**Ronald A. Jones**
Vice President
New Nuclear Operations

February 15, 2017
NND-17-0078
10 CFR 50.90
10 CFR 52.63

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Virgil C. Summer Nuclear Station (VCSNS) Units 2&3
Combined License Nos. NPF-93 and NPF-94
Docket Nos. 52-027 & 52-028

Subject: LAR 17-03: VCSNS Units 2&3 Request for License Amendment and Exemption: Hydrogen Venting from Passive Core Cooling System (PXS) Compartments

Pursuant to 10 CFR 52.98(c) and in accordance with 10 CFR 50.90, South Carolina Electric & Gas Company (SCE&G), acting on behalf of itself and South Carolina Public Service Authority (Santee Cooper), the licensees for Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3, request an amendment to Combined License (COL) Numbers NPF-93 and NPF-94, for VCSNS Units 2 and 3, respectively. The proposed amendment would revise the licensing basis information to reflect changes to the locations of the hydrogen venting primary openings in the passive core cooling system (PXS) valve/accumulator rooms inside containment.

The requested amendment proposes to depart from approved AP1000 Design Control Document (DCD) Tier 2 information (text and tables) as incorporated into the Updated Final Safety Analysis Report (UFSAR) as plant-specific DCD information, and also proposes to depart from involved plant-specific Tier 1 information (and associated COL Appendix C information).

Pursuant to the provisions of 10 CFR 52.63(b)(1), an exemption from elements of the design as certified in the 10 CFR Part 52, Appendix D, design certification rule is also requested for the plant-specific DCD Tier 1 material departures.

Enclosure 1 provides the description, technical evaluation, regulatory evaluation (including the significant hazards consideration determination), and environmental considerations for the proposed changes. Enclosure 2 provides the background and supporting basis for the requested exemption. Enclosure 3 provides the proposed changes to the licensing basis documents. Enclosure 4 addresses the applicability and endorsement of prior docketed information on this topic. Enclosure 5 provides the description of proposed changes that differ from the similar hydrogen venting from the

PXS compartments changes included in the Levy Nuclear Plant Units 1 and 2 submittal (for information only).

In order to support the VCSNS Unit 2 construction schedule, SCE&G requests NRC staff review and approval of the license amendment no later than February 9, 2018. Approval by this date will allow sufficient time to implement licensing basis changes prior to affected construction activities. SCE&G expects to implement this proposed amendment (through incorporation into the licensing basis documents; e.g., the UFSAR) within 30 days of approval of the requested changes. Southern Nuclear Operating Company (SNC) has stated it will be requesting a November 8, 2017 license amendment/exemption approval date for hydrogen venting changes related to Vogtle Electric Generating Plant (VEGP) Unit 3.

SCE&G also expects to submit a Preliminary Amendment Request (PAR) to support more near-term related construction activities within the coming weeks. This PAR is under development and review, and is expected to request a "no objections" finding from the NRC Staff by May 15, 2017.

In accordance with 10 CFR 50.91, SCE&G is notifying the State of South Carolina of this LAR by transmitting a copy of this letter and enclosures to the designated State Official.

This letter contains no regulatory commitments. This letter, including enclosures, has been reviewed and confirmed to not contain security-related information.

Should you have any questions, please contact Ms. April R. Rice by telephone at (803) 941-9858 or by email at arice@scana.com.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 15th day of February, 2017.

Sincerely,

Ronald A. Jones
Vice President
New Nuclear Operations

RAJ/gt

Enclosure 1: Request for License Amendment, Hydrogen Venting from Passive Core Cooling System (PXS) Compartments (LAR 17-03)

Enclosure 2: Request for Exemption, Hydrogen Venting from Passive Core Cooling System (PXS) Compartments (LAR 17-03)

Enclosure 3: Proposed Changes to the Licensing Basis Documents (LAR 17-03)

Enclosure 4: Applicability and Endorsement of Prior Docketed Information (LAR 17-03)

Enclosure 5: Proposed Changes that Differ from the Duke Submittals for Information Only (LAR 17-03)

c : Billy Gleaves
Ruth Reyes
Chandu Patel
Paul Kallan
Tom Fredette
Tomy Nazario
Jennifer Dixon-Herrity
Cathy Haney
Jim Reece
Stephen A. Byrne
Jeffrey B. Archie
Ronald A. Jones
Alvis J. Bynum
Kathryn M. Sutton
April Rice
Nick Kellenberger
Matt Kunkle
Mory Diane
Bryan Barwick
Dean Kersey
Greg Travers
Cynthia Lanier
Lisa Spears
Frederick Willis
Neil Haggerty
Carl Churchman
Pat Young
Zach Harper
Brian McIntyre
Brian Bedford
Joseph Cole
Chuck Baucom
Lisa Alberghini
Curt Castell
Susan E. Jenkins
William M. Cherry
Rhonda O'Banion
vcsummer2&3project@westinghouse.com
VCSummerMail@westinghouse.com
DCRM-EDMS@SCANA.COM

**South Carolina Electric & Gas Company**

**Virgil C. Summer Nuclear Station Units 2 and 3**

**NND-17-0078**

**Enclosure 1**

**Request for License Amendment,**

**Hydrogen Venting from Passive Core Cooling System (PXS) Compartments**

**(LAR 17-03)**

**(This enclosure contains 16 pages including this cover page.)**

Table of Contents

Pursuant to 10 CFR 52.98(c) and in accordance with 10 CFR 50.90, South Carolina Electric & Gas Company (SCE&G), acting on behalf of itself and South Carolina Public Service Authority (Santee Cooper), the licensees for Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3, request an amendment to Combined License (COL) Numbers NPF-93 and NPF-94, for VCSNS Units 2 and 3, respectively.

## 1. Summary Description

The proposed changes would revise the Combined Licenses (COLs) Appendix C Table 2.3.9-3, Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) 2.3.09.03.iii acceptance criteria and Updated Final Safety Analysis Report (UFSAR) Subsections 6.2.4.5.1, 19.41.7, 19.59.9.5.6, Table 19.59-18, and Table 19D-7 to change the locations for the hydrogen venting primary openings in the passive core cooling system (PXS) valve/accumulator rooms inside containment.

The requested amendment requires changes to the licensing basis documents, including the UFSAR information and involves changes to plant-specific Tier 1 information, with corresponding changes to COL Appendix C information. (See Section 2 for details.) This enclosure requests approval of the license amendment necessary to implement the UFSAR and COL Appendix C changes. Enclosure 2 requests the exemption necessary to implement the involved changes to the plant-specific Design Control Document (DCD) Tier 1 information.

## 2. Detailed Description

The function of the containment hydrogen control system (VLS) following a severe accident is to promote hydrogen burning soon after the lower flammability limit is reached in the containment. Initiation of hydrogen burning at the lower level of hydrogen flammability prevents accidental hydrogen burn initiation at high hydrogen concentration levels and thus provides confidence that containment integrity can be maintained during hydrogen burns and that safety-related equipment can continue to operate during and after the burns.

Hydrogen may be vented from the PXS-A and PXS-B compartment (Rooms 11206 and 11207, respectively) to the Core Make-up Tank (CMT)-A and CMT-B compartments (Room 11300) through openings in the floor of Room 11300 where each CMT is located, to prevent accumulation of hydrogen in a dead-ended compartment during a beyond design basis accident. COL Appendix C (and corresponding plant-specific Tier 1) ITAAC 2.3.09.03.iii acceptance criteria and UFSAR Subsection 6.2.4.5.1 describe the minimum distance between the primary openings and the containment shell. The acceptance criteria also define primary openings of these compartments as those that constitute 98% of the opening area. UFSAR Figure 1.2-7 shows the equipment access opening from Room 11206 to Room 11300 which is located along the refueling cavity wall. UFSAR Figure 1.2-9 shows the locations of the CMT-A and CMT-B. The CMT openings are located directly underneath each CMT. Because the equipment access opening and CMT-A account for at least 98% of the opening area, the other openings shown from Room 11206 to Room 11300 on UFSAR Figure 1.2-7 are bounded by these two openings.

The openings in Room 11206 are proposed to be reconfigured to allow for access to perform maintenance activities on the equipment in Room 11206. The revised layout led to the equipment access opening along the refueling cavity wall no longer constituting 98% of the

primary openings from Room 11206 to 11300. Because of this, the opening around the CMT-A also needed to be considered a primary opening. Therefore, the description of the primary openings in ITAAC 2.3.09.03.iii acceptance criteria for Room 11206 is proposed to be changed. For Room 11206 the equipment access opening and CMT-A opening constitute at least 98% of the vent paths within Room 11206 that vent to Room 11300. Because the CMT-A opening is closer to the containment vessel than the 19 feet currently specified in the acceptance criteria, the actual distances (less 6 inches for construction tolerances) for each opening are proposed to be used instead of 19 feet. The equipment access opening is at least 24.3 feet away from the containment vessel and the CMT-A opening is at least 9.4 feet away from the containment vessel, instead of 19 feet as currently described. To be consistent with the use of actual distances for the openings, the acceptance criteria for the CMT-B opening from Room 11207 to Room 11300 is revised to use the actual distance to the containment vessel which is 24.6 feet (less 6 inches for construction tolerances) instead of 19 feet. The analyses described below in Section 3 evaluate hydrogen venting from these actual distances for the openings in Rooms 11206 and 11207.

UFSAR Subsection 6.2.4.5.1 is also proposed to be revised to reflect the revised layout of the vent openings from Rooms 11206 and 11207 to Room 11300.

UFSAR Subsections 19.41.7 and 19.59.9.5.6, and Table 19.59-18 and Table 19D-7 are proposed to be revised to reflect the analysis results which show that a diffusion flame hydrogen burn from Rooms 11206 and 11207 does not challenge containment integrity.

UFSAR Table 19D-7 is proposed to be revised to add the containment vessel lower equipment hatch to the sustained hydrogen combustion survivability assessment.

The proposed revised hydrogen venting locations from the PXS compartments (Rooms 11206 and 11207) have been evaluated to confirm that a diffusion flame hydrogen burn at the venting locations does not challenge containment integrity. The methodology used in the analyses to evaluate the diffusion flame hydrogen burn is described below in the technical evaluation.

**Licensing Basis Change Descriptions**

| **Plant-Specific Change** | **Description of Proposed Change** |
|---|---|
| COL App. C and plant-specific Tier 1 Table 2.3.9-3 | Revise the Acceptance Criteria for ITAAC 2.3.09.03.iii to define the primary openings and revise the minimum distances of the primary openings from the containment shell for Rooms 11206 and 11207. |
| UFSAR Subsection 6.2.4.5.1 | Revise Tier 2 information under the heading, "Hydrogen Ignition System" to reflect the revised layout of the primary openings in Rooms 11206 and 11207. |
| UFSAR Subsection 19.41.7 | Revise Tier 2 information by changing the description of hydrogen burning to include statements that the supporting analysis that shows that a diffusion flame at the revised vent locations does not challenge containment integrity. |

| | |
|---|---|
| UFSAR Subsection 19.59.9.5.6 | Revise Tier 2 information by changing the description of hydrogen burning to include a statement that a diffusion flame at the revised vent locations does not challenge containment integrity. |
| UFSAR Table 19.59-18, Item 31 | Revise Tier 2 information by changing the description of hydrogen burning to include a statement that a diffusion flame at the revised vent locations does not challenge containment integrity. |
| UFSAR Table 19D-7 | Revise Tier 2 information by adding the containment lower equipment hatch and seals to the sustained hydrogen combustion survivability assessment. |

## 3. Technical Evaluation

The VLS uses a distributed hydrogen ignition subsystem to burn hydrogen as it is released from the reactor coolant system (RCS) to the containment to prevent hydrogen concentrations from exceeding 10 volume percent of the containment volume. Initiation of hydrogen burning at the lower level of hydrogen flammability prevents accidental hydrogen burn initiation at high hydrogen concentration levels and thus provides confidence that containment integrity can be maintained during hydrogen burns and that safety-related equipment can continue to operate during and after the burns. Specific locations of igniters within the compartments are based on an evaluation of hydrogen transport in the containment and the hydrogen combustion characteristics, and meet the design criteria identified in UFSAR Table 6.2.4-6. For enclosed areas of the containment, at least two igniters on separate power supplies are installed. The separation between igniter locations was selected to prevent the velocity of a flame front initiated by one igniter from becoming significant before being extinguished by a similar flame front propagating from another igniter because the gas mixture behind the flame front has already been burned.

The proposed revised hydrogen venting locations in the PXS compartments (Rooms 11206 and 11207) have been evaluated to confirm that a diffusion flame hydrogen burn at the venting locations does not challenge containment integrity. A one-dimensional heat transfer analysis and computational fluid dynamics (CFD) analysis were performed to develop temperature profiles from the postulated hydrogen burn at the vent locations. These temperature profiles are evaluated in structural analysis to validate containment integrity is not challenged by a hydrogen burn at the vent locations in the PXS compartments.

The scenario that creates hydrogen releases to a PXS compartment is a beyond design basis severe accident involving significant core damage and hydrogen generation due to cladding oxidation resulting from a double-ended direct vessel injection (DVI) line break in the PXS-A compartment. The PXS piping in the PXS compartments is leak-before-break piping and double-ended breaks are therefore not expected to occur in these locations. For the scenario to progress to a severe accident, additional failures must occur to prevent the emergency core cooling system from mitigating the accident. For the hydrogen release to be directed to the breaks, at least three of four Automatic Depressurization System (ADS)-4 valves must fail. Otherwise the hydrogen will be released through the ADS-4 valves to the loop compartments. Because this specific scenario requires failure of the ADS-4 valves to release the hydrogen into the PXS compartments, there is not 100% cladding oxidation. The frequency for a DVI line break initiating event and common cause failure of ADS-4 valves is $6.4 \times 10^{-9}$ per reactor-year.

A DVI line break in the PXS-A compartment vents to the CMT-A compartment through two locations through the floor at elevation 107′-2″, an equipment access opening located along the refueling canal wall 24.8 ft from the containment shell and the CMT-A discharge penetration through the floor 9.9 ft from the containment shell. During a loss of coolant accident (LOCA), the CMT compartment floor will be flooded approximately 3 feet above the floor. Because of In-containment Refueling Water Storage Tank (IRWST) water draining through the break, the PXS compartment will most likely be water-filled. The hydrogen plume then rises and a diffusion flame can be postulated at the exit of the CMT compartment.

A DVI line break in the PXS-B compartment vents to the CMT-B compartment through one location through the floor at elevation 107′-2″, the CMT-B discharge penetration located 25.1 ft from the containment shell. The distance from the source to the vent is comparable with the PXS-A floor hatch resulting in comparable flame temperature and radiative heat transfer. The source and vent flow areas for the PXS-B location are larger than those for the PXS-A location resulting in smaller plume velocities and convection heat transfer coefficients. Therefore, the PXS-A location bounds the PXS breaks. The vent locations described above are analyzed 6 inches closer to the containment shell to account for construction tolerances. This assumption is factored into the revised ITAAC wording which verifies the as-built distances meet the design assumptions.

A one-dimensional heat transfer calculation was performed to evaluate temperature distribution on the containment vessel resulting from the diffusion flame hydrogen burn. A CFD analysis was also performed. Insights from the CFD analysis are only used if they point to a non-conservative assumption. Given the nature of the modelling, the flame can only be modelled at each vent location individually. The results of the one-dimensional calculation and the CFD model show the equipment access opening produces the highest temperature on the containment shell and equipment hatch. The analysis created two temperature distributions. The first distribution assumed that the plume creates a hot spot that spans the hatch cover, hatch barrel, insert plate and containment shell. The second distribution was developed based on the insights from the CFD analysis in which the hot spot occurs on the containment shell at the vent exit.

The hot spot is the local area where the burning plume flow impacts the containment pressure boundary. The heat transfer consists of radiation heat transfer and horizontal (flat plate in cross flow) and vertical (flat plate in parallel flow) convection. For the structural analysis, the surface temperatures within the hot spot are the bounding temperature limits of the containment shell and the hatch door cover. For the hatch barrel hot spot temperature, where the hatch seals are located, the average wall temperature was calculated and the corresponding surface temperature is reported. Zone 1 is the area of the containment pressure boundary above the hot spot in contact with the plume that flows up the containment wall. The heat transfer consists of radiation heat transfer and vertical (flat plate in parallel flow) convection. Zone 2 is the area of the containment pressure boundary below the hot spot where the containment shell is not in contact with the plume flow but is receiving radiation heat transfer from the plume. The resultant temperatures are shown in the table and figures below.

**Table 3-1**

**Summary of Peak Temperatures**

| **Peak Surface Temperatures (°F)** | | | |
|---|---|---|---|
| Component | Hot Spot | Z1 = Radiation and Convection | Z2 = Radiation Only |
| Containment Shell | 650 | 470 | 436 |
| Insert Plate/Barrel | 488** | 366 | 344 |
| Hatch Cover | 800 | 591 | 543 |
| **Peak Average Wall Temperatures (°F)** | | | |
| Component | Hot Spot | Z1 = Radiation and Convection | Z2 = Radiation Only |
| Containment Shell | 607 | 442 | 411 |
| Insert Plate/Barrel | 390** | 308 | 293 |
| Hatch Cover | 780 | 577 | 530 |

** Peak average barrel temperature corresponds to acceptance criterion for the ethylene propylene diene monomer (EPDM) rubber

**Figure 3-1**

**Component Layout for Temperature Distribution**

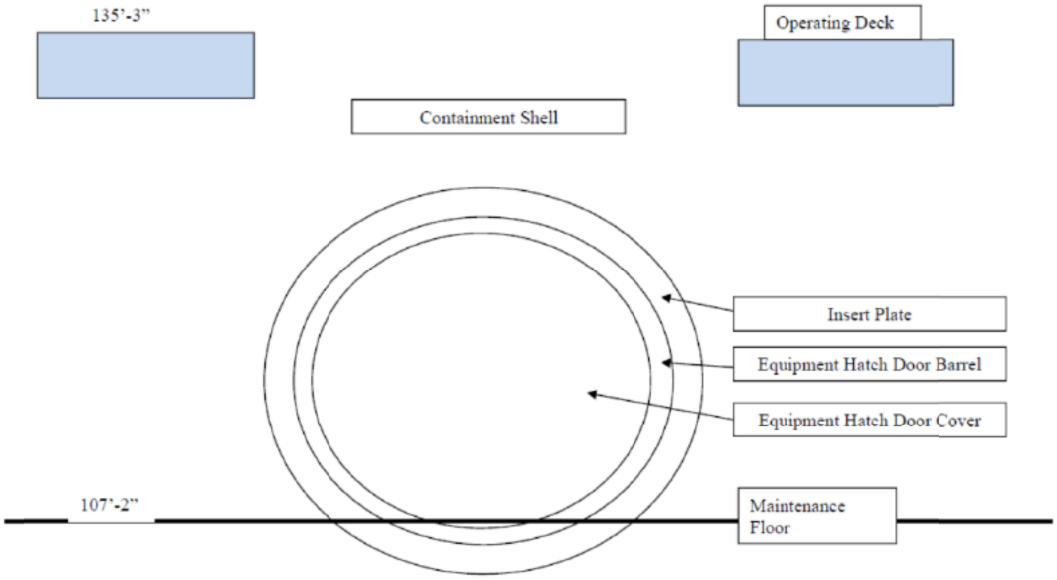


**Figure 3-2**

**Temperature Distribution 1: Hot Spot on the Equipment Hatch**

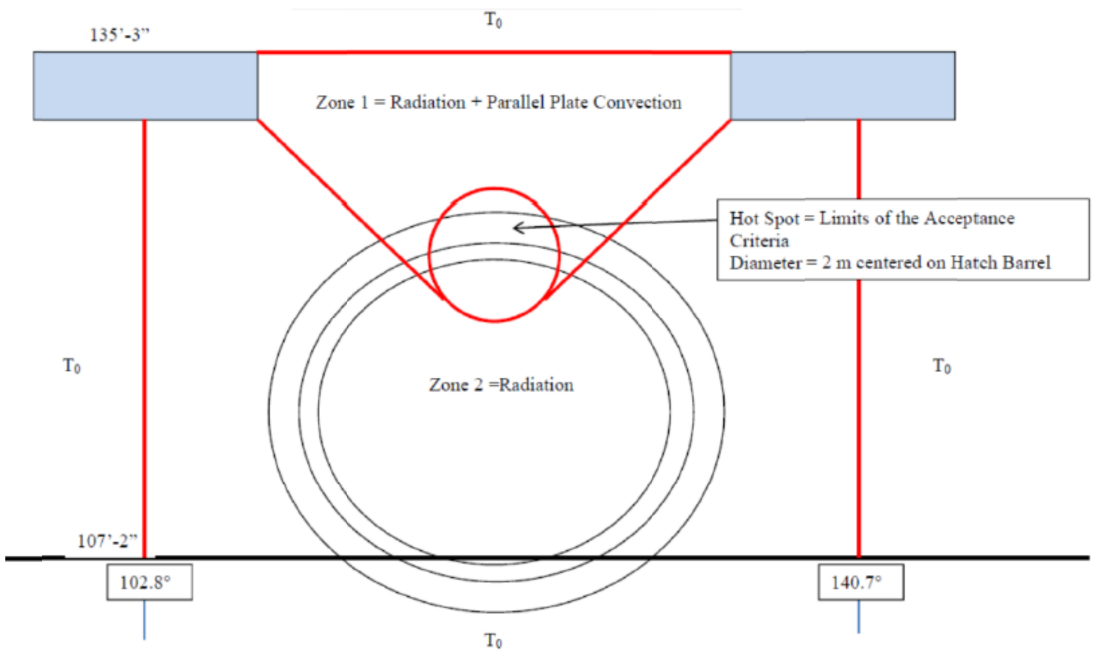
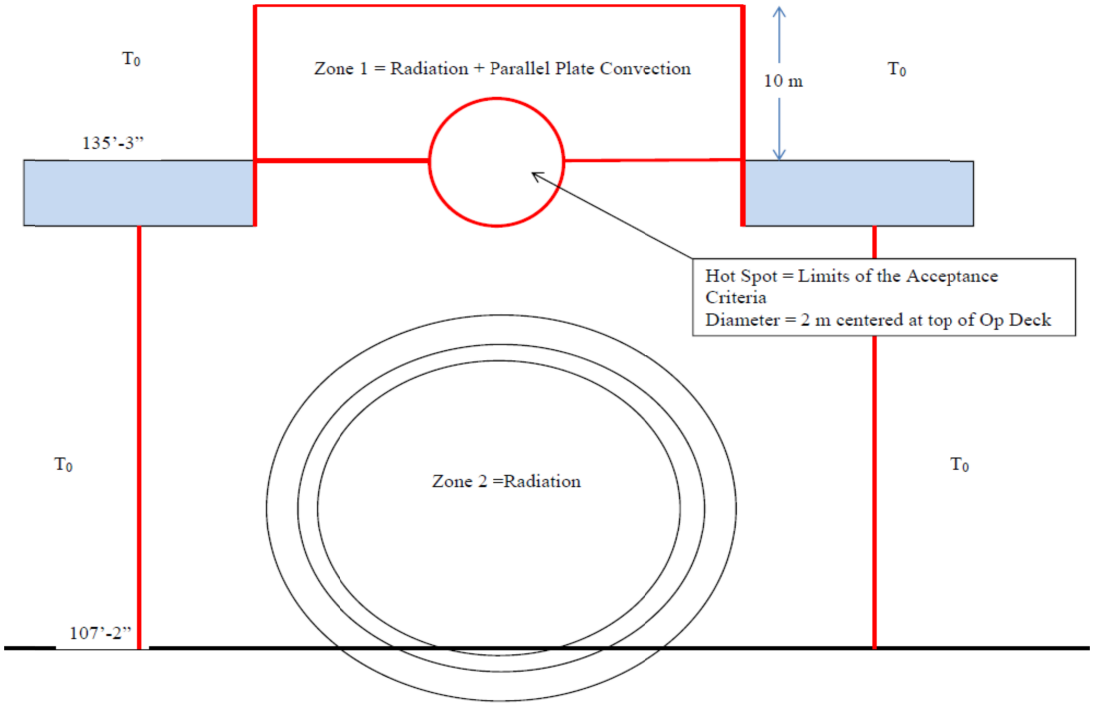



**Figure 3-3**

**Temperature Distribution 2: Hot Spot on the Containment Shell at the Ceiling Vent Exit**



In order to assess the integrity of the containment vessel, these temperature profiles were used as inputs for structural analysis. The containment vessel and equipment hatch cover are SA738 Grade B steel. The hot spot area shown on Figure 3-2, above, is at the top of the equipment hatch and covers the hatch barrel. A finite element analysis was used to calculate the maximum resultant stress intensity corresponding to the hot spots on the equipment hatch. The maximum resultant stress intensity on the equipment hatch is 15.25 ksi which is below the ASME Service Level C limit of 63.6 ksi. Therefore, although at the hot spot the equipment hatch cover peak temperature (780°F) exceeds the maximum service level temperature (650°F), the maximum resultant stress intensity is less than the ASME Service Level C allowable limit and meets the Service Level C requirements of ASME Code, Section III, Division 1, and Subsection NE-3230.

Within the hatch barrel are EPDM rubber seals. The seals are exposed to a lower temperature than the hatch barrel surface because they are behind the equipment hatch; however, the seals exceed their design temperature of 300°F. The EPDM rubber compression set has been tested to temperatures beyond the design temperature for extended durations. Because the duration during which the seals are above their design temperature is low (less than 2 hours), the structural integrity of the seal is not compromised and there is reasonable assurance of the integrity of the seals at 390°F (for the inner seal ring the temperature is slightly above 390°F). Additional analysis was completed to evaluate the equipment hatch which experiences uneven heating due to the asymmetric thermal loading condition. This uneven heating could lead to potential distortion of the equipment hatch cover relative to the barrel flange and therefore the additional analysis determined whether this distortion could lead to potential leakage. The two rubber seals inside the flange function to prevent leakage. These rubber seals are designed with a high temperature resistance and elasticity. Based on this design, as long as the bolts around the perimeter of the equipment hatch cover are not stressed and stretched beyond the acceptable recovery of the seals, there is no path for leakage. A Finite Element Model was used to evaluate this. The analysis concluded that the equipment hatch bolts remain in the elastic region and do not deform to distort the connection. There are non-uniform gaps which form in the equipment hatch joint but the gaps are smaller than the gap that the seals in the joint fill. There is no leakage through the equipment hatch. Therefore, the containment remains leak tight following a hydrogen burn at the vent openings in Rooms 11206 and 11207.

Based on the results of the analyses described above, it was determined that containment integrity is not challenged due to diffusion flames resulting from a hydrogen burn at the vent openings from Rooms 11206 and 11207 to Room 11300.

An equipment survivability assessment has been performed to evaluate the survivability of essential equipment for the most likely severe accident scenarios that produce a hydrogen burn in containment. This evaluation concludes that there is reasonable assurance that equipment in Room 11300 is not adversely impacted by a hydrogen burn. The proposed changes to the layout of the openings do not adversely affect the ability of equipment to perform its intended function in a severe accident.

Conclusion

Based on the technical evaluation described above, the following is concluded:

- The revised venting locations do not adversely impact the capability of the VLS to maintain the hydrogen concentration below 10 volume percent of the containment volume.

- A hydrogen burn at the revised venting locations in the PXS compartments does not challenge containment integrity.
- No safety-related component is adversely affected by a hydrogen burn at the revised venting locations from the PXS compartments.
- The change in venting locations does not result in a significant increase in the probability or consequences of an accident previously evaluated.

Change Evaluation

The proposed change to the layout of the vent openings in Rooms 11206 and 11207 does not create an adverse condition. The CMT-A opening constitutes approximately 12% of the openings in Room 11206 from which hydrogen can be vented to Room 11300, and in concert with the equipment access opening is at least 98% of the openings in Room 11206 from which hydrogen can be vented to Room 11300. The analysis considering this distance and the configuration of the revised openings show that a potential hydrogen diffusion flame would not challenge containment integrity.

The proposed changes to the hydrogen venting locations for Rooms 11206 and 11207 in the containment do not affect the hydrogen control function of preventing the hydrogen concentration from exceeding 10 volume percent of the containment volume during and following a beyond design basis accident as postulated in accordance with 10 CFR 50.44(c). The venting flow paths do not adversely affect the containment integrity. The changes do not affect any function or feature used for the prevention and mitigation of accidents or their safety analyses. No safety-related structure, system, component (SSC) or function is adversely affected. The relocated vent path from Room 11206, and potential hydrogen burn at the vent location, does not challenge containment integrity. The containment remains leak tight therefore there is no adverse effect on the maximum allowable containment leakage rate of 0.10% of containment air weight per day as defined in the technical specifications. The proposed changes do not involve nor interface with any SSC accident initiator or initiating sequence of events related to the accidents evaluated in the UFSAR. The proposed changes do not affect the radiological source terms (i.e., amounts and types of radioactive materials released, their release rates and release durations) used in the accident analyses.

The hydrogen venting inside containment does not adversely interface with/affect safety-related equipment or a fission product barrier. Venting paths for areas within containment are provided to address the production of hydrogen following a beyond design basis accident in accordance with 10 CFR 50.44(c).The hydrogen ignition subsystem is a non-Class 1E subsystem and does not interface with any safety-related system; thus, no system or design function or equipment qualification is affected by the proposed changes. The changes do not result in a new failure mode, malfunction or sequence of events that could affect a radioactive material barrier or safety-related equipment. The proposed changes do not allow for a new fission product release path, result in a new fission product barrier failure mode, or create a new sequence of events that would result in significant fuel cladding failures.

The revision of the hydrogen venting paths from Rooms 11206 and 11207 does not adversely affect the ability of the containment hydrogen ignition subsystem to perform its beyond design basis function as defined in the UFSAR. The hydrogen ignition subsystem does not affect safety-related equipment or equipment whose failure could initiate an accident. The changes do

not adversely involve safety-related equipment or a radioactive material barrier. The proposed changes do not adversely affect any safety-related equipment, design code limit (allowable value), safety-related function or design analysis, nor do they adversely affect any safety analysis input or result. As shown by the completed analysis, containment integrity is not challenged and the containment remains leak tight and does not exceed the maximum allowable containment leakage rate of 0.10% of containment air weight per day, as defined in the technical specifications. Therefore, the changes do not adversely affect any design basis or safety limit and there is no reduction in a margin of safety.

Summary

The proposed changes would revise the COL (and corresponding plant-specific Tier 1) in regard to the hydrogen venting locations from Rooms 11206 and 11207 as described in the acceptance criteria of ITAAC 2.3.09.03.iii and UFSAR Subsections 6.2.4.5.1 and 19.41.7.

These proposed changes do not adversely affect any design function. The changes do not involve an adverse change to any method of evaluation for establishing design bases or safety analyses.

## 4. Regulatory Evaluation

### 4.1 Applicable Regulatory Requirements/Criteria

10 CFR 52.98(f) requires NRC approval for any modification to, addition to, or deletion from the terms and conditions of a COL. This activity involves a departure from COL Appendix C, Inspections, Tests, Analyses and Acceptance Criteria information and corresponding plant-specific Tier 1 information, therefore, this activity requires an amendment to the COL. Accordingly, NRC approval is required prior to making the plant-specific changes requested by this license amendment request.

10 CFR 52, Appendix D, Section VIII.B.5.a allows an applicant or licensee who references this appendix to depart from Tier 2 information, without prior NRC approval, unless the proposed departure involves a change to or departure from Tier 1 information, Tier 2* information, or the Technical Specifications, or requires a license amendment under paragraphs B.5.b or B.5.c of the section. This change involves a revision to COL Appendix C information (and corresponding plant-specific Tier 1 information), and thus requires NRC approval for the Tier 2 departures and involved Tier 1 (and COL Appendix C) changes.

10 CFR 50, Appendix A, Criterion 41 - *Containment atmosphere cleanup,* requires systems to control fission products, hydrogen, oxygen, and other substances which may be released into the reactor containment to be provided as necessary to reduce, consistent with the functioning of other associated systems, the concentration and quality of fission products released to the environment following postulated accidents, and to control the concentration of hydrogen or oxygen and other substances in the containment atmosphere following postulated accidents to assure that containment integrity is maintained. The change to the hydrogen venting for the Passive Core Cooling System (PXS) Valve/Accumulator Rooms (Rooms 11206 and 11207) does not adversely affect the ability of the containment hydrogen control system to control the concentration of hydrogen within acceptable limits. The analysis shows that a hydrogen burn at the revised locations does not challenge containment integrity. Therefore, the proposed changes in this LAR maintain compliance with GDC 41.

10 CFR 50.34(f)(2)(ix) requires a system be provided for hydrogen control that can safely accommodate hydrogen generated by the equivalent of a 100% fuel-clad metal water reaction. The hydrogen control system and associated systems shall provide, with reasonable assurance, that: (A) Uniformly distributed hydrogen concentrations in the containment do not exceed 10% during and following an accident that releases an equivalent amount of hydrogen as would be generated from a 100% fuel clad metal-water reaction. (B) Combustible concentrations of hydrogen will not collect in areas where unintended combustion or detonation could cause loss of containment integrity or loss of appropriate mitigating features. (C) Equipment necessary for achieving and maintaining safe shutdown of the plant and maintaining containment integrity will perform its safety function during and after being exposed to the environmental conditions attendant with the release of hydrogen generated by the equivalent of a 100% fuel-clad metal water reaction including the environmental conditions created by activation of the hydrogen control system. The change to the hydrogen venting for the Passive Core Cooling System (PXS) Valve/Accumulator Rooms (Rooms 11206 and 11207) does not adversely affect the ability of the containment hydrogen control system to prevent the concentration of hydrogen in containment from exceeding 10 volume percent of the containment volume. The revised hydrogen venting locations from the PXS Valve/Accumulator Rooms continues to prevent collection of hydrogen in a dead-ended compartment which could lead to a detonable hydrogen concentration. The analysis shows that a hydrogen burn at the revised locations does not challenge containment integrity. Therefore, the proposed changes in this LAR maintain compliance with 10 CFR 50.34(f)(2)(ix).

10 CFR 50.44(c) requires that all combined licenses under 10 CFR 52 must meet requirements to ensure a mixed containment atmosphere; provide means to limit hydrogen concentrations in containment during and following an accident that releases an equivalent amount of hydrogen as would be generated by 100 percent fuel clad-coolant reaction, uniformly distributed, to less than 10 percent by volume and maintain containment structural integrity and appropriate accident mitigating features; establish and ensure safe shutdown and containment integrity with systems and components capable of performing their functions during and after exposure to environmental conditions by burning of hydrogen; provide equipment for monitoring hydrogen in containment; and must perform an analysis to demonstrate containment structural integrity that addresses an accident that releases hydrogen generated from 100 percent fuel-cladding reaction accompanied by hydrogen burning. The change to the hydrogen venting from the Passive Core Cooling System (PXS) Valve/Accumulator Rooms (Rooms 11206 and 11207) does not adversely affect the ability of the containment hydrogen control system to prevent the concentration of hydrogen in containment from exceeding 10 volume percent of the containment volume. The revised hydrogen venting locations from the PXS Valve/Accumulator Rooms continues to prevent collection of hydrogen in a dead-ended compartment which could lead to a detonable hydrogen concentration. The analysis shows that a hydrogen burn at the revised locations does not challenge containment integrity and does not adversely affect any system, structure or component that performs a function following a hydrogen burn. Therefore, the proposed changes in this LAR maintain compliance with 10 CFR 50.44(c).

### 4.2 Precedent

Duke Energy Florida and Duke Energy Carolinas have previously submitted similar information. See Enclosures 4 and 5 for further information on applicability and differences.

### 4.3 Significant Hazards Consideration

The proposed changes would revise the Updated Final Safety Analysis Report (UFSAR) and Combined Licenses (COLs) with regard to COL Appendix C information (and associated plant-specific Tier 1 information), and Tier 2 information involving Tier 1 information. The changes would revise the hydrogen venting for the Passive Core Cooling System (PXS) Valve/Accumulator Room A (Room 11206) and provide clarification of the venting path definition for PXS Valve/Accumulator Room B (Room 11207).

An evaluation to determine whether or not a significant hazards consideration is involved with the proposed amendment was completed by focusing on the three standards set forth in 10 CFR 50.92, “Issuance of Amendment,” as discussed below:

#### 4.3.1 Does the proposed amendment involve a significant increase in the probability or consequences of an accident previously evaluated?

Response: No

The proposed revision to the hydrogen venting for the Passive Core Cooling System (PXS) Valve/Accumulator Room A (Room 11206) and clarification of the venting path definition for PXS Valve/Accumulator Room B (Room 11207) do not affect any safety-related equipment or function. The hydrogen ignition subsystem, including designed hydrogen venting features, is designed to mitigate beyond design basis hydrogen generation in the containment. The hydrogen venting changes do not involve any accident, initiating event or component failure; thus, the probabilities of the accidents previously evaluated are not affected. The modified venting locations and definitions will maintain the hydrogen ignition subsystem designed and analyzed beyond design basis function to maintain containment integrity. The maximum allowable containment leakage rate specified in the Technical Specifications is unchanged, and radiological material release source terms are not affected; thus, the radiological releases in the accident analyses are not affected.

Therefore, the proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated.

#### 4.3.2 Does the proposed amendment create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No

The proposed revision to the hydrogen venting for the Passive Core Cooling System (PXS) Valve/Accumulator Room A (Room 11206) and clarification of the venting path definition for PXS Valve/Accumulator Room B (Room 11207) will maintain the beyond design basis function of the hydrogen ignition subsystem. The hydrogen venting changes do not impact the hydrogen ignition subsystem's function to maintain containment integrity during beyond design basis accident conditions, and, thus does not introduce any new failure mode. The proposed changes do not create a new fault or sequence of events that could result in a radioactive release. The proposed changes would not affect any safety-related accident mitigating function.

Therefore, the proposed amendment does not create the possibility of a new or different kind of accident.

#### 4.3.3 Does the proposed amendment involve a significant reduction in a margin of safety?

Response: No

The proposed revision to the hydrogen venting for the Passive Core Cooling System (PXS) Valve/Accumulator Room A (Room 11206) and clarification of the venting path definition for PXS Valve/Accumulator Room B (Room 11207) will maintain the beyond design basis function of the hydrogen ignition subsystem. The proposed changes do not have any effect on the ability of safety-related structures, systems, or components to perform their beyond design basis functions. The proposed changes are a result of a low probability, severe accident scenario being evaluated. The revision to this scenario does not result in an increase in the plant risk (frequency and/or consequences). The frequency is low and there is no increase to the consequences because containment integrity is maintained and there is no containment leakage. There is no change to the maximum allowed containment leakage rate (0.10% of containment air weight per day) for the containment vessel. The proposed changes do not affect the ability of the hydrogen igniter subsystem to maintain containment integrity following a beyond design basis accident. The hydrogen igniter subsystem continues to meet the requirements for which it was designed and continues to meet the regulations.

Therefore, the proposed amendment does not involve a significant reduction in a margin of safety.

Based on the above, it is concluded that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of “no significant hazards consideration” is justified.

### 4.4 Conclusions

Based on the considerations discussed above, (1) there is reasonable assurance that the health and safety of the public will not be endangered by 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. The above evaluations demonstrate that the requested changes can be accommodated without an increase in the probability or consequences of an accident previously evaluated, without creating the possibility of a new or different kind of accident from any accident previously evaluated, and without a significant reduction in a margin of safety. Having arrived at negative declarations with regard to the criteria of 10 CFR 50.92, this assessment determined that the requested change does not involve a Significant Hazards Consideration.

## 5. Environmental Consideration

The details of the proposed changes are provided in Sections 2 and 3 of this license amendment request.

This review supports a request to amend the licensing basis documents to allow departure from Updated Final Safety Analysis Report (UFSAR) and Combined Licenses (COLs) with regard to COL Appendix C information (and associated plant-specific Tier 1 information), and Tier 2 information involving Tier 1 information related to proposed changes to the hydrogen venting for the Passive Core Cooling System (PXS) Valve/Accumulator Room A (Room 11206) and clarification of the venting path definition for PXS Valve/Accumulator Room B (Room 11207).

The proposed change requires a revision to the UFSAR information.

A review has determined that the proposed amendment would change a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR Part 20, or would change an inspection or surveillance requirement. However, facility construction and operation following implementation of the proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9), in that:

*(i) There is no significant hazards consideration.*

As documented in Section 4.3, Significant Hazards Consideration, of this license amendment request, an evaluation was completed to determine whether or not a significant hazards consideration is involved by focusing on the three standards set forth in 10 CFR 50.92, “Issuance of amendment.” The Significant Hazards Consideration determined that (1) the proposed amendment does not involve a significant increase in the probability or consequences of an accident previously evaluated; (2) the proposed amendment does not create the possibility of a new or different kind of accident from any accident previously evaluated; and (3) the proposed amendment does not involve a significant reduction in a margin of safety. Therefore, it is concluded that the proposed amendment does not involve a significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and accordingly, a finding of “no significant hazards consideration” is justified.

*(ii) There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.*

The proposed changes in the requested amendment maintain the performance objective of the hydrogen ignition subsystem to preserve containment integrity following a beyond design basis accident. The proposed changes are unrelated to any aspect of plant construction or operation that would introduce any change to effluent types (e.g., effluents containing chemicals or biocides, sanitary system effluents, and other effluents), or affect any plant radiological or non-radiological effluent release quantities. Furthermore, the proposed changes do not affect any effluent release path or diminish the functionality of any design or operational features that are credited with controlling the release of effluents during plant operation. Therefore, it is concluded that the proposed amendment does not involve a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite.

*(iii) There is no significant increase in individual or cumulative occupational radiation exposure.*

The proposed changes modify the hydrogen venting provisions for the hydrogen ignition subsystem within the containment. Plant radiation zones (addressed in UFSAR Section 12.3) are not affected, and controls under 10 CFR 20 preclude a significant increase in occupational radiation exposure. Therefore, the proposed amendment does not involve a significant increase in individual or cumulative occupational radiation exposure.

Based on the above review of the requested amendment, it has been determined that anticipated construction and operational effects of the proposed amendment do not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in the individual or cumulative occupational radiation exposure. Accordingly, the requested amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

## 6. REFERENCES

None

**South Carolina Electric & Gas Company**

**Virgil C. Summer Nuclear Station Units 2 and 3**

**NND-17-0078**

**Enclosure 2**

**Request for Exemption,**

**Hydrogen Venting from Passive Core Cooling System (PXS) Compartments**

**(LAR 17-03)**

**(This enclosure contains 7 pages including this cover page.)**

## 1.0 Purpose

South Carolina Electric & Gas Company (SCE&G), acting on behalf of itself and South Carolina Public Service Authority (Santee Cooper) (the Licensees) request a permanent exemption from the provisions of 10 CFR 52, Appendix D, Section III.B, "Design Certification Rule for the AP1000 Design, Scope and Contents," to allow a departure from elements of the certification information in Tier 1 of the Generic DCD. The regulation, 10 CFR 52, Appendix D, Section III.B, requires an applicant or licensee referencing Appendix D to 10 CFR Part 52 to incorporate by reference and comply with the requirements of Appendix D, including certification information in DCD Tier 1.

The Tier 1 information for which a plant-specific departure and exemption is being requested includes changes to improve the venting of hydrogen from the Passive Core Cooling System (PXS) compartments into the Core Makeup Tank (CMT) rooms above. Vent layout is designed such that burning of postulated beyond-design-basis accident hydrogen releases from small compartments does not challenge the containment integrity.

The Acceptance Criteria in Tier 1, Table 2.3.9-3, Inspections, Tests, Analyses and Acceptance Criteria (ITAAC), requires 98% of the primary openings through the ceilings of the PXS valve/accumulator rooms must be at least 19 feet away from the containment shell and other openings must be at least 3 feet away.

The ITAAC acceptance criteria is proposed to be revised to change the locations for the hydrogen venting primary openings in the passive core cooling system (PXS) valve/accumulator rooms inside containment.

## 2.0 Background

The Licensees are the holders of Combined License Nos. NPF-93 and NPF-94, which authorize construction and operation of two Westinghouse Electric Company AP1000 nuclear plants, named Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3, respectively.

UFSAR Subsection 6.2.4 identifies that a containment hydrogen control system (VLS) is provided to limit the hydrogen concentration in the containment so that containment integrity is not endangered. The VLS functions following a severe accident to promote hydrogen burning soon after the lower flammability limit is reached in the containment. Initiation of hydrogen burning at the lower level of hydrogen flammability prevents accidental hydrogen burn initiation at high hydrogen concentration levels and thus provides confidence that containment integrity can be maintained during hydrogen burns and that safety-related equipment can continue to operate during and after the burns.

Two general characteristics have been incorporated into the design of the plant to promote mixing and eliminate dead-end compartments. The compartments below the operating deck are large open volumes with relatively large interconnections, which promote mixing throughout the below deck region. Other compartments below deck are provided with openings through the top of the compartment to eliminate the potential for a pocket of high-hydrogen concentration. In addition, if forced containment air-circulation is operated during post-accident recovery, then nonsafety-related fan coolers contribute to circulation in containment.

Within the PXS A and B compartments (Rooms 11206 and 11207), hydrogen may be vented through openings in the ceiling to the Containment Maintenance Area, Room 11300, to prevent accumulation of hydrogen in a dead ended compartment during a beyond design basis accident. ITAAC 2.3.09.03.iii acceptance criteria and UFSAR Subsection 6.2.4.5.1 describe the minimum distance between the primary openings and the containment shell. The acceptance criteria also define primary openings as those that constitute 98% of the opening area.

The openings in Rooms 11206 and 11207 are proposed to be reconfigured such that the primary openings description in the acceptance criteria is required to be changed.

## 3.0 Technical Justification of Acceptability

Acceptance Criteria 3.iii in Tier 1, Table 2.3.9-3 Inspections, Tests, Analyses and Acceptance Criteria, requires 98% of the primary openings through the ceilings of the passive core cooling system valve/accumulator rooms and the containment shell are at least 19 feet and other openings must be 3 feet away.

This ITAAC verifies that in the postulated beyond-design-basis accident (severe accident) scenarios discussed in UFSAR Subsections 19.34 and 19.41, hydrogen generated as a result of the accident which migrates to the passive core cooling system (PXS) compartments (Rooms 11206 and 11207) is vented through large openings in the ceilings of these rooms such that, in the event of ignition of the hydrogen plume, a failure of the containment does not result.

The openings in Room 11206 have been reconfigured to allow for access to perform maintenance activities on the equipment in Room 11206. The revised configuration is such that the equipment access opening along the refueling cavity wall no longer constitutes 98% of the opening area from Room 11206 to 11300. As such, the CMT-A opening from Room 11206 into Room 11300 must also be considered as a primary opening. These reconfigured primary openings have been analyzed and the minimum distance to the containment shell is to be revised to reflect the revised analysis.

The CMT-B opening in Room 11207 has similarly been re-analyzed and the minimum distance to the containment shell is also to be revised to reflect the revised analysis.

Additional detail for justification for this exemption is provided in Sections 2 and 3 of the accompanying License Amendment Request in Enclosure 1.

## 4.0 Justification of Exemption

10 CFR Part 52, Appendix D, Section VIII.A.4 and 10 CFR 52.63(b)(1) govern the issuance of exemptions from elements of the certified design information for AP1000 nuclear power plants. Because the Licensee has identified changes to the Tier 1 information related to the Tier 2 departure discussed in Enclosure 1 of the accompanying License Amendment Request, an exemption from the certified design information in Tier 1 is needed.

10 CFR Part 52, Appendix D, and 10 CFR §§ 50.12, 52.7, and 52.63 state that the NRC may grant exemptions from the requirements of the regulations provided six conditions are met: 1) the exemption is authorized by law [§50.12(a)(1)]; 2) the exemption will not present an undue risk to the health and safety of the public [§50.12(a)(1)]; 3) the exemption is consistent with the

common defense and security [§50.12(a)(1)]; 4) special circumstances are present [§50.12(a)(2)]; 5) the special circumstances outweigh any decrease in safety that may result from the reduction in standardization caused by the exemption [§52.63(b)(1)]; and 6) the design change will not result in a significant decrease in the level of safety [Part 52, App. D, VIII.A.4].

The requested exemption satisfies the criteria for granting specific exemptions, as described below.

1. **This exemption is authorized by law**

   The NRC has authority under 10 CFR §§ 50.12, 52.7, and 52.63 to grant exemptions from the requirements of NRC regulations. Specifically, 10 CFR §§50.12 and 52.7 state that the NRC may grant exemptions from the requirements of 10 CFR Part 52 upon a proper showing. No law exists that would preclude the changes covered by this exemption request. Additionally, granting of the proposed exemption does not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations.

   Accordingly, this requested exemption is "authorized by law," as required by 10 CFR §50.12(a)(1).

2. **This exemption will not present an undue risk to the health and safety of the public**

   The proposed exemption from the requirements of 10 CFR 52, Appendix D, Section III.B allows changes to elements of the plant-specific Tier 1 DCD to depart from the AP1000 certified (Tier 1) design information. The plant-specific Tier 1 DCD continues to reflect the approved licensing basis for the Licensee, and maintains a consistent level of detail with that which is currently provided elsewhere in Tier 1 of the plant-specific DCD. Because the change to the ITAAC acceptance criteria in Tier 1 Table 2.3.9-3 maintains the design margins of the Containment Hydrogen Control System, the changed acceptance criteria continues to provide the protection of the health and safety of the public. Therefore, no adverse safety impact which would present any additional risk to the health and safety of the public is present. The affected Design Description in the plant-specific Tier 1 DCD also continues to provide the detail necessary to support the performance of the associated ITAAC.

   Therefore, the requested exemption from 10 CFR 52, Appendix D, Section III.B does not present an undue risk to the health and safety of the public.

3. **The exemption is consistent with the common defense and security**

   The exemption from the requirements of 10 CFR 52, Appendix D, Section III.B changes elements of the plant-specific Tier 1 DCD by departing from the AP1000 certified (Tier 1) design information. The exemption does not alter the design, function, or operation of any structures or plant equipment that are necessary to maintain a secure status of the plant. The proposed exemption has no impact on plant security or safeguards procedures.

   Therefore, the requested exemption is consistent with the common defense and security.

**4. Special circumstances are present**

10 CFR 50.12(a)(2) list six "special circumstances" for which an exemption may be granted. Pursuant to the regulation, it is necessary for one of these special circumstances to be present in order for the NRC to consider granting an exemption request. The requested exemption meets the special circumstances of 10 CFR 50.12(a)(2)(ii). That subsection defines special circumstances as when "Application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule."

The rule under consideration in this request for exemption is 10 CFR 52, Appendix D, Section III.B, which requires that a licensee referencing the AP1000 Design Certification Rule (10 CFR Part 52, Appendix D) shall incorporate by reference and comply with the requirements of Appendix D, including Tier 1 information. The licensing basis documents reference the AP1000 Design Certification Rule and incorporate by reference the requirements of 10 CFR Part 52, Appendix D, including Tier 1 information. The underlying purpose of Appendix D, Section III.B is to describe and define the scope and contents of the AP1000 design certification, and to require compliance with the design certification information in Appendix D to maintain the level of safety in the design.

The proposed changes to the locations for the primary openings of the passive core cooling system compartments into the core makeup rooms above maintain the combustible gas control capability of the containment hydrogen control system. This change does not impact the ability of any structures, systems, or components to perform their functions or negatively impact safety. Accordingly, this exemption from the certification information enables the licensee to safely construct and operate the AP1000 facility consistent with the purpose of the design certified by the NRC in 10 CFR 52, Appendix D.

Therefore, special circumstances are present, because application of the current generic certified design information in Tier 1 as required by 10 CFR Part 52, Appendix D, Section III.B, in the particular circumstances discussed in this request is not necessary to achieve the underlying purpose of the rule.

**5. The special circumstances outweigh any decrease in safety that may result from the reduction in standardization caused by the exemption**

Based on the nature of the changes to the plant-specific Tier 1 information and the understanding that these changes support the design function of the containment hydrogen control system, it is expected that other AP1000 applicants and licensees will also request this exemption. Regardless, the special circumstances continue to outweigh any decrease in safety from the reduction in standardization because the key design function of the containment hydrogen control system associated with this request continues to be maintained. This exemption request demonstrates that the system function continues to be maintained following implementation of the change from the generic AP1000 DCD Tier 1 information, thereby minimizing the safety impact resulting from any reduction in standardization.

Therefore, the special circumstances associated with the requested exemption outweigh any decrease in safety that may result from the reduction in standardization caused by the exemption.

6. **The design change will not result in a significant decrease in the level of safety.**

   The requested exemption revises the plant-specific DCD Tier 1 information by altering the acceptable locations for the primary openings of the passive core cooling system compartments into the core makeup rooms above while maintaining the combustible gas control capability of the containment hydrogen control system. Because this change does not impact the ability of any structures, systems, or components to perform their functions, the change does not result in a significant decrease in the level of safety.

## 5.0 Risk Assessment

A risk assessment was determined to be not applicable to address the acceptability of this request.

## 6.0 Precedent

Duke Energy Florida and Duke Energy Carolinas have previously submitted similar information. See Enclosures 4 and 5 for further information on applicability and differences.

## 7.0 Environmental Consideration

A review has determined that the proposed exemption changes a requirement with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20, or changes an inspection or surveillance requirement. However, the proposed exemption does not involve (i) a significant hazards consideration, (ii) a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Specific justification is provided in Section 5 of the corresponding License Amendment Request in Enclosure 1. Accordingly, the proposed exemption meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed exemption.

## 8.0 Conclusion

The proposed changes to Tier 1 are necessary to revise the passive core cooling system design description in the plant-specific DCD Tier 1. The exemption request meets the requirements of 10 CFR 52.63, *"Finality of design certifications,"* 10 CFR 52.7, *"Specific exemptions,"* 10 CFR 50.12, *"Specific exemptions,"* 10 CFR 51.22, *"Criterion for categorical exclusion; identification of licensing and regulatory actions eligible for categorical exclusion or otherwise not requiring environmental review,"* and 10 CFR 52 Appendix D, *"Design Certification Rule for*

*the AP1000 Design."* Specifically, the exemption request meets the criteria of 10 CFR 50.12(a)(1) in that the request is authorized by law, presents no undue risk to public health and safety, and is consistent with the common defense and security. Furthermore, approval of this request does not result in a significant decrease in the level of safety, presents special circumstances, does not present a significant decrease in safety as a result of a reduction in standardization, and meets the eligibility requirements for categorical exclusion.

**South Carolina Electric & Gas Company**

**Virgil C. Summer Nuclear Station Units 2 and 3**

**NND-17-0078**

**Enclosure 3**

**Proposed Changes to the Licensing Basis Documents**

**(LAR 17-03)**

Additions identified by blue underlined text.
~~Deletions Identified by red strikethrough of text.~~
… Indicates omitted existing text that is not shown.

**(This enclosure contains 5 pages including this cover page.)**

**Plant-Specific Tier 1 and associated COL Appendix C Table 2.3.9-3, line item 3, is revised as shown below.**

| Table 2.3.9-3<br>Inspections, Tests, Analyses, and Acceptance Criteria | | |
|---|---|---|
| **Design Commitment** | **Inspections, Tests, Analyses** | **Acceptance Criteria** |
| … | | |
| 3. The VLS provides the nonsafety-related function to control the containment hydrogen concentration for beyond design basis accidents. | i) [no change]<br>ii) [no change]<br>iii) An inspection of the as-built containment internal structures will be performed.<br>iv) [no change] | i) [no change]<br>ii) [no change]<br>iii) The equipment access opening and CMT-A opening constitute at least 98% of the vent path area from Room 11206 to Room 11300. The minimum distance between the equipment access opening ~~primary openings through the ceilings of the passive core cooling system valve/accumulator rooms (11206, 11207)~~ and the containment shell is at least 24.3 ~~19~~ feet. The minimum distance between the CMT-A opening and the containment shell is at least 9.4 feet. The CMT-B opening constitutes at least 98% of the vent path area from Room 11207 to Room 11300 and is a minimum distance of 24.6 feet away from the containment shell. ~~Primary openings are those that constitute 98% of the opening area.~~ Other openings through the ceilings of these rooms must be at least 3 feet from the containment shell.<br>iv) [no change] |
| … | | |

**The UFSAR Subsection 6.2.4.5.1, Preoperational Inspection and Testing, second paragraph of Hydrogen Ignition Subsystem discussion is revised as shown below.**

Pre-operational inspection is performed to verify the location of openings through the ceilings of the passive core cooling system valve/accumulator rooms with respect to the containment pressure boundary. The primary openings ~~must be at least 19 feet from the containment shell. Primary openings~~ are those that constitute at least 98% of the opening area. The primary openings in Room 11206 that vent to Room 11300 are the equipment access opening and CMT-A opening. These openings are verified to be a minimum distance of 24.3 feet and 9.4 feet, respectively, from the containment shell. The primary opening in Room 11207 that vents to Room 11300 is the CMT-B opening, which is verified to be a minimum distance of 24.6 feet from the containment shell. Other openings must be at least 3 feet from the containment shell.

**The UFSAR Subsection 19.41.7, Diffusion Flame Analysis, second, fifth, and sixth paragraphs of AP1000 Diffusion Flame Mitigation Strategy discussion are revised as shown below.**

The AP1000 addresses diffusion flames by adopting a defense-in-depth philosophy in the design. In the highest frequency severe accidents, sustained hydrogen release is prevented from occurring in the dead-ended compartments. In sequences where diffusion flames at IRWST or PXS/CVS compartment vents may be postulated, design strategies are initiated to mitigate the threat to the containment integrity by locating hydrogen plumes ~~away from the containment shell~~ where they do not challenge containment integrity.

{3rd paragraph, no change}

{4th paragraph, no change}

In the event that ADS stage 4 fails to adequately direct hydrogen away from confined compartments, the compartment vents are designed to preferentially release the hydrogen at locations where it burns ~~away from the containment shell~~, but does not challenge containment integrity.

Vents from the PXS and CVS compartments to the CMT room are located well away from the containment shell and containment penetrations. Access hatches to the subcompartments that are near the containment shell are covered and secured closed such that they will not open as a result of a pipe break inside the compartment. Therefore, hydrogen releases to the CMT room from the subcompartments ~~are not considered as a threat to the~~ have been shown to not challenge containment integrity.

**The UFSAR Subsection 19.59.9.5.6, Combustible Gases Generation and Burning, fifth paragraph, final two sentences, are revised as shown below.**

… The AP1000 uses a defense-in-depth approach to release hydrogen in ~~benign~~ locations away from the containment shell and penetrations where it burns, but does not challenge containment integrity. Therefore, the potential for containment failure from the formation of a diffusion flame at the in-containment refueling water storage tank vents is considered to be low.

**The UFSAR Subsection 19.59, Table 19.59-18, Item 31, is revised as shown below.**

**Table 19.59-18 (Sheet 16 of 25)**
**AP1000 PRA-Based Insights**

| Insight | Disposition |
|---|---|
| … | |
| 31. Mitigation of the effects of a diffusion flames on the containment shell are addressed by the following containment layout features: | 1.2, General Arrangement Drawings |
| – Vents from the PXS and CVS compartments (where hydrogen releases can be postulated) to the CMT room are located well away from the containment shell and containment penetrations. The access hatch to the PXS-B compartment is located near the containment wall and is normally closed to address severe accident considerations. Hydrogen releases to the CMT room from the subcompartments have been shown to not challenge containment integrity. The access hatch to the PXS-B compartment is accessible from Room 11300 on elevation 107′-2″. | 3.4.1.2.2.1 & 19.41.7 |
| – IRWST vents are designed so that those located away from the containment wall open to vent hydrogen releases. In this situation IRWST vents located close to the containment wall would not open because flow of hydrogen through the other vents would not result in a IRWST pressure sufficient to open them. | 6.2.4.5.1 |
| … | |

**The UFSAR Appendix 19D, Table 19D-7, is revised to include a new line item as shown below.**

**Table 19D-7 (Sheet 2 of 3)**
**Sustained Hydrogen Combustion Survivability Assessment**

| EQUIPMENT AND INSTRUMENTATION | SUSTAINED HYDROGEN COMBUSTION SURVIVABILITY ASSESSMENT |
|---|---|
| **Equipment** | |
| Containment Shell | {no change} |
| Containment Lower Equipment Hatch and Seals | The lower equipment hatch and seals on the containment vessel may be exposed to heat transfer from a sustained flame at the vents from the PXS valve/accumulator room to the maintenance floor. The equipment hatch and seals have been shown by analysis to be unlikely to fail or leak. |
| Igniters | {no change} |
| **Instrumentation** | |
| … | … |

**South Carolina Electric & Gas Company**

**Virgil C. Summer Nuclear Station Units 2 and 3**

**NND-17-0078**

**Enclosure 4**

**Applicability and Endorsement of Prior Docketed Information**

**(LAR 17-03)**

**(This enclosure contains 2 pages including this cover page.)**

By letter dated September 24, 2014, the NRC submitted a Request for Additional Information (RAI) to Duke Energy Florida (DEF) for the Levy Nuclear Plant, Units 1 and 2 (LNP) regarding Combustible Gas Control in Containment. DEF provided an initial response by letter dated June 30, 2015 and superseded that with a subsequent response dated January 6, 2016.

The RAI responses included with the following DEF letter have been reviewed for applicability to Virgil C. Summer Nuclear Station, Units 2 and 3.

1. Duke Energy Florida, Levy Nuclear Plant, Units 1 and 2, Docket Nos. 52-029 and 52-030, Letter NPD-NRC-2016-001, dated January 6, 2016. [ML16008A082]

As identified in the DEF response to the RAI, a change is necessary to comply with the subject Inspections, Tests, Analyses and Acceptance Criteria (ITAAC) identified in Item 3.iii) of plant-specific Tier 1 Table 2.3.9-3.

**South Carolina Electric & Gas Company**

**Virgil C. Summer Nuclear Station Units 2 and 3**

**NND-17-0078**

**Enclosure 5**

**Proposed Changes that Differ from the Duke Submittals for Information Only**

**(LAR 17-03)**

**(This enclosure contains 3 pages including this cover page.)**

The following comparison is based on Duke Energy Florida (DEF), Levy Nuclear Plant, Units 1 and 2, Docket Nos. 52-029 and 52-030, Letter NPD-NRC-2016-001, Enclosure 3, dated January 6, 2016. [ML16008A082]. Enclosure 3 of that letter provided a set of proposed changes to the Levy Nuclear Plant Licensing Basis Documents.

*Changes which are "technically consistent" with the referenced proposed changes are listed below. Changes which are not "technically consistent" with the referenced proposed changes are then identified and discussed. "Technically consistent" allows for minor editorial differences that do not impact the technical details of the discussion, e.g., grammar, verb tense, capitalization, use of acronyms or initialisms, etc.*

*The following LAR changes to COL Appendix C (and plant-specific Tier 1) are technically consistent with the corresponding departure to COLA Part 10, Appendix B, provided in the Duke Energy Florida submittal for the Levy Nuclear Plant, dated January 6, 2016.*

- COL Appendix C (and plant-specific Tier 1) Table 2.3.9-3

*The LAR changes to the UFSAR listed below are technically consistent with the corresponding departure to COLA Part 2, provided in the Duke Energy Florida submittal for the Levy Nuclear Plant, dated January 6, 2016. However, additional information is provided for each and the differences are discussed following this listing.*

- UFSAR Subsection 6.2.4.5.1 (generally consistent; see discussion of differences below)
- UFSAR Subsection 19.41.7 (generally consistent; see discussion of differences below)
- UFSAR Subsection 19.59.9.5.6 (additional change not in DEF submittal)
- UFSAR Subsection 19.59, Table 19.59-18, Item 31 (additional change not in DEF submittal)
- UFSAR Appendix 19D, Table 19D-7 (additional change not in DEF submittal)

*See discussion for each item below.*

*Additional information for each LAR change identified above.*

**UFSAR Subsection 6.2.4.5.1:**

DEF/Levy: Revises the text to reflect the proposed acceptance criteria.

SCE&G/VCSNS: Revises the text to reflect the proposed acceptance criteria. Adds “at least” to identify the 98% is a lower bound.

Basis for Difference:

Consistency with the lower bound wording proposed for the ITAAC.

**UFSAR Subsection 19.41.7:**

DEF/Levy: Revises the discussion to recognize the plumes may get close to the containment, but will not challenge the integrity, in two locations.

SCE&G/VCSNS: Revises the discussion to recognize the plumes may get close to the containment, but will not challenge the integrity, in three locations.

Basis for Difference:

One additional location of impacted text was identified.

**UFSAR Subsection 19.59.9.5.6, Table 19.59-18, & Table 19D-7:**

DEF/Levy: No change to these sections in DEF submittal.

SCE&G/VCSNS: Revises the discussion to recognize the plumes may get close to the containment, but will not challenge the integrity.

Basis for Difference:

Additional locations of impacted text were identified.