SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

RELATED TO AMENDMENT NO. 48

TO THE COMBINED LICENSE NO. NPF-93

AND LICENSE NO. NPF-94

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

VIRGIL C. SUMMER NUCLEAR STATION UNITS 2 AND 3

DOCKET NOS. 52-027 AND 52-028

1.0 INTRODUCTION

By letter dated December 17, 2015 (ADAMS Accession No. ML15351A452), and supplemented by letter dated January 11 and March 16, 2016 (ADAMS Accession Nos. ML16011A500 and ML16076A392), the South Carolina Electric & Gas Company, on behalf of itself and the South Carolina Public Service Authority (both hereafter called the licensee), requested that the U.S. Nuclear Regulatory Commission (NRC) amend Combined License (COL) Numbers NPF-93 and NPF-94 for Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3. The requested amendment proposes to depart from approved AP1000 Design Control Document (DCD) Tier 2 information, including Tier 2* information as incorporated into the VCSNS Units 2 and 3 Updated Final Safety Analysis Report (UFSAR) with respect to proposed changes to Wall 11, and also involves a change to a license condition.

The NRC staff issued a *Federal Register* notice of consideration of issuance of a license amendment, a proposed No Significant Hazard Determination, and an opportunity to request a hearing and petition for leave to intervene on February 2, 2016 (81 FR 5499). The supplements to the license amendment request, dated January 11 and March 16, 2016, provided additional information that did not change the scope or the conclusions of the proposed No Significant Hazard Determination.

2.0 REGULATORY EVALUATION

10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Appendix D, "Design Certification Rule for the AP1000 Design," Sections VIII.B.5.a and VIII.B.6 require prior NRC approval for changes to Tier 2* information that meet certain criteria specified in Section VIII.B.5. The proposed changes affect some information designated as Tier 2*. Accordingly, the changes require NRC's approval.

In addition the NRC staff considered the following regulatory requirements in reviewing the LAR that included proposed UFSAR changes:

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," General Design Criterion (GDC) 1, "Quality Standards and Records," requires that structures, systems, and components important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

10 CFR Part 50, Appendix A, GDC 1, "Quality Standards and Records," requires that Structures, Systems, and Components (SSCs) important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed.

10 CFR Part 50, Appendix A, GDC 2, "Design Bases for Protection Against Natural Phenomena," requires that structures, systems, and components 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.

10 CFR Part 50, Appendix A, GDC 4, "Environmental and Dynamic Effects Design Bases," requires that structures, systems, and components important to safety be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing and postulated accidents, including loss-of-coolant accidents.

10 CFR Part 50, Appendix A, GDC 19, "Control Room," requires that a control room be provided from which actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain it in a safe condition under accident conditions, including loss-of-coolant accidents. Adequate radiation protection shall be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body, or its equivalent to any part of the body, for the duration of the accident. Equipment at appropriate locations outside the control room shall be provided (1) with a design capability for prompt hot shutdown of the reactor, including necessary instrumentation and controls to maintain the unit in a safe condition during hot shutdown, and (2) with a potential capability for subsequent cold shutdown of the reactor through the use of suitable procedures.

3.0 TECHNICAL EVALUATION

3.1.1 Evaluation of Proposed Changes

3.1.1.1 Wall 11.2 Structural Changes

Wall 11 is the Northern perimeter wall of the Auxiliary Building adjacent to the Turbine Building (TB). The wall has been designed as Seismic Category I (SC I) in the AP1000 certified design in accordance with the American Concrete Institute (ACI) 349-01. As SC I, the designed wall meets the demands of the design basis wind-borne missile impact. The design has been incorporated by reference in the UFSAR. The LAR makes the following modifications to the wall as addressed and evaluated below by the staff.

The LAR addresses the changes made to the Wall 11 Tier 2* critical section in the vicinity of the main steam pipe penetrations in the Auxiliary Building. In the LAR, the licensee proposes to

make changes to the wall that will modify the detailing of the reinforcements in the vicinity of the main steam line penetrations that will continue to conform to the detailing requirements of ACI 349-01 and ACI 318-11. Additional changes to Wall 11 propose to rearrange the anchorage sleeve shear lugs and headed stud to facilitate wall constructability. The staff has reviewed the proposed changes to the detailing. Since the design of the wall remains unchanged the staff concludes that the amendment to the detailing in the Wall 11 Tier 2* critical cross-section is acceptable in assuring that the capacity of the wall is capable of withstanding the applied Design Basis demands on the wall.

In addition, the LAR modifies Wall 11 in the portions that form the North walls of Main Steam Isolation Valve (MSIV) Compartment A (Room 12406/12504) and MSIV Compartment B (Room 12404/12504). The modification results in the closing of a vent near the top of each MSIV compartment north wall as shown on Appendix H, Figure 3H.5-5 of UFSAR. The licensee continues the same reinforcement pattern of the wall through the opening filled with the concrete which meets Design Basis commitments. The licensee in the LAR states that "the ability of the Auxiliary Building MSIV compartments to withstand the pressurization effects from the design basis one square foot pipe rupture in the MSIV compartment is not adversely affected by the removal of the Wall 11 upper vent openings, because vents at these locations are not credited in the sub compartment pressurization analysis." Additionally, the LAR states that the proposed Wall 11 has been assessed for additional loads from postulated breaks in the Turbine Building, first bay, jet loads and pipe whip loads. The staff evaluated the information provided by the licensee and has determined that the demand on the wall has not changed as a result of the vent closure and concluded that this modification is acceptable. This modification does not result in any design change to the reference AP1000 Certified Wall 11 design.

3.1.1.2 Wall 11.2 Tornado Missile Protection

Wall 11.2 is the South wall of the Turbine Building and North of Wall 11, and along with Wall R and Wall I.2, forms the concrete enclosure of the "first bay" of the Turbine Building. The walls of this bay are designed to Seismic Category II (SC II), and are, in addition, designed against the impact of design basis tornado missiles specified in FSAR Section 3.5.1.4. As there are openings in Wall 11, in this LAR the licensee amends the USFAR to reflect the use of the first bay of the Turbine Building as a protection against design basis wind-borne missiles in conjunction with the use of tornado missile barriers at select locations.

In the LAR the licensee uses first bay Wall 11.2 as the primary protection against all types of design basis wind-borne missiles from entering the Auxiliary Building through the Wall 11 openings. Tornado missile barriers installed over large openings in the Turbine Building first bay walls (Wall 11.2 and Wall R), an interior missile barrier, and the line of sight evaluations ensure that all type of missiles are prevented from entering the Auxiliary Building through any penetration on Wall 11.

The licensee in the UFSAR states that the SC II building structures are designed to the same codes and stress limits as the SC I. In addition, the SC II structures are designed to resist the impact of design basis missiles specified in FSAR Section 3.5.1.4. Since the Wall 11 and Wall 11.2 have been designed to the same design codes and load combinations, the staff concludes that the Wall 11.2 will provide reasonable assurance of adequate capacity to meet the demands of the imposed loads which includes design basis wind-borne missile impact. Hence, the staff finds this part of the licensee's amendment request to use Wall 11.2, I.2 and Wall R as protection against design basis wind-borne missiles for openings in Wall 11 to be acceptable.

3.1.1.3 Tornado Missile Barriers

The licensee in this LAR has provided tornado missile protection using a variety of systems which included concrete walls (discussed above), steel tornado barriers of grating type and solid plate design, and missile resistant doors for the openings of Wall 11. Each of these barriers are designed to provide protection against specified missile types. The LAR cites the use of steel grating type missile barriers used on all Wall 11.2 and Wall R opening to prevent automobiles and other smaller missiles from entering the first bay due to barrier interference with the line of sight. The AP1000 DCD discusses the missiles these barriers are designed to protect against in Section 3.5.1.4, "Missiles Generated by Natural Phenomena."

For those missiles (1" sphere and 8" artillery shell) not prevented by the line of sight, a solid plate missile barrier is used to prevent the missiles from entering the Auxiliary Building through the Main Steam line penetrations. In the cases where the line of sight indicates that these two smaller missiles can reach the Wall 11 door openings, protection is provided using doors qualified for protection against these missiles. Section 3.5 of the UFSAR, incorporates by reference Section 3.5.3, "Barrier Design Procedures," of the AP1000 DCD, Revision 19 without any departures or supplements.

The licensee in the LAR states that the steel barriers have been designed to AISC N690-1994 specifications and conform to the ductility requirements stated in Section 3.5.3.1 of the UFSAR. The LAR in addition attests that the doors for the Wall 11 openings are analyzed and designed to withstand the impact of an 8" artillery shell and 1" sphere missile meeting the barrier ductility requirements of UFSAR Section 3.5.3.1. The doors' hinges are anchored using the design provision of ACI 349-01. The staff finds the design of each of the barrier types, the cumulative effect of which prevents design basis wind-borne missiles of the types considered in the design basis from entering the Auxiliary Building through the openings in Wall 11, to be acceptable because it is consistent with the design approach used in the AP1000 DCD.

3.1.1.4 Wall 11.2 Structural Design for High Energy Line Break

In the LAR the licensee requests an amendment to the USFAR to address the potential impact of high energy line break (HELB) in the non-seismic portion of the Turbine Building on Wall 11. The licensee has analyzed the use of Wall 11.2 to absorb the effects of a HELB in the non-seismic portion of the TB. Wall 11.2, North of Wall 11, is designed using the same design requirements as Wall 11 and hence will have similar capacities when subject to a similar set of loads and load combinations. Wall 11 is capable of absorbing the HELB loads arising south of Wall 11.2 as shown in the certified design. The licensee states in the LAR that Wall 11.2 has the capacity of absorbing the HELB loads, as it is designed for such loads.

The staff has evaluated the stated design process for Wall 11.2 in the LAR and concludes that the design capacities for Wall 11.2 will be adequate for the loads and load combinations in a manner consistent with Wall 11. Hence, the staff finds acceptable the use of Wall 11.2 as a protection against HELB loads arising in the non-seismic portion of the Turbine Building from impacting the Auxiliary Building North perimeter Wall 11. There is no design change of Wall 11 as a result of this amendment.

3.1.1.5 Wall 11.2 High Energy Line Break Loads

In the LAR, the licensee proposes to revise UFSAR 3.6.1.1, "Design Basis," 3.6.1.3.2, "Protection Mechanisms," and COL Condition 2.D(12)(a) to credit Wall 11.2 as a HELB barrier.

The licensee proposes to modify UFSAR 3.6.1.1, paragraph J, which describes safety-related systems and components that are used to mitigate the effects of postulated pipe ruptures, by adding a statement that the SCII Wall 11.2, is credited with protecting Wall 11 from HELB loads resulting from postulated ruptures in main steam and main feedwater piping north of the Turbine Building first bay. The licensee will also add a paragraph to the Barrier and Shields discussion in UFSAR 3.6.1.3.2 describing Wall 11.2 as protecting Wall 11 from HELB loads north of the Turbine Building first bay. The licensee will also add a paragraph describing the wall as being designed and analyzed for load combinations in Subsection 3.8.4, and that the wall will meet acceptance criteria contained in ACI 349-01 and AISC N690-1994. The licensee also proposes to modify COL License Condition 2.D(12)(a) which references Subsection 3.6.1.3.2, as a part of this LAR.

On page 42 of LAR 14-02, the licensee stated that the AP1000 pipe rupture hazards analysis (PRHA) is performed to identify and address the consequences of rupture in containment and Auxiliary Building, and ruptures in the Turbine Building. With the exception of the request to credit Wall 11.2 as a HELB barrier to protect Wall 11, the licensee also states that the identification of pipe rupture locations and the evaluation of the dynamic and environmental effects of pipe ruptures on Wall 11 is consistent with the methodology described in UFSAR Subsection 3.6.1, which was reviewed and approved by the NRC during the certification of the AP1000 design. In addition, the licensee stated that, in accordance with the pipe break criteria in UFSAR Subsection 3.6.2.5, HELBs are postulated at every fitting and terminal end for main steam and main feedwater piping in the non-seismic Turbine Building. Moreover, the licensee stated that bounding HELB loads resulting from bounding postulated breaks are applied to Wall 11.2. Furthermore, the licensee stated that Wall 11.2 has been analyzed and determined to be capable of withstanding the loads resulting from the dynamic and environmental effects of HELBs postulated to occur north of the Turbine Building first bay in conjunction with the required load combinations identified in UFSAR Subsection 3.8.4, as discussed in Section 3.1.1.2 and 3.1.1.4 above. Table 2 of the LAR provides additional information concerning how the design loads, which include jet impingement loads and pipe impact loads developed from PRHA, were developed and/or applied in the Wall 11.2 design.

Based on its review of the information provided by the licensee, the staff determined that the licensee has included the appropriate HELB inputs into the design of Wall 11.2 for use as a HELB barrier for protecting Wall 11 from HELB loads resulting from postulated ruptures in main steam and main feedwater piping north of the Turbine Building first bay. Specifically, the staff found that the reviewed and approved methodologies in UFSAR 3.6.1 and 3.6.2.5 are used in the licensee's evaluation of the HELB effects on the Wall 11.2. Therefore, the staff determined that crediting Wall 11.2 with protecting Wall 11 from HELB loads resulting from postulated ruptures in main steam and main feedwater piping north of the Turbine Building first bay is acceptable because the appropriate HELB inputs will be used in Wall 11.2 design. The staff also noted that LAR 14-02 information related to PRHA will be included within the scope of ITAAC item numbers 3.3.00.08 and C.3.8.02.01 in Appendix C of the VCSNS UFSAR. Therefore, as the LAR 14-02 may be inspected as a part of overall Design Acceptance Criteria closure, the staff finds the licensing changes acceptable. The staff finds the change to UFSAR Subsections 3.6.1.1 and 3.6.1.3 to be acceptable as well as the associated changes to License Condition 2.D(12)(a). The staff also finds the proposed additions to be acceptable, as the revision clarifies Turbine Building first bay Wall 11.2 as a HELB Barrier and the acceptance criteria to which it is designed.

3.1.1.6 Tornado Missile Barrier Change to Licensing Basis

The current licensing basis defines the protection of Class A, B, and C SSCs from events such as internal and external missiles, seismic, and flooding as a safety-related, Equipment Class C function. In the LAR, the licensee proposes to revise UFSAR 3.2.2.5, 3.2.2.6, and Table 3.2-1 to reflect an exception to the Equipment Class C criterion for specific tornado missile barriers located in the Turbine Building first bay building structure, to remove the references to "buildings" in Equipment Class C, and to add, "dynamic and environmental effects of pipe failures" to the list of events for which the structures provide a protective function. The reason for the exception to Equipment Class C for the specific tornado missile barriers is that the Turbine Building first bay building structure is SC II. SSCs mounted to an SC II structure cannot be classified as Class A, B, or C, although they provide a function considered to be safety related. Section 3.1.1.9.2 of this SER contains additional discussion regarding the graded approach incorporated within the Quality Assurance (QA) program and design process, with special emphasis on SC II SSCs.

As discussed in Section 3.1.1.9.2 of this SER, building structures are not assigned a safety classification in UFSAR 3.2.2 with the exception of the containment vessel. Therefore, staff finds that it is acceptable to remove the words "and buildings" from the discussion of Equipment Class C, as proposed in the LAR, since assigning them to this equipment class is inconsistent with the statement in UFSAR Subsection 3.2.1.3.

The licensee also proposes to add a statement regarding the Turbine Building first bay building structure providing tornado missile protection for openings in Wall 11, which is further discussed in Part 1D of the LAR. This specific statement notes a case where a building is credited with a safety function attributed to Equipment Class C SSCs, but is not classified as such, as buildings are typically not assigned a safety classification. The staff finds this proposed change acceptable as the added text provides clarity to the classification of the protective function assigned to this structure.

The licensee proposes to add "and the dynamic and environmental effects of pipe failures" to the listing of examples of events Equipment Class C structures may be credited for in the protection of Class A, B, and C SSCs. The existing language allows for crediting for protection "from events such as internal/external missiles, seismic, and flooding." The existing language already indicates that the listed examples are not meant to be exhaustive, based on the use of the language "such as," but the addition of this specific event adds clarity for the HELB protection function proposed in Part 1C of the LAR. As such, the staff finds this proposed addition to the listing of examples of events for Equipment Class C structures for the protection of Class A, B, and C SSCs to be acceptable.

GDC 1, "Quality standards and records," in Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires that SSCs important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. The proposed change attributes a protective function normally assigned to Equipment Class C to an Equipment Class D SSC. Equipment Class D SSCs have additional requirements on procurement, inspection, or monitoring, as compared to other non-safety-related equipment, which reflects the graded approach to quality assurance previously reviewed by staff. The specific Equipment Class D SSCs discussed in this exception are also SC II and are subject to the augmented quality assurance requirements previously discussed.

Based on the discussion above, and the discussion regarding the graded approach incorporated within the QA program and design process in Section 3.1.1.9.2 of this SE, the staff finds the level of quality standards applied to these SSCs to be commensurate with the importance of the safety functions performed in this specific instance. The additional requirements placed on these SC II, Equipment Class D SSCs, as discussed in the paragraph above, provides reasonable assurance that the barriers will perform their protective function when required. The staff finds the proposed change to be acceptable in this specific case, as the barriers are limited by the quality level of the supporting structure; however appropriate quality standards are still applied, commensurate with the safety functions to be performed and consistent with the graded approach in the licensee's QA program.

3.1.1.7 Protection of SSCs from Tornado Missiles

In the current design, as stated in UFSAR Subsection 3.5.2, "Protection from Externally Generated Missiles,"

> "Protection from external missiles…is provided by the external walls and roof of the Seismic Category I nuclear island structures…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 50.34."

This LAR proposes to change the UFSAR to use the Turbine Building first bay structure (including Wall R, Wall 11.2, and Wall I.2) for providing additional missile barriers to protect openings in the north wall of the Auxiliary Building (Wall 11). The licensee states in the LAR that a realistic assessment of potential missile paths and trajectories was performed using the design-basis tornado missiles described in UFSAR Subsection 3.5.1.4. Where a line of sight missile passing through a Turbine Building first bay structure opening could potentially result in a missile impact on a Wall 11 opening, the LAR stated that either additional protection was provided, or additional evaluation was performed.

The staff reviewed the LAR and found that openings in Wall 11 are protected against the automobile missile by either the Turbine Building first bay structure, barriers installed in the large openings of the Turbine Building first bay structure, or showing that there is no potential line of sight to the openings. The barriers installed in the large openings of the Turbine Building first bay structure are steel and have a grating configuration to allow required air-flow through the Turbine Building first bay openings. The spacing of the bars prevents missiles larger than 8-inch from passing through the grating into the first bay.

The staff reviewed the LAR and found that openings in Wall 11 are protected against the 8-inch artillery shell and 1-inch sphere missiles by either the Turbine Building first bay structure, doors installed and qualified as a barrier in Wall 11, a missile barrier installed in the interior of the Turbine Building first bay, penetration covers, the geometry of the potential path, or showing that no safe shutdown equipment is in the line of sight for the missiles passing through the opening. The missile barrier installed in the interior of the Turbine Building first bay is designed to prevent the 8-inch artillery shell and the 1-inch sphere from entering the east MSIV compartment (MSIV compartment B) drain/vent and is located at elevation 117'-6", northeast of the east MSIV compartment. Acceptability of missile barrier design and classification is reviewed in Section 3.1.1.3 and Section 3.1.1.6 of this report.

The applicant's assessment determined that the design-basis tornado missiles are prevented from reaching Wall 11 by the Turbine Building first bay structure and associated missile barriers, prevented from entering the Auxiliary Building by Wall 11 and its doors, or is shown that there is no credible line of sight pathway for the missiles. As part of this LAR, the licensee included additional information in UFSAR Subsection 3.5.2 that describes the methodology used to provide tornado missile protection of openings in the nuclear island structures and describes the evaluation performed on openings in the north wall of the Auxiliary Building (Wall 11). The proposed UFSAR changes also include missile barrier location and design characteristics, and Table 3.5-1, "External Missile Protection for Auxiliary Building Wall 11 Openings," is added to the UFSAR, including a list of all the openings and penetrations in Wall 11 and describing the method of protection from each design-basis tornado missile.

The staff evaluated the information provided in the LAR, including changes to UFSAR Subsection 3.5.2, and determined that all the openings in the north wall of the Auxiliary Building have been accounted for in Table 3.5-1 and have been provided with protection against the design-basis tornado missiles; i.e., 4000 lb. automobile, 8-inch artillery shell, and 1-inch sphere. The staff concludes that adequate missile protection features consistent with SRP 3.5.2 and Regulatory Guide (RG) 1.117 have been provided for the openings in the north wall of the Auxiliary Building (Wall 11) and, therefore, are acceptable and conform to the requirements of GDC 2 and GDC 4.

3.1.1.8 Design Basis Accident Radiological Consequences and Control Room Habitability

In Part 1A of the license amendment request, the licensee describes proposed changes to portions of the north wall of the Auxiliary Building on Column Line 11 (Wall 11) adjacent to the Turbine Building first bay. The proposed changes include removal of an opening near the top of each of the MSIV compartment north walls, also called the Wall 11 upper vent openings. The licensee stated in its license amendment request that the Wall 11 upper vent openings were originally intended to accommodate MSIV compartment pressure relief vents, but they were not retained in the final Wall 11 design due to the capacity of the roof vents in each MSIV compartment. The Wall 11 upper vent openings were not credited in the MSIV compartment pressurization analysis. The licensee stated that the Wall 11 upper vent openings were not evaluated as a release location for the DBA releases from the MSIV compartments in the AP1000 DCD. Instead the AP1000 DCD Chapter 15.1.5 main steam line break (MSLB) radiological consequence analysis assumed releases through the MSIV compartment roof vents. In the licensee's submittal dated March 16, 2016, on page 21 of 29 of updated Enclosure 1, the licensee stated that the removal of the Wall 11 upper vent openings will result in a larger proportion of the effluent release through the MSIV compartment roof vents for a steam line rupture occurring in a compartment. The licensee indicated that this change will result in no adverse impact on the estimated main control room dose or offsite doses from DBAs.

The staff has evaluated the proposed removal of the Wall 11 upper vent openings. The VCSNS Units 2 and 3 UFSAR incorporated by reference without departure the AP1000 DCD evaluation of DBA radiological consequence analyses. The staff checked information in the AP1000 DCD, Chapter 15A, to verify the licensee's statement that the release location from the MSIV compartments was assumed to be the roof vent. Because the MSLB radiological consequence analyses in the AP1000 DCD assumed accident releases were through the MSIV compartment roof vent, the staff finds that the removal of the Wall 11 upper vent openings will have no effect on assumed release location. The proposed changes to Wall 11 do not affect any other aspect of the DBA radiological consequence analyses, including the amount and type of radioactive

materials released, the release rates or the release durations. The staff finds that the evaluation of the radiological consequences of DBAs incorporated in the VCSNS Units 2 and 3 UFSAR remain bounding, and are therefore, acceptable. Therefore, the staff finds that the siting and safety analysis offsite dose guidelines in 10 CFR 52.79(a)(1)(vi) and the control room radiological habitability dose criterion in 10 CFR 50, Appendix A, GDC 19 continue to be met for the proposed changes with respect to the radiological consequences of design basis accidents and the proposed changes are, therefore, acceptable.

3.1.1.9 Related Licensing Basis Changes

3.1.1.9.1 UFSAR 3.2.1.1.1 Seismic Category I (SC I)

In the LAR, the licensee proposes to revise a reference in UFSAR 3.2.1.1.1, which describes the SC I classification as, "applies to, in general, safety-related structures, systems, and components." and "…applies to those structures systems, and components required to support or protect safety-related structures, systems, and components." This subsection also discusses an exception to this general rule, noting, "The exceptions to this general rule are a limited number of structures, such as those required for tornado missile protection, which do not have a safety-related function to perform during or following a seismic event. (See subsection 3.2.2.3.)" Specifically, the licensee proposes to revise this reference from Subsection 3.2.2.3 to 3.2.2.5.

Subsection 3.2.2.3 discusses Equipment Class A and makes no mention of an exception to the general rule stated in UFSAR Subsection 3.2.1.1.1. However, Subsection 3.2.2.5 discusses Equipment Class C and includes the following language, which is pertinent to the exception mentioned above: "Structures protecting equipment from non-seismic events are not required to be Seismic Category I." The staff finds this proposal to be acceptable, as the revision adds clarity to the UFSAR and corrects a reference.

3.1.1.9.2 UFSAR 3.2.1.1.2 Seismic Category II (SC II)

In the LAR, the licensee proposes to add additional language to UFSAR 3.2.1.1.2 in order to clarify the description of the SC II classification. Specifically, the licensee proposes to add the following language after the first paragraph:

> "The turbine building first bay building structure, including Wall 11.2, is a seismic Category II structure as identified in Table 3.2-2. The turbine building first bay building structure provides tornado missile protection for openings in Wall 11 as described in Table 3.5-1. Wall 11.2 also protects Wall 11 from the dynamic effects of pipe failure events in the non-seismic portion of the turbine building."

The licensee also proposes to add the following language after the third paragraph:

> "As identified in Subsection 3.7.2, seismic Category II building structures are designed for the safe shutdown earthquake using the same methods and design stress limits as are used for seismic Category I structures. Seismic Category II building structures are also designed to withstand the design basis tornado loads, including missiles, in accordance with the loading combinations identified in Table 3.8.4-2."

The licensee also proposes to add the following language after the final paragraph:

"These quality requirements are applicable to the seismic Category II turbine building first bay building structure."

These changes are proposed in order to support crediting SC II structures for protective functions during non-seismic events. Crediting SC II SSCs with protective functions is already established as precedent in the current licensing basis. Specifically, UFSAR 3.2.1.1.1 states, "Seismic Category I applies to, in general, safety-related structures, systems, and components. Seismic Category I also applies to those structures, systems, and components required to support or protect safety-related structures, systems, and components. The exceptions to this general rule are a limited number of structures, such as those required for tornado missile protection, which do not have a safety-related function to perform during or following a seismic event." Additionally, UFSAR 3.2.1.2 states, "In most cases, except as noted in Subsection 3.2.2.5, safety-related items are also seismic Category I items." Given these statements, certain SSCs, whose protective functions are called upon during non-seismic events, may be designed to SC II standards, as they are not required to perform their protective function during or following a seismic event, provided they still meet the requirements of GDC 1.

GDC 1, "Quality standards and records," in Appendix A, "General Design Criteria for Nuclear Power Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," requires that structures, systems, and components (SSCs) important to safety be designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. The proposed changes specifically discuss crediting certain SSCs with safety functions previously not assigned to them, so the staff reviewed the quality standards applied to these SSCs.

As discussed in UFSAR Subsection 3.2.1.3, "Classification of Building Structures," "The building structures are not assigned a safety classification in Subsection 3.2.2 with the exception of the containment vessel." Because building structures are not assigned a safety classification, the quality assurance requirements are assigned based on the seismic category. SC I SSCs comply with 10 CFR 50, Appendix B, in its entirety, while SC II SSCs are designed and analyzed to the "pertinent portions" of 10 CFR 50, Appendix B and constructed, installed, and tested to the applicant's broader QA program.

The proposed additions to the third paragraph reinforce the point that, for the AP1000 certified design, SC I and II SSCs are designed and analyzed to the same standards, codes, design requirements, load combinations, methodology, and quality program. The primary difference between SC I and II structures is the difference in construction codes, as both codes use the same materials, but the code for SC I requires certified material test reports to document and trace the material used, and has more stringent recordkeeping, inspection, and testing requirements for construction. The discussion regarding design for design basis tornado loads is consistent with the proposed changes in Part 1C of the LAR. Evaluation of this portion of the LAR is located in Section 3.1.1.5.

The proposed additions to the final paragraph specify that the Turbine Building first bay building structure is subject to the pertinent portions of 10 CFR 50, Appendix B. This is consistent with the current licensing basis, as well as Position C.4 of RG 1.29, "Seismic Design Classification," which states that the pertinent quality assurance requirements of Appendix B to 10 CFR Part 50 should be applied to all activities affecting the safety-related functions of those portions of SSCs covered under Regulatory Positions 2 and 3 above," where Position 2 contains the basis for the definition of SC II.

In order to further determine conformance with GDC 1, the staff reviewed the quality assurance program's treatment of SSCs, with special emphasis on the graded approach. The quality assurance program complies with the pertinent portions of 10 CFR 50, Appendix B, and has been reviewed by the staff and found to be acceptable. The quality assurance program's treatment of SC II SSCs was specifically scrutinized by staff during design certification and was determined to be acceptable, as described in NUREG-1793, Supplement 2. Staff performed an on-site review to examine detailed design documents, which was documented in a report dated March 17, 2009 (ADAMS Accession No. ML0906402470). This on-site review sought, in part, to clarify to what extent the pertinent QA requirements of Appendix B applied to non-site-specific SC II SSCs, as well as to clarify the process of identifying augmented requirements for the regulatory treatment of non-safety systems (RTNSS) SSCs. A result of this review was a finding that "although operability or functionality is not entirely ensured unless either classified as SC I or otherwise justified, it is reasonable to expect that SC II anchorage and locations within a SC II structure will afford some degree of structural integrity."

An RAI response that complemented the onsite review further reinforced the treatment of SC II SSCs, restating that pertinent portions of 10 CFR Part 50 Appendix B apply to these SSCs and that pertinent portions are those required to provide that unacceptable structural failure or interactions with SC I items does not occur. Furthermore, SC II SSCs are covered by the same quality programs (which utilize a graded approach based on classification) as SC I and the extent of design activities are determined by the responsible engineers and are identified in the design specifications and design criteria documents. The RAI response clarified that QA requirements are performed consistent with the quality plan as described in the AP1000 DCD Section 17.3.

In consideration of the increased importance of safety functions applied to these SC II SSCs, staff considered the graded approach applied to the design process. As noted in NUREG-1793, Supplement 2, during the design certification review, the DC applicant clarified its process to identify supplemental requirements for RTNSS SSCs and SC II SSCs. The DC applicant stated that application of augmented QA is a function of the RTNSS assessment, not the seismic categorization. The response identified that the Design Reliability Assurance Program (D-RAP) described in DCD Section 17.4 did not impose augmented design or quality requirements on SSCs. As the staff documented in NUREG-1793, Supplement 2, although the DC applicant did not impose quality requirements based on the D-RAP, the staff believed that reliability depends on the design and quality of the SSCs and that the purpose of the D-RAP is to ensure reliability using the design process. As stated in DCD Section 17.4, the AP1000 D-RAP is implemented as an integral part of the AP1000 design process to provide confidence that reliability is designed into the plant. The staff ultimately recognized that the RTNSS process combined with the D-RAP should be used to establish reliability of risk-significant SSCs so that appropriate specific QA requirements may be established during the detailed design. Therefore, the staff found it reasonable to expect appropriate QA requirements to be applied to risk-significant SC II SSCs and that these requirements were to be included in the design or procurement specifications that can be verified when available. DCD Sections 3.2.1.1.2 and 3.2.2.6 were also revised to reference DCD Section 17.3 for augmented quality requirements for SC II SSCs consistent with RG 1.29, without a specific reference to the D-RAP. In light of this review of the DC applicant's design process and the graded approach integrated within and the acceptable findings, staff has reasonable assurance that the quality standards applied to these SSCs through the AP1000 design process are commensurate with the importance of the safety functions assigned to these SSCs. Therefore, the staff finds the proposed changes in this LAR acceptable.

3.1.2 Evaluation Summary

The staff reviewed the licensee's proposed changes provided in the LAR. Based on the staff's regulatory and technical evaluation, the staff makes the following findings:

The staff finds the proposed changes to Tier 2 UFSAR Subsection 3.8.4.6.3, Tier 2* Subsection 3H.5-1.4 and Appendix H, Figure 3H5-5, Sheet 1 thru 3, to be acceptable as the amendment makes the reinforcement detailing consistent with the staff accepted codes ACI 349-01, AISC N690-1994 and ACI 318-11. The changes do not impact the designed strength of the wall nor its safety margin, which remains as approved in the AP1000 DC.

The staff finds the proposed change to use Wall 11.2 of first bay of the Turbine Building (SC II) as protective structure to protect openings in the Auxiliary Building Wall 11 from tornado missiles to be acceptable because the SC II structures are designed to the same codes and stress limits as the SC I structures. The Turbine Building first bay walls provide protection against design basis wind-borne missiles for the openings in the Wall 11.

The staff finds the proposed changes to use the Wall 11.2 against HELB loads is acceptable because the reviewed and approved methodologies in UFSAR 3.6.1.1, 3.6.1.3 and 3.6.2.5 are used in the licensee's evaluation of the HELB effects on Wall 11.2, as well as the conforming changes to COL Condition 2.D(12)(a) to credit Wall 11.2 as a HELB barrier. In addition, these HELB loads, in conjunction with the required load combinations, are included in the design of Wall 11.2, and the design meets acceptance criteria contained in ACI 349-01 and AISC N690-1994.

The proposed changes to UFSAR Subsection 3.5.2 to provide variety of missile barriers systems which include concrete walls, solid steel and grating type barriers is acceptable to the staff because the licensee used barrier design procedures and ductility requirements per UFSAR Subsection 3.5.3, AISC N690 code and anchorage requirements per UFSAR Subsection 3.8.4.5.1. Use of these procedures and requirements is consistent with the design bases.

The proposed changes to UFSAR Subsection 3.5.2, including the addition of Table 3.5-1, "External Missile Protection Provided for Auxiliary Building Wall 11 Openings," associated with the protection of openings in the Auxiliary Building north wall against design basis missiles are acceptable to the staff because the method of protection for the openings is consistent with SRP 3.5.2 and RG 1.117, "Tornado Design Classification."

Based on its review of the impact of the removal of the Wall 11 upper vent openings, the staff finds that the evaluation of the radiological consequences of DBAs incorporated in the VCSNS Units 2 and 3 UFSAR remain bounding. Therefore, the staff finds that the siting and safety analysis offsite dose guidelines in 10 CFR 52.79(a)(1)(vi) and the control room radiological habitability dose criterion in 10 CFR 50, Appendix A, GDC 19 continue to be met for the proposed changes with respect to the radiological consequences of design basis accidents.

Based on its review, the NRC staff concludes that there is reasonable assurance that the requirements of GDC 1, GDC 2, GDC 4, and GDC 19 of 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"), and Appendix D ("Design Certification Rule for the AP1000 Design") to 10 CFR Part 52, "Licenses, Certifications, and

Approvals for Nuclear Power Plants," will continue to be met. Therefore, the staff finds the proposed changes to be acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations in 10 CFR 50.91(b), the designated State of South Carolina official was notified of the proposed issuance of the amendment. The State of South Carolina had no comment.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20, "Standards for Protection Against Radiation." The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration (81 FR 5499; published on February 2, 2016), and has now made a final finding that the amendment involves no significant hazards consideration. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment. The supplements to the license amendment request, dated January 11 and March 16, 2016, provided additional information that did not change the scope or the conclusions of the proposed No Significant Hazard Determination.

6.0 CONCLUSION

The staff has concluded, based on the considerations discussed above, that there is reasonable assurance that: (1) the health and safety of the public will not be endangered by construction activities or operation in the proposed manner; (2) such activities will be conducted in compliance with the Commission's regulations; and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public. Therefore, the staff finds the changes proposed in LAR 14-02 to be acceptable.

7.0 REFERENCES

1. Request for License Amendment and Exemption 14-02, Supplement 2, Wall 11 changes via letter from South Carolina Electric & Gas (SCE&G), dated March 16 2016 (ADAMS Accession No. ML15351A452)

2. AP1000 Design Control Document, Revision 19, dated June 13, 2012 (ADAMS Accession No. ML11171A500).

3. Final Safety Evaluation Report Related to Certification of the AP1000 Standard Plant Design, NUREG-1793, Supplement 2, dated August 5, 2011 (ADAMS Accession No. ML112061231).

4. U.S. Nuclear Regulatory Commission, "Final Safety Evaluation Report for Combined Licenses for Virgil C. Summer Nuclear Station, Units 2 and 3," Volume 1, NUREG 2153, September 2013 (ADAMS Accession No. ML13275A125).

5. American Concrete Institute (ACI), ACI-349-01, “Building Code Requirements for Nuclear Safety Related Structures.”

6. American Institute of Steel Construction (AISC), AISC-N690-1994, “Specification for the Design, Fabrication, and Erection of Steel Safety Related Structures for Nuclear Facilities.”