained for the operational life of the plant.

The Environmental Qualification Master Equipment List (EQMEL) identifies the electrical and mechanical equipment or components that must be environmentally qualified for use in a harsh environment. The BLN COL FSAR states that the EQMEL and a summary of equipment qualification results are maintained as part of the equipment qualification file for the operational life of the plant. Administrative programs are in place to control revision to the EQ files and the EQMEL. When adding or modifying components in the EQ Program, EQ files are generated or revised to support qualification. The EQMEL is revised to reflect these new components. Plant modifications and design basis changes are subject to change process reviews, e.g., reviews in accordance with 10 CFR 50.59 or Section VIII of Appendix D to 10 CFR Part 52, in accordance with appropriate plant procedures. Any changes to the EQMEL that are not the result of a modification or design basis change are subject to a separate review that is accomplished and documented in accordance with plant procedures.

Based on the above, the NRC staff concludes that the COL applicant would keep the equipment qualification file and information in the file current and retain the file in an auditable form for the entire period during which the covered item is installed in the nuclear power plant or is stored for the future use to permit verification that each item of electrical equipment important to safety: (1) is qualified for its application; and (2) meets its specified performance requirements. This is consistent with 10 CFR 50.49(j) and acceptable.

In addition, the staff requested additional information related to specific implementation of this program, which is discussed below.

BLN COL FSAR Section 3.11 incorporates by reference AP1000 DCD Tier 2, Section 3.11.2.2, "Environmental Qualification of Mechanical Equipment," in the AP1000 DCD, which references Appendix 3D, "Methodology for Qualifying AP1000 Safety-Related Electrical and Mechanical Equipment." In RAI 3.11-1, the NRC staff requested that the applicant describe in more detail the EQ Program for safety-related mechanical equipment to be used at BLN Units 3 and 4. In its response, the applicant stated that the EQ Program will be performed as described in Section 3.11 and Appendix 3D of the AP1000 DCD, by reference as stated in the BLN COL FSAR. The EQ Program will be implemented through design specifications, equipment procurement documents, and equipment qualification procedures. Equipment qualification specifications and equipment design specifications will be developed based on the AP1000 EQ requirements. The incorporation of the AP1000 DCD, Section 3.11 and Appendix 3D into the BLN COL FSAR also includes future maintenance, surveillance, and replacement activities to maintain EQ over the life of the BLN plant through operational programs and procedures. AP1000 DCD, Table 3.11-1 provides a listing of the safety-related mechanical equipment, its location, and the environment to be considered in the EQ Program. AP1000 DCD, Appendix 3D, describes: (1) qualification methodology for the critical safety-related nonmetallic sub-components; (2) thermal and radiation information for the nonmetallic components used in safety-related mechanical equipment; (3) plant normal, abnormal, and accident environmental parameters; and (4) documentation requirements. On October 14 and 15, 2008, the NRC staff conducted an onsite review of design and procurement specifications, including EQ, for pumps, valves, and dynamic restraints to be used for the AP1000 reactor at the Westinghouse offices in Monroeville, PA. The staff found that Westinghouse had included ASME Standard QME-1-2007, "Qualification of Active Mechanical Equipment Used in Nuclear Power Plants," in its design and procurement specifications for AP1000 components, including ASME QME-1, Appendix QR-B, "Guide for Qualification of Nonmetallic Parts." At the conclusion of the onsite review, the staff provided comments on the AP1000 design procurement specifications, and Westinghouse indicated that those comments would be addressed in a future revision to the specifications. The staff also identified several items that remain open from the onsite review that are specified in Section 3.9.6 of the SER on the AP1000 DCD revision. As noted in Section 3.9.6 of the BLN COL FSAR, the NRC staff documented the results of the on-site review with follow-up items in a memorandum dated November 6, 2008, (ML083110154). ***This is Open Item 3.11-1.***

Section 3D.6.2.3, "Analysis of Safety-Related Mechanical Equipment," in the AP1000 DCD, Appendix 3D, summarizes the EQ of safety-related mechanical equipment by analysis methods, but does not discuss implementation of the EQ approach. In RAI 3.11-2, the NRC staff requested that the applicant discuss the implementation of the EQ approach, including the application of industry standards, prescribed in Section 3D.6.2.3 in Appendix 3D to Chapter 3 in the AP1000 DCD. In its response to this RAI, the applicant stated that equipment qualification specifications and equipment design specifications have been developed based on the AP1000 DCD EQ requirements. The applicant stated that these procurement documents reference ASME QME-1 and Institute of Electrical and Electronic Engineers (IEEE) Standard 323 for the EQ of active safety-related mechanical equipment. As noted above, the NRC staff conducted an onsite review of the Westinghouse design and procurement specifications for the AP1000 components on October 14 and 15, 2008. The issues in this RAI are being addressed under ***Open Item 3.11-1****. Therefore, RAI 3.11-2 is closed.*

AP1000 DCD, Appendix 3D, Section 3D.6.3, "Operating Experience in the Equipment Qualification Program," states that the COL applicant will provide documentation of the EQ methodology where seismic experience data are used. In RAI 3.11-3, the NRC staff requested that the applicant discuss the documentation of the EQ methodology where seismic experience data are used. In its response to this RAI, the applicant stated that Westinghouse would revise the AP1000 DCD to resolve this issue. Revision 17 to the AP1000 DCD, Appendix 3D, Section 3D.6.3 specifies that qualification by experience is not employed in the AP1000 equipment qualification program as a method of qualification. The applicant revised the BLN COL FSAR to reflect the revision to the AP1000 DCD. Therefore, RAI 3.11-3 is resolved.

The section titled "In-Service Vibration" in Section B.4.5, "External Stresses," in Attachment B, "Aging Evaluation Program," to Appendix 3D to Chapter 3 in the AP1000 DCD, states that inservice pipe and FIV may be significant for line-mounted equipment. As a consequence, the section states that an additional vibration aging step is included in the aging sequence. Operating experience has revealed that FIV from acoustic resonance and hydraulic loading can adversely impact safety-related mechanical equipment at nuclear power plants. The COL applicant will demonstrate the performance of this additional vibration aging step specified in the AP1000 DCD in the EQ of safety-related mechanical equipment to be used at BLN Units 3 and 4. This technical issue is addressed in Section 3.9.6 of this SER.

<u>License Conditions</u>

Section 3, "Operational Program Implementation," in Part 10 of the BLN COL application provides proposed license conditions for operational program implementation. One specified license condition is that the EQ Program will be implemented prior to initial fuel loading. In addition, Section 6 in Part 10 provides a proposed license condition for operational program readiness that requires the licensee to submit a schedule no later than 12 months after COL issuance that supports planning and conducting NRC inspections of operational programs with

periodic updating. These license conditions are consistent with the policy established in SECY-05-0197 and are, thus, acceptable.

Resolution of Standard Content Open Item 3.11-1

Standard Content Open Item 3.11-1 resulted from the identification of items that remained open from the October 14 and 15, 2008, onsite review at Westinghouse offices of design and procurement specifications, including EQ, for pumps, valves, and dynamic restraints to be used for the AP1000 reactor. As noted in Section 3.9.6.4 of the BLN COL FSAR, the NRC staff documented the results of the onsite review with follow-up items in a memorandum dated November 6, 2008. In a letter dated December 14, 2009, the VEGP applicant stated that it had not identified any specific actions for the VEGP COL application based on the audit open items. The NRC staff's discussion of the audit of the EQ specifications, which includes the issues in RAI 3.11-2 addressed to the BLN applicant, is in NUREG-1793 and its supplements. Therefore, Standard Content Open Item 3.11-1 is resolved for the VEGP COL application.

Supplemental Review of Operational Aspects of the EQ Program

As discussed in RG 1.206 and Commission Paper SECY-05-0197, COL applicants must fully describe their operational programs to avoid the need for ITAAC regarding those programs. In addition to the initial EQ of electrical and mechanical equipment, the NRC staff reviewed the VEGP COL FSAR Section 3.11 with its incorporation by reference of the AP1000 DCD and supplemental information for operational aspects of the EQ Program. For example, AP1000 DCD Tier 2, Appendix 3D, Section 3D.7, "Documentation," states that information regarding maintenance, refurbishment, or replacement of the equipment will be included in the equipment qualification package if necessary to provide confidence in the equipment's capability to perform its safety function. Further, Section 3D.7.1, "Equipment Qualification Data Package," states that equipment qualification data packages will specify preventive maintenance that is required to support qualification or the qualified life, including maintenance or periodic activities assumed as part of the qualification program or necessary to support qualification. With respect to safety-related mechanical equipment, AP1000 DCD Tier 2, Section 3D.6.2.3.8, "Equipment Qualification Maintenance Requirements," specifies that maintenance requirements resulting from EQ activities will be based on: (1) qualification evaluation results (for example, periodic replacement of age-susceptible parts before the end of their qualified life); (2) equipment qualification-related maintenance activities derived from the qualification report; and (3) vendor recommended equipment qualification maintenance, if required, in order to maintain qualification. The staff finds that the VEGP COL applicant provides an acceptable description of the transition from the initial to the operational aspects of the EQ Program in support of the VEGP COL application through the VEGP COL FSAR with its incorporation by reference of the AP1000 DCD Tier 2, Section 3.11. The NRC staff will evaluate the implementation of the EQ Program through inspections conducted during plant construction and operation. The NRC inspection activities will include consideration of: (1) evaluation of EQ results for design life to establish activities

to support continued EQ; (2) determination of surveillance and preventive maintenance activities based on EQ results; (3) consideration of EQ maintenance recommendations from equipment vendors; (4) evaluation of operating experience in developing surveillance and preventive maintenance activities for specific equipment; (5) development of plant procedures that specify individual equipment identification, appropriate references, installation requirements, surveillance and maintenance requirements, post-maintenance testing requirements, condition monitoring requirements, replacement part identification, and applicable design changes and modifications; (6) development of plant procedures for reviewing equipment performance and EQ operational activities, and for trending the results to incorporate lessons learned through appropriate modifications to the EQ Program; and (7) development of plant procedures for the control and maintenance of EQ records.

Based on the above discussion, the NRC staff finds the information added to the VEGP COL application as part of STD COL 3.11-1 to be acceptable.

License Conditions

- *Part 10, License Condition 3, Item G1*

The applicant proposed a license condition providing the implementation milestone for the EQ Program.

- *Part 10, License Condition 6*

The applicant proposed a license condition to provide a schedule to support the NRC's inspection of operational programs including the EQ Program.

These license conditions are consistent with the policy established in SECY-05-0197 and are, thus, acceptable.

3.11.5 Post-Combined License Activities

The license condition language in this section has been clarified from previously considered language. In a letter dated April 8, 2016 (ADAMS Accession No. ML16103A507), the applicant did not identify any concerns with the clarified license condition language. The changes do not affect the staff's above analysis of the conditions, and therefore, for the reasons discussed in the technical evaluation section above, the staff finds the following license conditions acceptable:

- License Condition (3-8) – Before initial fuel load, the licensee shall implement the EQ Program.

- License Condition (3-9) – No later than 12 months after issuance of the COL, the licensee shall submit to the Director of NRO a schedule that supports planning for and conduct of NRC inspections of the EQ Program. The schedule shall be updated every 6 months until 12 months before scheduled fuel loading, and every month thereafter until the EQ Program has been fully implemented.

3.11.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL FSAR is acceptable and meets the guidance in Section 3.11 of NUREG-0800 and in RG 1.206. The staff based its conclusion on the following:

- PTN DEP 3.11-1, regarding a correction to the Environmental Zone designation for three level instruments for the spent fuel pool, is acceptable because the correction does not result in any changes in the environmental qualification requirements applicable to the instruments.

- PTN DEP 6.4-2, related to design changes affecting how the temperature and humidity in the main control room are maintained within the limits for reliable human performance, is reviewed and found acceptable by the staff in Section 21.3 of this SER.

- STD COL 3.11-1, regarding the administrative control of the EQ Program for Turkey Point Units 6 and 7, is acceptable because the requirements of 10 CFR 52.79(a)(10) and 10 CFR 52.79(a)(29)(i) are satisfied.

3.12 Piping Design (Related to RG 1.206, Section C.III.1, Chapter 3, C.I.3.12, "Piping Design Review")

3.12.1 Introduction

This section covers the design of the piping system and piping support for seismic Category I, Category II, and nonsafety systems. It also discusses the adequacy of the structural integrity, as well as the functional capability, of the safety-related piping system, piping components, and their associated supports. The design of piping systems should ensure that they perform their safety-related functions under all postulated combinations of normal operating conditions, system operating transients, postulated pipe breaks, and seismic events. This includes pressure-retaining piping components and their supports, buried piping, instrumentation lines, and the interaction of NS Category I piping and associated supports with seismic Category I piping and associated supports. This section covers the design transients and resulting loads and load combinations with appropriate specified design and service limits for seismic Category I piping and piping support, including those designated as ASME Code Classes 1, 2, and 3.

3.12.2 Summary of Application

Chapter 3 of the Turkey Point Units 6 and 7 COL FSAR, Revision 8, incorporates by reference Chapter 3 of the AP1000 DCD, Revision 19. Sections 3.7 and 3.9 of the AP1000 DCD address

Section 3.12, “ASME Code Class 1, 2, and 3 Piping Systems, Piping Components and Their Associated Supports” of NUREG-0800.

In addition, in Turkey Point Units 6 and 7 COL FSAR, Sections 3.7 and 3.9, the applicant provided the following:

Supplemental Information

- PTN SUP 3.7-1

PTN SUP 3.7-1 adds a new Section 3.7.1.1.1 to demonstrate that the AP1000 DCD design values for the CSDRS and HRHF response spectra are acceptable for the Turkey Point Units 6 and 7 site.

AP1000 COL Information Items

- STD COL 3.9-2

The applicant provided additional information in STD COL 3.9-2 to address COL Information Item 3.9-2, which states that design specifications and design reports for the ASME Code, Section III, piping will be available for the NRC’s review and that reconciliation of these documents is completed after construction and prior to fuel load.

- STD COL 3.9-5

The applicant provided additional information in STD COL 3.9-5 to address COL Information Item 3.9-5, which provides a description for pressurizer surge line monitoring.

- STD COL 3.9-7

In its letter dated November 15, 2010, the applicant endorsed the letter dated April 23, 2010, from the VEGP applicant, that proposed to add STD COL 3.9-7 to the FSAR. This COL item provides additional information on the process to be used to complete the piping design and ITAAC added to verify the design.

License Condition

- Part 10, License Condition 2, Item 3.9-7

In its letter dated November 15, 2010, the applicant endorsed the letter dated April 23, 2010, from the VEGP applicant, that proposed a license condition addressing the as-designed piping analysis completion schedule.

ITAAC

The applicant incorporated the information endorsed in the letter dated April 23, 2010, from the VEGP applicant, that proposed ITAAC requiring the completion of a design report referencing the as-designed piping calculation packages, including the ASME Code, Section III, piping

analysis, support evaluations, and piping component fatigue analysis for Class 1 piping using the methods and criteria outlined in AP1000 DCD, Table 3.9-19.

3.12.3 Regulatory Basis

The regulatory basis of the information incorporated by reference is addressed in NUREG-1793 and its supplements.

In addition, the acceptance criteria associated with the relevant requirements of the NRC regulations for the pipe and support analysis are given in Section 3.12, Revision 1, of NUREG-0800.

3.12.4 Technical Evaluation

The NRC staff reviewed Section 3.9 of the Turkey Point Units 6 and 7 COL FSAR and checked the referenced DCD to ensure that the combination of the DCD and the COL application represents the complete scope of information relating to this review topic.[1] The NRC staff's review confirmed that the information in the application and incorporated by reference addresses the required information relating to the piping design review. The results of the NRC staff's evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

Section 1.2.3 of this SER provides a discussion of the strategy used by the NRC to perform one technical review for each standard issue outside the scope of the DC and uses this review in evaluating subsequent COL applications. To ensure that the staff's findings on standard content that were documented in the SER for the reference COL application (VEGP, Units 3 and 4) were equally applicable to the Turkey Point Units 6 and 7 COL application, the staff undertook the following reviews:

- The staff compared the VEGP COL FSAR, Revision 5, to the Turkey Point Units 6 and 7 COL FSAR. In performing this comparison, the staff considered changes made to the Turkey Point Units 6 and 7 COL FSAR (and other parts of the COL application, as applicable) resulting from RAIs.

- The staff confirmed that all responses to RAIs identified in the corresponding standard content evaluation were endorsed.

- The staff verified that the site-specific differences were not relevant.

The staff completed its review and finds the evaluation performed for the standard content to be directly applicable to the Turkey Point Units 6 and 7 COL application. This standard content material is identified in this SER by use of italicized, double-indented formatting.

The following portion of this technical evaluation section is reproduced from Section 3.12.4 of the VEGP SER:

> *Due to the significant amount of new information provided by both the VEGP applicant and Westinghouse on the piping design issues since the development*

of the BLN SER for Section 3.12, the NRC staff decided not to use the BLN SER material as a starting point for the evaluation of these issues.

AP1000 COL Information Items

- *STD COL 3.9-2*

COL Information Item 3.9-2 states that design specifications and design reports for the ASME Code, Section III piping will be available for the NRC's review and that reconciliation of the piping is completed prior to fuel load in accordance with an ITAAC in AP1000 DCD Tier 1, Section 2. The discussion on STD COL 3.9-7 below addresses design specifications and design reports.

The staff acknowledged that an ITAAC in the AP1000 DCD Tier 1 addresses verification of this aspect of the design and that COL Information Item 3.9-2 has been addressed.

- *STD COL 3.9-5*

The staff reviewed STD COL 3.9-5 (surge line thermal monitoring) and determined that the proposed program did not provide sufficient information for the staff to determine reasonable assurance for safety. The staff issued RAI 3.12-2 to ask the applicant to provide additional information including a test abstract including stating the standard operating conditions in Chapter 14 that identifies the objective, prerequisites, test method, data required, and acceptance criteria for surge line thermal monitoring that complies with NRC Bulletin 88-11, "Pressurizer Surge Line Thermal Stratification." In this RAI, the staff also noted that:

> *For subsequent SCOLs, the design is such that assumptions are made that the layout will be the same such that monitoring of the follow-on plants is not required. However, all plants are required to comply with NRC Bulletin 88-11. Given that the heatup and cooldown procedures have not been developed and the affect on the plant, even with similar layout, will be different depending on the procedures used, subsequent plants will need to verify that they will be using the same heatup and cooldown procedures as the monitored plant to comply with NRC Bulletin 88-11.*

In a letter dated July 2, 2010, the applicant provided its response to address the staff's concern. In the response, the applicant stated that VEGP COL FSAR Section 3.9.3.1.2 would be revised to add the following paragraph:

> *Subsequent AP1000 plants (after the first AP1000 plant) confirm that the heatup and cooldown procedures are consistent with the pertinent attributes of the first AP1000 plant surge line monitoring. In addition, changes to the heatup and cooldown procedures consider the potential impact on stress and fatigue analyses consistent with the concerns of NRC Bulletin 88-11.*

In this letter, the applicant also added a new Section 14.2.9.2.22 to provide a test abstract. The test abstract included the purpose, prerequisites, general test methods, and acceptance criteria.

In a subsequent letter dated August 6, 2010, the applicant provided additional information for the location of test instruments. In the response, the applicant stated that VEGP COL FSAR Section 3.9.3.1.2 would be revised to add the following paragraph:

> *In addition to the existing permanent plant temperature instrumentation, temperature and displacement monitoring will be included at critical locations on the surge line. The additional locations utilized for monitoring during the hot functional testing and the first fuel cycle (see Subsection 14.2.9.2.22) are selected based on the capability to provide effective monitoring.*

The staff reviewed the RAI responses and concluded the position is acceptable to comply with NRC Bulletin 88-11. On this basis, the proposed program for surge line thermal monitoring is acceptable. The incorporation of the planned changes to the VEGP COL FSAR detailed in the applicant's July 2, 2010, and August 6, 2010, letters will be tracked as ***Confirmatory Item 3.12-1****.*

Resolution of Standard Content Confirmatory Item 3.12-1

Confirmatory Item 3.12-1 is an applicant commitment to revise its FSAR Table 1.9-204 and Sections 3.9.3.1.2 and 3.9.8.5 for surge line monitoring testing. The staff verified that the VEGP COL FSAR was appropriately updated. As a result, Confirmatory Item 3.12-1 is now closed.

- *STD COL 3.9-7*

In letter dated April 23, 2010, the applicant proposes that the as-designed piping analysis is made available for NRC review. Additionally in this letter, License Condition 2, Item 3.9-7, proposed by the applicant, calls for the design to be made available for review prior to installation of the piping and adding a site-specific ITAAC in Table 3.8-# [where # is the next sequential number] of Part 10 of the VEGP COL application for verification of the ASME Code design reports. In this letter, the applicant also proposed adding Section 14.3.3.# [where # is the next sequential number] to the VEGP COL FSAR, describing the process to be followed to address closure of the piping DAC during the construction period, to complete the review of the piping design including an ITAAC to review the design, and an ITAAC to review reconciliation of the design after it is built.

The staff reviewed the applicant's proposed approach of including ITAAC for verification of the design and reconciliation of the design, and a license condition to address timing of when the initial design verification would occur. The approach, including the ITAAC and the license condition, is acceptable to the staff as it allows verification that the methodology described in the AP1000 DCD

and VEGP COL FSAR and the general requirements of the ASME Code, as specified in 10 CFR 50.55a, were met.

Proposed VEGP COL FSAR Section 14.3.3.# [where # is the next sequential number] also states that "The piping design completed for the first standard AP1000 plant will be available to subsequent standard AP1000 plants under the "one issue, one review, one position" approach for closure." Westinghouse letter dated August 17, 2010, as supplemented by letter dated August 23, 2010, stated that the ASME Code Class 1, 2 and 3 piping systems will be evaluated as part of the piping DAC for hard rock site to address hard rock site seismic issue. The standard AP1000 plant will have analysis that addresses both CSDRS and HRHF GMRS effect. Therefore, the one issue, one review, one position approach applies and the staff finds this acceptable for piping analysis.

The incorporation of the planned changes to the VEGP COL application detailed in the applicant's April 23, 2010, letter and in response to hard rock seismic issues will be tracked as ***Confirmatory Item 3.12-2****.*

Resolution of Standard Content Confirmatory Item 3.12-2

Confirmatory Item 3.12-2 is an applicant commitment to revise its FSAR Table 1.8-202, Section 3.9.8.2, Section 3.9.8.7, and Section 14.3.3.3 for pipe analysis and add an ITAAC (Table 3.8-2) for verification of the ASME Code design reports. The staff verified that the VEGP COL FSAR and Part 10 of the application (ITAAC Table 3.8-2) were appropriately updated. As a result, Confirmatory Item 3.12-2 is now closed.

Supplemental Information

- PTN SUP 3.7-1

Section 3.7.1.1.1 of the Turkey Point Units 6 and 7 COL FSAR states that a comparison of the Turkey Point Units 6 and 7 site-specific GMRS to the HRHF spectra and CSDRS is provided in Figures 2.0-201 and 2.0-202. These figures demonstrate that the Turkey Point Units 6 and 7 site-specific GMRS is enveloped by the AP1000 HRHF spectra. On this basis, the staff determined that the piping design with HRHF spectra input can be applied to Turkey Point Units 6 and 7 with adequate design margin.

3.12.5 Post-Combined License Activities

The license condition language in this section has been clarified from previously considered language. In a letter dated April 8, 2016 (ADAMS Accession No. ML16103A507), the applicant did not identify any concerns with the clarified license condition language. The changes do not affect the staff's above analysis of the conditions, and therefore, for the reasons discussed in the technical evaluation section above, the staff finds the following ITAAC and license condition related to piping design analysis acceptable:

- The licensee shall perform and satisfy the piping design analysis ITAAC in SER Table 3-3.

- License Condition (3-10)—Before commencing installation of individual piping segments identified in AP1000 DCD, Revision 19, Section 3.9.8.7, and connected components in their final locations in the facility, the licensee shall complete the analysis of the as-designed individual piping segments and shall inform the Director of NRO, or the Director's designee, in writing, upon the completion of these analyses and the availability of the design reports for the selected piping packages.

3.12.6 Conclusion

The NRC staff reviewed the application and checked the referenced DCD. The staff's review confirmed that the applicant has addressed the required information relating to this section, and no outstanding information related to this section remains to be addressed in the Turkey Point Units 6 and 7 COL FSAR. The results of the NRC staff's technical evaluation of the information incorporated by reference in the Turkey Point Units 6 and 7 COL application are documented in NUREG-1793 and its supplements.

In addition, the staff concludes that the relevant information presented in the Turkey Point Units 6 and 7 COL application is acceptable and meets the NRC regulations. The staff based its conclusion on the following:

- STD COL 3.9-2 is acceptable because it meets the general requirements of the ASME Code, as specified by 10 CFR 50.55a.

- STD COL 3.9-5 is acceptable because it is consistent with pressurizer surge line monitoring discussed in 10 CFR Part 52, Appendix D, "Design Certification Rule for the AP1000 Design."

- STD COL 3.9-7 is acceptable because it meets the general requirements of the ASME Code, as specified by 10 CFR 50.55a.

- PTN SUP 3.7-1 is acceptable and meets the guidance in Section 3.12 of NUREG-0800 because the Turkey Point site-specific GMRS are enveloped by the HRHF spectra and, therefore, the AP1000 DCD design values for the CSDRS are acceptable for the Turkey Point site.

Table 3-3 Piping Design ITAAC

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
The ASME Code, Section III piping is designed in accordance with the ASME Code, Section III requirements.	Inspection of the ASME Code Design Reports (NCA-3550) and required documents will be conducted for the set of lines chosen to demonstrate compliance.	The ASME Code Design Report(s) (NCA-3550) (certified, when required by the ASME Code) exist and conclude that the design of the piping for lines chosen to demonstrate all aspects of the piping design complies with the requirements of the ASME Code section.