

## SummerRAIsPEm Resource

---

**From:** Gleaves, Bill  
**Sent:** Thursday, July 28, 2016 11:41 AM  
**To:** SummerRAIsPEm Resource  
**Subject:** FW: Vogtle/Summer LAR SEs for Vogtle LAR-16-005 and Summer LAR 14-12  
**Attachments:** Vogtle LAR-16-005 Safety Evaluation (2016-07-27).docx; V.C. Summer LAR-14-12 Safety Evaluation (2016-07-27).docx

**From:** Karas, Rebecca  
**Sent:** Wednesday, July 27, 2016 6:52 PM  
**To:** Dixon-Herrity, Jennifer  
**Cc:** Patel, Chandu; Gleaves, Bill; Burja, Alexandra; Van Wert, Christopher; Scully, Derek; Dias, Antonio  
**Subject:** FW: Vogtle/Summer LAR SEs

Jennifer,

Attached are SERs for the Vogtle and Summer CMT Volume Inconsistency LARs. I concur on this input. Please process.

Thanks,

Rebecca Karas, Chief  
Reactor Systems, Nuclear Performance & Code Review  
Division of Safety Systems and Risk Assessment  
Office of New Reactors  
U.S. Nuclear Regulatory Commission  
Phone: 301-415-7533

---

**From:** Burja, Alexandra  
**Sent:** Wednesday, July 27, 2016 2:55 PM  
**To:** Karas, Rebecca <[Rebecca.Karas@nrc.gov](mailto:Rebecca.Karas@nrc.gov)>  
**Cc:** Van Wert, Christopher <[Christopher.VanWert@nrc.gov](mailto:Christopher.VanWert@nrc.gov)>  
**Subject:** RE: Vogtle/Summer LAR SEs

Becky,

Per Rick Scully's earlier email, he was fine with the SEs, particularly the TS-related aspects. Attached are clean versions of the SEs. I made two changes since earlier today:

- Reworded a sentence on Page 6 of 8 to clarify that the accession number I provided was for an audit report and said "calculation note" instead of just "calculation" to be consistent with wording in the audit report
- Added a "Principal Contributors" section at the very end based on other similar SEs having it

If you have any questions or concerns, please let me know. If not, now that we have Rick's blessing, we can go ahead and issue it to Projects.

Thanks,

Alex

**Hearing Identifier:** Summer\_COL\_eRAIs  
**Email Number:** 170

**Mail Envelope Properties** (f091f8c68822425ca31cd906364b0c53)

**Subject:** FW: Vogtle/Summer LAR SEs for Vogtle LAR-16-005 and Summer LAR 14-12  
**Sent Date:** 7/28/2016 11:41:09 AM  
**Received Date:** 7/28/2016 11:41:11 AM  
**From:** Gleaves, Bill

**Created By:** Bill.Gleaves@nrc.gov

**Recipients:**  
"SummerRAIsPEm Resource" <SummerRAIsPEm.Resource@nrc.gov>  
Tracking Status: None

**Post Office:** HQPWMSMRS05.nrc.gov

<b>Files</b>	<b>Size</b>	<b>Date &amp; Time</b>
MESSAGE	1609	7/28/2016 11:41:11 AM
Vogtle LAR-16-005 Safety Evaluation (2016-07-27).docx	46924	
V.C. Summer LAR-14-12 Safety Evaluation (2016-07-27).docx	47902	

**Options**  
**Priority:** Standard  
**Return Notification:** No  
**Reply Requested:** No  
**Sensitivity:** Normal  
**Expiration Date:**  
**Recipients Received:**

SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

RELATED TO AMENDMENT NO. 16-005

TO COMBINED LICENSE NOS. NPF-91 AND NPF-92

SOUTHERN NUCLEAR OPERATING COMPANY, INC.

GEORGIA POWER COMPANY

OGLETHORPE POWER CORPORATION

MUNICIPAL ELECTRIC AUTHORITY OF GEORGIA

CITY OF DALTON, GEORGIA

VOGTLE ELECTRIC GENERATING PLANT UNITS 3 AND 4

DOCKET NOS. 52-025 AND 52-026

1.0 INTRODUCTION

By letter dated May 18, 2016 (Agencywide Documents Access and Management System [ADAMS] Accession No. ML16139A796), Southern Nuclear Operating Company, Inc. (SNC or licensee) requested that the U.S. Nuclear Regulatory Commission (NRC or Commission) amend the combined licenses (COLs) for Vogtle Electric Generating Plant (VEGP) Units 3 and 4, COL Nos. NPF-91 and NPF-92, respectively. By letter dated June 17, 2016 (ADAMS Accession No. ML16166A092), the NRC provided SNC with the results of the staff's acceptance review of license amendment request (LAR) 16-005, which concluded that the LAR is sufficient for the staff to perform the detailed technical review.

The proposed license amendment would change the listed minimum volume of the passive core cooling system core makeup tanks (CMTs) reflected in Appendix A of the VEGP Units 3 and 4 COLs, Technical Specifications (TS), and supporting information in the VEGP Units 3 and 4 Updated Final Safety Analysis Report (UFSAR). Specifically, these changes would align these licensing documents, which originally specified a minimum CMT volume of 2,500 ft<sup>3</sup>, with the minimum CMT volume given in the VEGP COL Tier 1 information as 2,487 ft<sup>3</sup>. The licensee stated this change is based on and supported by a small-break loss-of-coolant accident (SBLOCA) safety analysis.

2.0 BACKGROUND

Title 10 of the *Code of Federal Regulations*, Part 52 (10 CFR Part 52), Subpart C, "Combined Licenses," sets forth the requirements and procedures applicable to Commission issuance of COLs for nuclear power facilities. Sections 52.79(a) and (d) set forth the requirements for a COL application that references a standard design certification. On February 10, 2012, the NRC issued COLs under 10 CFR Part 52, Subpart C to SNC for VEGP Units 3 and 4. SNC's reference COL (RCOL) application for VEGP Units 3 and 4 was the first to reference the Westinghouse AP1000 design certification rule, Appendix D to 10 CFR Part 52. The VEGP Units 3 and 4 UFSAR consists of the information incorporated by reference from the AP1000

Design Control Document (DCD), Revision 19, along with VEGP site-specific information, including supplements and departures from the DCD. Similarly, the VEGP Units 3 and 4 TS, which were issued with the VEGP RCOLs, consist of the AP1000 generic TS (DCD Tier 2, Chapter 16, Revision 19) and the VEGP site-specific TS. The AP1000 generic TS were modeled after Revision 2 of NUREG-1431, dated June 30, 2001, and were incorporated by reference into the VEGP plant-specific TS.

### Content of LAR-16-005

The LAR letter has three enclosures:

- Enclosure 1, Request for Licensing Amendment Regarding Core Makeup Tank Volume
- Enclosure 2, Proposed Changes to Licensing Basis Documents
- Enclosure 3, Conforming Technical Specification Bases Changes (For Information Only)

Enclosure 1 contains a summary description of the LAR, a detailed description of the changes, technical and regulatory evaluations for the proposed changes, environmental considerations, and applicable references.

Enclosure 2 provides a markup of affected TS and UFSAR pages, and Enclosure 3 provides a markup of affected TS Bases. Pages with no changes are not included.

### 3.0 REGULATORY EVALUATION

The NRC staff considered the following regulatory requirements and guidance in reviewing the licensee's LAR:

- 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-water Nuclear Power Reactors," prescribes acceptance criteria for emergency core cooling systems (ECCSs) and requirements for evaluation models.
- 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 34, "Residual Heat Removal," requires a residual heat removal (RHR) system that is capable of transferring fission product decay heat and other residual heat from the reactor core at a rate such that specified acceptable fuel design limits and the design conditions of the reactor coolant pressure boundary are not exceeded.
- GDC 35, "Emergency Core Cooling," requires a system to provide abundant emergency core cooling whose safety function is to transfer heat from the reactor core following any loss of reactor coolant at a rate such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented and (2) clad metal-water reaction is limited to negligible amounts.
- GDC 36, "Inspection of Emergency Core Cooling System," requires the ECCS to be designed to permit appropriate periodic inspection of important components.
- GDC 37, "Testing of Emergency Core Cooling System," requires that the ECCS be designed to permit appropriate periodic pressure and functional testing.

- 10 CFR Part 50, Appendix K, "ECCS Evaluation Models," prescribes required and acceptable features of evaluation models as well as required documentation.

In addition, Section 182a of the Atomic Energy Act (the Act) requires that applicants for nuclear power plant operating licenses will state:

[S]uch technical specifications, including information of the amount, kind, and source of special nuclear material required, the place of the use, the specific characteristics of the facility, and such other information as the Commission may, by rule or regulation, deem necessary in order to enable it to find that the utilization . . . of special nuclear material will be in accord with the common defense and security and will provide adequate protection to the health and safety of the public. Such technical specifications shall be a part of any license issued.

In 10 CFR 50.36, the Commission established its regulatory requirements related to the content of TS. In doing so, the Commission placed emphasis on those matters related to the prevention of accidents and the mitigation of accident consequences. As recorded in the Statements of Consideration, "Technical Specifications for Facility Licenses; Safety Analysis Reports" (33 FR 18610, December 17, 1968), the Commission noted that applicants were expected to incorporate into their TS "those items that are directly related to maintaining the integrity of the physical barriers designed to contain radioactivity." Pursuant to 10 CFR 50.36, TS for nuclear reactors are required to include items in the following categories: (1) safety limits and limiting safety system settings; (2) limiting conditions for operation (LCOs); (3) surveillance requirements (SRs); (4) design features; and (5) administrative controls. However, the rule does not specify the particular requirements to be included in a nuclear reactor plant's TS.

On February 6, 1987, the Commission issued an interim policy statement on TS improvements, "Interim Policy Statement on Technical Specification Improvements for Nuclear Power Reactors" (52 FR 3788). From 1989 to 1992, industry PWR and BWR owners groups and the NRC staff developed improved standard TS (STS) (e.g., NUREG-1431) that would establish model TS based on the Commission's policy for each primary reactor type. In addition, representatives from the NRC, nuclear reactor plant licensees, and industry owners groups developed generic administrative and editorial guidelines in the form of a writer's guide for preparing TS (most recently issued in June 2005 as TSTF-GG-05-01, Revision 1), which gives appropriate consideration to human factors engineering principles and was used throughout the development of plant-specific improved TS (ITS).

In September 1992, the Commission issued NUREG-1431, Revision 0, which was developed using the guidance and criteria contained in the Commission's Interim Policy Statement. The STS in NUREG-1431 were established as a model for developing plant-specific ITS for Westinghouse plants, in general. The STS reflect the results of a detailed review of the application of the Interim Policy Statement criteria, which have been incorporated in 10 CFR 50.36(c)(2)(ii), to generic system functions, which were published in a "split report" issued to the PWR and BWR nuclear steam supply system vendor owners groups in May 1988. The STS also reflect the results of extensive discussions concerning various drafts of STS so that the application of the TS LCO criteria and the writer's guide would consistently reflect detailed system configurations and operating characteristics for all reactor designs. As such, the generic bases presented in NUREG-1431 provide an abundance of information regarding the extent to which the STS present requirements that are necessary to protect public health and safety.

On July 22, 1993, the Commission issued its Final Policy Statement, expressing the view that satisfying the guidance in the policy statement also satisfies Section 182a of the Act and 10 CFR 50.36. The Final Policy Statement described the safety benefits of the STS and encouraged licensees to use the STS as the basis for plant-specific TS amendments and for complete conversions to ITS based on the STS. In addition, the Final Policy Statement gave guidance for evaluating the required scope of the TS and defined the guidance criteria to be used in determining which of the LCOs and associated SRs should remain in the TS. The Commission noted that, in allowing certain items to be relocated to licensee-controlled documents while requiring that other items be retained in the TS, it was adopting the qualitative standard enunciated by the Atomic Safety and Licensing Appeal Board in *Portland General Electric Co.* (Trojan Nuclear Plant), ALAB-531, 9 NRC 263, 273 (1979). There, the Appeal Board observed:

[T]here is neither a statutory nor a regulatory requirement that every operational detail set forth in an applicant's safety analysis report (or equivalent) be subject to a technical specification, to be included in the license as an absolute condition of operation which is legally binding upon the licensee unless and until changed with specific Commission approval. Rather, as best we can discern it, the contemplation of both the Act and the regulations is that technical specifications are to be reserved for those matters as to which the imposition of rigid conditions or limitations upon reactor operation is deemed necessary to obviate the possibility of an abnormal situation or event giving rise to an immediate threat to the public health and safety.

By this approach, existing LCO requirements that fall within or satisfy any of the criteria in the Final Policy Statement should be retained in the TS; those LCO requirements that do not fall within or satisfy these criteria may be relocated to licensee-controlled documents. The Commission codified the four criteria in 10 CFR 50.36 (60 FR 36953, July 19, 1995). The four criteria, as stated in 10 CFR 50.36(c)(2)(ii) subparagraphs (A), (B), (C), and (D), are as follows:

- Criterion 1      Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.
- Criterion 2      A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
- Criterion 3      A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
- Criterion 4      A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.

Part 4.0 of this safety evaluation (SE) explains the NRC staff's determination that the VEGP TS based on STS is consistent with the proposed changes to the VEGP licensing basis documents,

the requirements and guidance of the Final Policy Statement, and 10 CFR 50.36 and 10 CFR 50.36a.

#### 4.0 TECHNICAL EVALUATION

In its review of LAR 16-005, the NRC staff evaluated the proposed changes to the TS and the UFSAR against the regulatory requirements identified in Section 3.0 of this SER. The staff also reviewed the proposed changes to the TS Bases for consistency with the proposed changes to the TS. The proposed changes and the staff's evaluation are discussed below.

##### Proposed Changes to the TS

TS 3.5.2, "Core Makeup Tanks (CMTs) – Operating," includes SR 3.5.2.2, which requires verification that the borated water volume in each CMT is greater than or equal to a specified volume every seven days. LAR 16-005 proposes to change that minimum volume from 2,500 ft<sup>3</sup> to 2,487 ft<sup>3</sup>.

##### Proposed Changes to the TS Bases

LAR 16-005 proposes to add the following text to the "Applicable Safety Analyses" portion of Bases 3.5.2: "In the case of a small break LOCA, the borated water volume of one CMT is adequate for RCS safety injection, where one CMT completely spills via the pipe break."

##### Proposed Changes to the UFSAR

LAR 16-005 proposes to change the minimum CMT volume from 2,500 ft<sup>3</sup> to 2,487 ft<sup>3</sup> in the following UFSAR locations:

- Section 5.4.13.2, "Design Description"
- Table 6.3-2, "Component Data – Passive Core Cooling System"
- Table 14.3-2, "Design Basis Accident Analysis"

##### Overall Evaluation of Proposed Changes

The AP1000 design includes two CMTs as part of the passive core cooling system, which serves as the ECCS for the AP1000. The CMTs store borated water for high pressure reactor coolant makeup. The CMT inlet nozzle is connected to cold leg piping, and the outlet nozzle is connected to direct vessel injection (DVI) piping.

The licensee stated that the basis for the change in minimum CMT volume from 2,500 ft<sup>3</sup> to 2,487 ft<sup>3</sup> is the assumption in the SBLOCA analysis that one CMT provides adequate safety injection. According to the licensee, the value of 2,487 ft<sup>3</sup> was established during inspections, tests, analyses, and acceptance criteria (ITAAC) development to permit a 0.5 percent construction tolerance to the design tank volume of 2,500 ft<sup>3</sup> and is the minimum volume required to accomplish the CMT design function. The staff confirmed the minimum CMT volume to be 2,487 ft<sup>3</sup> in the AP1000 ITAAC, which the VEGP Units 3 and 4 COLs incorporate by reference.

In addition, the licensee stated that the safety analyses were performed with a CMT volume of 2,500 ft<sup>3</sup> or greater except for the SBLOCA analyses, which assumed a CMT volume of 2,487 ft<sup>3</sup>. To ensure no impacts to the ECCS functions required by 10 CFR 50.46 and GDC 35 or

RHR functions required by GDC 34, the staff verified that the assumptions made in the AP1000 transient and accident analyses are valid and conservative relative to a minimum CMT volume of 2,487 ft<sup>3</sup>.

The CMTs provide reactor coolant system (RCS) makeup and boration for non-LOCAs when normal makeup is not available or insufficient. During non-LOCAs involving RCS heatup or inventory increase, the CMTs primarily provide cooldown and decay heat removal capability. The larger CMT volume is conservative for these cases because the additional volume that may be added to the RCS makes pressurizer overfill more likely. For non-LOCAs that involve RCS cooldown, the major function of the CMTs is to provide borated water to mitigate the reactivity transient due to a negative moderator temperature coefficient. The licensee stated that CMT volume is not a critical parameter to shutdown margin for these events. The staff agrees, noting that the change in boron worth due to a 0.5 percent smaller CMT volume is small enough to be negligible.

The purpose of the CMTs during LOCAs is to provide borated makeup water to the RCS. During large-break LOCAs (LBLOCAs), the core depressurizes rapidly enough to allow injection from lower-pressure makeup sources. In contrast, SBLOCAs move much more slowly, so not all ECCS features are available to mitigate the SBLOCA due to slower depressurization. Therefore, the staff agrees with the licensee's statement that the analyses most affected by CMT volume are the SBLOCA analyses. The staff confirmed that the SBLOCA analyses include a double-ended rupture of the DVI line, which shows that only one CMT—and only half of the ECCS—is sufficient to mitigate the SBLOCA. However, the staff was unable to verify the licensee's claim that the CMT volume assumed for the SBLOCA analyses is 2,487 ft<sup>3</sup>. As a result, the staff audited an SBLOCA calculation note on June 22, 2016, and confirmed, as documented in an audit report (ADAMS Accession No. ML16179A342), that the SBLOCA analyses conservatively incorporate a CMT volume of 2,487 ft<sup>3</sup>.

The licensee stated that, for LBLOCAs, assuming a smaller CMT volume would not have an effect on peak cladding temperature (PCT). The staff noted that the LBLOCA analysis in the AP1000 DCD shows that, while the CMTs inject for a very short time at the beginning of the transient, they do not begin injecting again until long after PCT occurs. Therefore, the staff agrees that modeling a slightly smaller CMT volume would not affect the LBLOCA analysis. The staff also considered the impacts of a slightly smaller assumed CMT volume on long-term cooling following a LBLOCA. The staff concludes that the reduction in containment floodup level would be negligible; as a result, there would be no adverse impacts on long-term cooling analyses.

During a steam generator tube rupture, the CMT plays a role, along with the passive residual heat removal heat exchanger, startup feedwater, and chemical and volume control system, to remove decay heat for RCS cooldown and depressurization. The staff concludes that modeling a 0.5 percent smaller CMT volume would have a negligible impact on RCS cooldown and depressurization due to the other systems that also provide heat sink functions.

Regarding containment peak pressure analyses, the licensee stated that a 0.5 percent decrease in CMT volume leads to a negligible difference in mass and energy release into containment. The staff agrees that the change would be insignificant.

In conclusion, the staff finds that the existing transient and accident analyses are consistent with or are conservative with respect to a CMT volume of 2,487 ft<sup>3</sup>. Based on this, the staff concludes that the proposed changes continue to meet 10 CFR 50.46 with regard to ECCS

performance, GDC 34, and GDC 35. In addition, the staff agrees with the licensee that no corresponding changes are required related to the tank construction and design requirements; design and safety evaluation methods; tests, experiments, and procedures; inspection requirements; or ex-vessel severe accident assessment. Therefore, the staff concludes that the proposed changes continue to meet 10 CFR 50.46 with respect to evaluation models; 10 CFR 50, Appendix K; and GDC 36 and 37.

#### Evaluation of Proposed TS Change

The staff evaluated the proposed change to the TS and reviewed the provided markups for completeness and accuracy. The staff noted that SR 3.5.2.2 in the AP1000 STS requires verification that the CMT volume is greater than or equal to 2,500 ft<sup>3</sup>. However, for the reasons described above, and because the change would align the TS value with the ITAAC value, the staff finds the proposed change from 2,500 ft<sup>3</sup> to 2,487 ft<sup>3</sup> acceptable.

#### Review of Proposed Change to the Bases

The staff reviewed the proposed change to the Bases as well as the provided markups. The markup adds clarification to the “Applicable Safety Analyses” portion of Bases 3.5.2. As previously discussed, the staff confirmed that one CMT provides sufficient RCS makeup for a SBLOCA. Therefore, the staff concludes that the proposed change to the Bases is consistent with the proposed change to the TS.

#### Evaluation of Proposed Changes to the UFSAR

The staff evaluated the proposed UFSAR changes and the accuracy and completeness of the associated markups. For the reasons already described in this section, the proposed changes are technically acceptable and consistent with the Tier 1 information, and the markups accurately reflect the proposed changes. Therefore, the staff concludes that the proposed UFSAR changes are acceptable.

#### 4.1 Summary

Based on the technical evaluation of the proposed changes to the VEGP Units 3 and 4 TS and UFSAR and the review of the proposed changes to the TS Bases above, the NRC staff concludes that the VEGP Units 3 and 4 COLs continue to meet the requirements of 10 CFR 50.36; 10 CFR 50.46; 10 CFR Part 50, Appendix K; and GDC 34, 35, 36, and 37. Therefore, the proposed changes to the VEGP Units 3 and 4 TS and UFSAR are acceptable.

#### 5.0 STATE CONSULTATION

In accordance with the Commission regulations in 10 CFR 50.91(b)(2), the designated Georgia State official was notified of the proposed issuance of the amendment. The State of Georgia had no comment.

#### 6.0 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. In addition, 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, and there has been no public comment on such finding (*Federal Register* dated July 5, 2016 [81 FR 43653]). 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 issuing the amendment.

## 7.0 CONCLUSION

Based on the considerations discussed above in Section 4.0, the staff concludes that there is reasonable assurance that (1) the proposed operation will not endanger public health and safety, (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 public health and safety. Therefore, the staff finds the proposed changes to be acceptable.

### Principal Contributors:

A. Burja  
D. Scully

SAFETY EVALUATION BY THE OFFICE OF NEW REACTORS

RELATED TO AMENDMENT NO. 14-12

TO COMBINED LICENSE NOS. NPF-93 AND 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 May 12, 2016, and its revision dated the same to address a digital error (Agencywide Documents Access and Management System [ADAMS] Accession Nos. ML16133A382 and ML16172A194, respectively), South Carolina Electric & Gas Company, Inc. (SCE&G or licensee) requested that the U.S. Nuclear Regulatory Commission (NRC or Commission) amend the combined licenses (COLs) for Virgil C. Summer Nuclear Station (VCSNS) Units 2 and 3, COL Nos. NPF-93 and NPF-94, respectively. By email dated May 27, 2016 (ADAMS Accession No. ML16148A538), the NRC provided SCE&G with the results of the staff's acceptance review of license amendment request (LAR) 14-12, which concluded that the LAR is sufficient for the staff to perform the detailed technical review.

The proposed license amendment would change the listed minimum volume of the passive core cooling system core makeup tanks (CMTs) reflected in Appendix A of the VCSNS Units 2 and 3 COLs, Technical Specifications (TS), and supporting information in the VCSNS Units 2 and 3 Updated Final Safety Analysis Report (UFSAR). Specifically, these changes would align these licensing documents, which originally specified a minimum CMT volume of 2,500 ft<sup>3</sup>, with the minimum CMT volume given in the VCSNS COL Tier 1 information as 2,487 ft<sup>3</sup>. The licensee stated this change is based on and supported by a small-break loss-of-coolant accident (SBLOCA) safety analysis.

2.0 BACKGROUND

Title 10 of the *Code of Federal Regulations*, Part 52 (10 CFR Part 52), Subpart C, "Combined Licenses," sets forth the requirements and procedures applicable to Commission issuance of COLs for nuclear power facilities. Sections 52.79(a) and (d) set forth the requirements for a COL application that references a standard design certification. On March 30, 2012, the NRC issued COLs under 10 CFR Part 52, Subpart C to SCE&G for VCSNS Units 2 and 3. SCE&G's subsequent COL (SCOL) application for VCSNS Units 2 and 3 references the Westinghouse AP1000 design certification rule, Appendix D to 10 CFR Part 52. The VCSNS Units 2 and 3 UFSAR consists of the information incorporated by reference from the AP1000 Design Control Document (DCD), Revision 19, along with VCSNS site-specific information, including supplements and departures from the DCD. Similarly, the VCSNS Units 2 and 3 TS, which were issued with the VCSNS SCOLs, consist of the AP1000 generic TS (DCD Tier 2, Chapter 16, Revision 19) and the VCSNS site-specific TS. The AP1000 generic TS were modeled after Revision 2 of NUREG-1431, dated June 30, 2001, and were incorporated by reference into the

VCSNS plant-specific TS.

### Content of LAR-14-12

The LAR letter has three enclosures:

- Enclosure 1, Request for Licensing Amendment Regarding Core Makeup Tank Volume Inconsistency
- Enclosure 2, Proposed Changes to Licensing Basis Documents
- Enclosure 3, Conforming Technical Specification Bases Changes (For Information Only)

Enclosure 1 contains a summary description of the LAR, a detailed description of the changes, technical and regulatory evaluations for the proposed changes, environmental considerations, and applicable references.

Enclosure 2 provides a markup of affected TS and UFSAR pages, and Enclosure 3 provides a markup of affected TS Bases. Pages with no changes are not included.

### 3.0 REGULATORY EVALUATION

The NRC staff considered the following regulatory requirements and guidance in reviewing the licensee's LAR:

- 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light-water Nuclear Power Reactors," prescribes acceptance criteria for emergency core cooling systems (ECCSs) and requirements for evaluation models.
- 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 34, "Residual Heat Removal," requires a residual heat removal (RHR) system that is capable of transferring fission product decay heat and other residual heat from the reactor core at a rate such that specified acceptable fuel design limits and the design conditions of the reactor coolant pressure boundary are not exceeded.
- GDC 35, "Emergency Core Cooling," requires a system to provide abundant emergency core cooling whose safety function is to transfer heat from the reactor core following any loss of reactor coolant at a rate such that (1) fuel and clad damage that could interfere with continued effective core cooling is prevented and (2) clad metal-water reaction is limited to negligible amounts.
- GDC 36, "Inspection of Emergency Core Cooling System," requires the ECCS to be designed to permit appropriate periodic inspection of important components.
- GDC 37, "Testing of Emergency Core Cooling System," requires that the ECCS be designed to permit appropriate periodic pressure and functional testing.
- 10 CFR Part 50, Appendix K, "ECCS Evaluation Models," prescribes required and acceptable features of evaluation models as well as required documentation.

In addition, Section 182a of the Atomic Energy Act (the Act) requires that applicants for nuclear power plant operating licenses will state:

[S]uch technical specifications, including information of the amount, kind, and source of special nuclear material required, the place of the use, the specific characteristics of the facility, and such other information as the Commission may, by rule or regulation, deem necessary in order to enable it to find that the utilization . . . of special nuclear material will be in accord with the common defense and security and will provide adequate protection to the health and safety of the public. Such technical specifications shall be a part of any license issued.

In 10 CFR 50.36, the Commission established its regulatory requirements related to the content of TS. In doing so, the Commission placed emphasis on those matters related to the prevention of accidents and the mitigation of accident consequences. As recorded in the Statements of Consideration, "Technical Specifications for Facility Licenses; Safety Analysis Reports" (33 FR 18610, December 17, 1968), the Commission noted that applicants were expected to incorporate into their TS "those items that are directly related to maintaining the integrity of the physical barriers designed to contain radioactivity." Pursuant to 10 CFR 50.36, TS for nuclear reactors are required to include items in the following categories: (1) safety limits and limiting safety system settings; (2) limiting conditions for operation (LCOs); (3) surveillance requirements (SRs); (4) design features; and (5) administrative controls. However, the rule does not specify the particular requirements to be included in a nuclear reactor plant's TS.

On February 6, 1987, the Commission issued an interim policy statement on TS improvements, "Interim Policy Statement on Technical Specification Improvements for Nuclear Power Reactors" (52 FR 3788). From 1989 to 1992, industry PWR and BWR owners groups and the NRC staff developed improved standard TS (STS) (e.g., NUREG-1431) that would establish model TS based on the Commission's policy for each primary reactor type. In addition, representatives from the NRC, nuclear reactor plant licensees, and industry owners groups developed generic administrative and editorial guidelines in the form of a writer's guide for preparing TS (most recently issued in June 2005 as TSTF-GG-05-01, Revision 1), which gives appropriate consideration to human factors engineering principles and was used throughout the development of plant-specific improved TS (ITS).

In September 1992, the Commission issued NUREG-1431, Revision 0, which was developed using the guidance and criteria contained in the Commission's Interim Policy Statement. The STS in NUREG-1431 were established as a model for developing plant-specific ITS for Westinghouse plants, in general. The STS reflect the results of a detailed review of the application of the Interim Policy Statement criteria, which have been incorporated in 10 CFR 50.36(c)(2)(ii), to generic system functions, which were published in a "split report" issued to the PWR and BWR nuclear steam supply system vendor owners groups in May 1988. The STS also reflect the results of extensive discussions concerning various drafts of STS so that the application of the TS LCO criteria and the writer's guide would consistently reflect detailed system configurations and operating characteristics for all reactor designs. As such, the generic bases presented in NUREG-1431 provide an abundance of information regarding the extent to which the STS present requirements that are necessary to protect public health and safety.

On July 22, 1993, the Commission issued its Final Policy Statement, expressing the view that satisfying the guidance in the policy statement also satisfies Section 182a of the Act and 10 CFR 50.36. The Final Policy Statement described the safety benefits of the STS and encouraged licensees to use the STS as the basis for plant-specific TS amendments and for complete conversions to ITS based on the STS. In addition, the Final Policy Statement gave guidance for evaluating the required scope of the TS and defined the guidance criteria to be

used in determining which of the LCOs and associated SRs should remain in the TS. The Commission noted that, in allowing certain items to be relocated to licensee-controlled documents while requiring that other items be retained in the TS, it was adopting the qualitative standard enunciated by the Atomic Safety and Licensing Appeal Board in *Portland General Electric Co. (Trojan Nuclear Plant)*, ALAB-531, 9 NRC 263, 273 (1979). There, the Appeal Board observed:

[T]here is neither a statutory nor a regulatory requirement that every operational detail set forth in an applicant's safety analysis report (or equivalent) be subject to a technical specification, to be included in the license as an absolute condition of operation which is legally binding upon the licensee unless and until changed with specific Commission approval. Rather, as best we can discern it, the contemplation of both the Act and the regulations is that technical specifications are to be reserved for those matters as to which the imposition of rigid conditions or limitations upon reactor operation is deemed necessary to obviate the possibility of an abnormal situation or event giving rise to an immediate threat to the public health and safety.

By this approach, existing LCO requirements that fall within or satisfy any of the criteria in the Final Policy Statement should be retained in the TS; those LCO requirements that do not fall within or satisfy these criteria may be relocated to licensee-controlled documents. The Commission codified the four criteria in 10 CFR 50.36 (60 FR 36953, July 19, 1995). The four criteria, as stated in 10 CFR 50.36(c)(2)(ii) subparagraphs (A), (B), (C), and (D), are as follows:

- Criterion 1      Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.
- Criterion 2      A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
- Criterion 3      A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.
- Criterion 4      A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.

Part 4.0 of this safety evaluation (SE) explains the NRC staff's determination that the VCSNS TS based on STS is consistent with the proposed changes to the VCSNS licensing basis documents, the requirements and guidance of the Final Policy Statement, and 10 CFR 50.36 and 10 CFR 50.36a.

#### 4.0 TECHNICAL EVALUATION

In its review of LAR 14-12, the NRC staff evaluated the proposed changes to the TS and the UFSAR against the regulatory requirements identified in Section 3.0 of this SER. The staff also reviewed the proposed changes to the TS Bases for consistency with the proposed changes to the TS. The proposed changes and the staff's evaluation are discussed below.

##### Proposed Changes to the TS

TS 3.5.2, "Core Makeup Tanks (CMTs) – Operating," includes SR 3.5.2.2, which requires verification that the borated water volume in each CMT is greater than or equal to a specified volume every seven days. LAR 14-12 proposes to change that minimum volume from 2,500 ft<sup>3</sup> to 2,487 ft<sup>3</sup>.

##### Proposed Changes to the TS Bases

LAR 14-12 proposes to add the following text to the "Applicable Safety Analyses" portion of Bases 3.5.2: "In the case of a small break LOCA, the borated water volume of one CMT is adequate for RCS safety injection, where one CMT completely spills via the pipe break."

##### Proposed Changes to the UFSAR

LAR 14-12 proposes to change the minimum CMT volume from 2,500 ft<sup>3</sup> to 2,487 ft<sup>3</sup> in the following UFSAR locations:

- Section 5.4.13.2, "Design Description"
- Table 6.3-2, "Component Data – Passive Core Cooling System"
- Table 14.3-2, "Design Basis Accident Analysis"

##### Overall Evaluation of Proposed Changes

The AP1000 design includes two CMTs as part of the passive core cooling system, which serves as the ECCS for the AP1000. The CMTs store borated water for high pressure reactor coolant makeup. The CMT inlet nozzle is connected to cold leg piping, and the outlet nozzle is connected to direct vessel injection (DVI) piping.

The licensee stated that the basis for the change in minimum CMT volume from 2,500 ft<sup>3</sup> to 2,487 ft<sup>3</sup> is the assumption in the SBLOCA analysis that one CMT provides adequate safety injection. According to the licensee, the value of 2,487 ft<sup>3</sup> was established during inspections, tests, analyses, and acceptance criteria (ITAAC) development to permit a 0.5 percent construction tolerance to the design tank volume of 2,500 ft<sup>3</sup> and is the minimum volume required to accomplish the CMT design function. The staff confirmed the minimum CMT volume to be 2,487 ft<sup>3</sup> in the AP1000 ITAAC, which the VCSNS Units 2 and 3 COLs incorporate by reference.

In addition, the licensee stated that the safety analyses were performed with a CMT volume of 2,500 ft<sup>3</sup> or greater except for the SBLOCA analyses, which assumed a CMT volume of 2,487 ft<sup>3</sup>. To ensure no impacts to the ECCS functions required by 10 CFR 50.46 and GDC 35 or RHR functions required by GDC 34, the staff verified that the assumptions made in the AP1000 transient and accident analyses are valid and conservative relative to a minimum CMT volume of 2,487 ft<sup>3</sup>.

The CMTs provide reactor coolant system (RCS) makeup and boration for non-LOCAs when normal makeup is not available or insufficient. During non-LOCAs involving RCS heatup or inventory increase, the CMTs primarily provide cooldown and decay heat removal capability. The larger CMT volume is conservative for these cases because the additional volume that may be added to the RCS makes pressurizer overfill more likely. For non-LOCAs that involve RCS cooldown, the major function of the CMTs is to provide borated water to mitigate the reactivity transient due to a negative moderator temperature coefficient. The licensee stated that CMT volume is not a critical parameter to shutdown margin for these events. The staff agrees, noting that the change in boron worth due to a 0.5 percent smaller CMT volume is small enough to be negligible.

The purpose of the CMTs during LOCAs is to provide borated makeup water to the RCS. During large-break LOCAs (LBLOCAs), the core depressurizes rapidly enough to allow injection from lower-pressure makeup sources. In contrast, SBLOCAs move much more slowly, so not all ECCS features are available to mitigate the SBLOCA due to slower depressurization. Therefore, the staff agrees with the licensee's statement that the analyses most affected by CMT volume are the SBLOCA analyses. The staff confirmed that the SBLOCA analyses include a double-ended rupture of the DVI line, which shows that only one CMT—and only half of the ECCS—is sufficient to mitigate the SBLOCA. However, the staff was unable to verify the licensee's claim that the CMT volume assumed for the SBLOCA analyses is 2,487 ft<sup>3</sup>. As a result, the staff audited an SBLOCA calculation note on June 22, 2016, and confirmed, as documented in an audit report (ADAMS Accession No. ML16179A342), that the SBLOCA analyses conservatively incorporate a CMT volume of 2,487 ft<sup>3</sup>. Although the audit report referenced the original LAR submittal (ADAMS Accession No. ML16133A382), the staff reviewed the revised LAR submittal (ADAMS Accession No. ML16172A194) and concluded that the changes made in the revision do not affect the audit outcome or conclusions made in this SE based on the audit.

The licensee stated that, for LBLOCAs, assuming a smaller CMT volume would not have an effect on peak cladding temperature (PCT). The staff noted that the LBLOCA analysis in the AP1000 DCD shows that, while the CMTs inject for a very short time at the beginning of the transient, they do not begin injecting again until long after PCT occurs. Therefore, the staff agrees that modeling a slightly smaller CMT volume would not affect the LBLOCA analysis. The staff also considered the impacts of a slightly smaller assumed CMT volume on long-term cooling following a LBLOCA. The staff concludes that the reduction in containment floodup level would be negligible; as a result, there would be no adverse impacts on long-term cooling analyses.

During a steam generator tube rupture, the CMT plays a role, along with the passive residual heat removal heat exchanger, startup feedwater, and chemical and volume control system, to remove decay heat for RCS cooldown and depressurization. The staff concludes that modeling a 0.5 percent smaller CMT volume would have a negligible impact on RCS cooldown and depressurization due to the other systems that also provide heat sink functions.

Regarding containment peak pressure analyses, the licensee stated that a 0.5 percent decrease in CMT volume leads to a negligible difference in mass and energy release into containment. The staff agrees that the change would be insignificant.

In conclusion, the staff finds that the existing transient and accident analyses are consistent with or are conservative with respect to a CMT volume of 2,487 ft<sup>3</sup>. Based on this, the staff concludes that the proposed changes continue to meet 10 CFR 50.46 with regard to ECCS

performance, GDC 34, and GDC 35. In addition, the staff agrees with the licensee that no corresponding changes are required related to the tank construction and design requirements; design and safety evaluation methods; tests, experiments, and procedures; inspection requirements; or ex-vessel severe accident assessment. Therefore, the staff concludes that the proposed changes continue to meet 10 CFR 50.46 with respect to evaluation models; 10 CFR 50, Appendix K; and GDC 36 and 37.

#### Evaluation of Proposed TS Change

The staff evaluated the proposed change to the TS and reviewed the provided markups for completeness and accuracy. The staff noted that SR 3.5.2.2 in the AP1000 STS requires verification that the CMT volume is greater than or equal to 2,500 ft<sup>3</sup>. However, for the reasons described above, and because the change would align the TS value with the ITAAC value, the staff finds the proposed change from 2,500 ft<sup>3</sup> to 2,487 ft<sup>3</sup> acceptable.

#### Review of Proposed Change to the Bases

The staff reviewed the proposed change to the Bases as well as the provided markups. The markup adds clarification to the “Applicable Safety Analyses” portion of Bases 3.5.2. As previously discussed, the staff confirmed that one CMT provides sufficient RCS makeup for a SBLOCA. Therefore, the staff concludes that the proposed change to the Bases is consistent with the proposed change to the TS.

#### Evaluation of Proposed Changes to the UFSAR

The staff evaluated the proposed UFSAR changes and the accuracy and completeness of the associated markups. For the reasons already described in this section, the proposed changes are technically acceptable and consistent with the Tier 1 information, and the markups accurately reflect the proposed changes. Therefore, the staff concludes that the proposed UFSAR changes are acceptable.

#### 4.1 Summary

Based on the technical evaluation of the proposed changes to the VCSNS Units 2 and 3 TS and UFSAR and the review of the proposed changes to the TS Bases above, the NRC staff concludes that the VCSNS Units 2 and 3 COLs continue to meet the requirements of 10 CFR 50.36; 10 CFR 50.46; 10 CFR Part 50, Appendix K; and GDC 34, 35, 36, and 37. Therefore, the proposed changes to the VCSNS Units 2 and 3 TS and UFSAR are acceptable.

#### 5.0 STATE CONSULTATION

In accordance with the Commission regulations in 10 CFR 50.91(b)(2), the designated South Carolina State official was notified of the proposed issuance of the amendment. The State of South Carolina had no comment.

#### 6.0 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. In addition, 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, and there has been no public comment on such finding (*Federal Register* dated July 5, 2016 [81 FR 43653]). 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 issuing the amendment.

## 7.0 CONCLUSION

Based on the considerations discussed above in Section 4.0, the staff concludes that there is reasonable assurance that (1) the proposed operation will not endanger public health and safety, (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 public health and safety. Therefore, the staff finds the proposed changes to be acceptable.

### Principal Contributors:

A. Burja  
D. Scully