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VCS-LIC/JRB R2
Docket No. 50-395
License No. NPF-12

SOUTH CAROLINA ELECTRIC & GAS COMPANY
VIRGIL C. SUMMER NUCLEAR STATION (VCSNS) UNIT 1
LICENSE AMENDMENT REQUEST – LAR-16-01490
NFPA 805 PROGRAM REVISIONS
RESPONSE TO FOLLOW-UP QUESTION TO PRA RAI 03


By letter dated August 29, 2018 (ML18242A657), South Carolina Electric and Gas (SCE&G)¹, submitted a license amendment request (LAR) for the Virgil C. Summer Nuclear Station (VCSNS), Unit 1, to make changes to its approved Fire Protection Program (FPP) under 10 CFR 50.48(c). By email dated June 27, 2019 (ML19179A126), the Nuclear Regulatory Commission (NRC) staff provided a follow-up request for additional information (RAI) to PRA RAI 03. This follow-up RAI provided two options for response, Option (i) and Option (ii). During a July 23, 2019 public teleconference with the NRC, SCE&G indicated its intention to respond to Option (ii) and the NRC staff verbally communicated several additional requests for information related to this option. The NRC provided an e-mail on July 30, 2019 (ML19211D510), documenting the supplemental information that the staff requested during the phone call.

The VCSNS response to Follow-Up Question PRA RAI 03 is provided in the attachment to this letter. Once approved, the amendment shall be implemented within 30 days.

Should you have any questions, please call Mr. Michael Moore at (803) 345-4752.

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

10/9/2019
Executed on


For George Lippard
George A. Lippard
Site Vice President
V.C. Summer Nuclear Station

(1) In a letter dated July 30, 2019, South Carolina Electric & Gas Company (SCE&G) requested a License Amendment to amend the VC Summer operating license to reflect the name change from SCE&G to Dominion Energy South Carolina (DESC). The amendment request is currently under review by the NRC.

Commitment contained in this letter: VCSNS will not credit the RCP abeyance seal in its PRA models until the NRC accepts the RCP abeyance seal model. In addition, VCSNS will not credit RCP operation without seal cooling beyond 20 minutes, as specified in WCAP-16175-A, until the NRC accepts an N9000 seal model with an extended time to trip. Within 60 days of NRC approval of LAR-16-01490, VCSNS will revise its PRA model control procedure to require NRC acceptance of an approved model prior to crediting: (1) the N9000 seal abeyance seal, and/or (2) RCP operation without seal cooling beyond 20 minutes.

Attachments:

- 1) Response to NRC Follow-Up Question to PRA RAI 03
- 2) Table PRA RAI 03-1(Update) – VCSNS Fire Area Risk Summary
(Attachment 2 Contains Sensitive Information – Withhold Under 10 CFR 2.390)

cc: Without Attachments Unless Noted
G. J. Lindamood – Santee Cooper
L. Dudes – NRC Region II
S. A. Williams – NRC Project Mgr. (With Attachments)
NRC Resident Inspector
A. Nair-Gimmi – SCDHEC

bc: Without Attachments Unless Noted
R. R. Haselden – VCS
J. H. Hamilton – VCS
C. D. Sly – IN2SE
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J. A. Langan – MPS
D. R. Taylor – NAPS
B. A. Garber – SPS
James Roth – IN2SE
Stacey Nelson – IN2SE
W. S. Blair – RS
RTS (CR-16-01490)
File (813.20)
PRSF – VCS

Email: NSRC – (Secretary, Reg. & Oversight Committee)

Concurrences

See Correspondence Routing and Approval CHOP Sheet

Craig Sly and Yan Gao were courtesy copied during the routing of Station CHOP approval.

Verification of Accuracy

Technical Verification Team

Action Plan

CR-16-01490-014 – Licensing to track the License Amendment Request LAR-16-01490 through the NRC review and approval process.

CR-16-01490-020 – NFA to update PRA model control procedure per commitment (complete)

CR-16-01490-023 – NL to ensure updated commitment from SN 19-339B is tracked in the appropriate commitment database

CR-16-01490-024 – Perform verification review of NRC Safety Evaluation for LAR-16-01490, if/when approved by NRC.

Changes to the UFSAR, USAR, QA Topical Report, ISFSI FSR, DSAR or PSDAR:

None

ATTACHMENT 1

**LAR-16-01490 – NFPA 805 Program Revisions
Response to Follow-Up Question to PRA RAI 03**

**Virgil C. Summer Nuclear Station – Unit 1
South Carolina Electric and Gas**

LICENSE AMENDMENT REQUEST LAR-16-01490
NFPA 805 PROGRAM REVISIONS
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

VIRGIL C. SUMMER NUCLEAR STATION UNIT 1

NRC Comment:

By letter dated August 29, 2018 (Agencywide Document Access and Management System (ADAMS) Package Accession No. ML18242A657), and supplemented by letters dated April 29, 2019 (ADAMS Accession No. ML19119A365) and May 22, 2019 (ADAMS Accession No. ML19150A696), South Carolina Electric and Gas (SCE&G) submitted a license amendment request (LAR) for the Virgil C. Summer Nuclear Station, Unit 1 (VCSNS), to make changes to its approved fire protection program (FPP) under 10 CFR 50.48(c). In its LAR, the licensee proposed to make several changes to its FPP including changes to plant modifications, use of performance-based alternatives to the requirements of NFPA 805, Chapter 3, and several clarifications and editorial corrections.

Based on the information in the supplement dated May 22, 2019, on June 27, 2019 (ADAMS Accession No. ML19179A126), the U.S. Nuclear Regulatory Commission (NRC) issued a follow-up Request for Additional Information (RAI) to PRA RAI 03.

On July 23, 2019, a public teleconference was held between SCE&G and NRC staff to discuss SCE&G's proposed response to the June 27, 2019, RAI to PRA RAI 03. During the teleconference, SCE&G stated they propose to utilize option (ii) of the June 27, 2019, RAI. Based on the discussion during the teleconference, the NRC staff is providing further clarification to PRA RAI 03, option (ii), below.

Follow-Up Question Probabilistic Risk Assessment (PRA), Request for Additional Information (RAI) 03 [Issued on June 27, 2019]:

Section 2.4.3.3 of NFPA 805 states that the probabilistic risk assessment (PRA) approach, methods, and data shall be acceptable to the NRC. Section 2.4.4.1 of NFPA 805 further states that the change in public health risk arising from transition from the current fire protection program to an NFPA 805 based program, and all future plant changes to the program, shall be acceptable to the NRC.

In the letter dated May 22, 2019, the licensee responded to PRA Request for Additional Information (RAI) 03 and stated, in part:

The longer the seals can withstand loss of seal cooling, the more time is available for operators to trip the RCPs [reactor coolant pumps], and the lower the failure probability of that action. Dynamic loss-of-seal-cooling tests of N-9000 RCP seals have shown that RCPs can operate in excess of 60 minutes with no measurable change in seal leakage. ... The Human Reliability Analysis (HRA) that supports the 2018 VCSNS FPRA [fire PRA] models a 60-minute system time window for the operator action to trip RCPs. The 60-minute system time window is retained in the current FPRA.

In the safety evaluation associated with Amendment No. 199, dated February 11, 2015 (ADAMS Accession No. ML14287A289), the NRC staff found acceptable the licensee's N-9000 RCP seal failure model applied in the FPRA, which is based on the RCP seal failure model and associated failure probabilities used in WCAP-16175-A, "Model for Failure of RCP Seals Given Loss of Seal Cooling in CE NSSS Plants" (ADAMS Accession No. ML071130383). WCAP-16175-A indicates that the N-9000 RCP seals have been designed to survive 30 minutes of continued RCP operation without RCP seal cooling. Also, the response to RAI 1.15.1 documented in WCAP-16175-A states, "[a]s data for RCP seal operation without seal cooling for 1 hour is not available, this event will be redefined to require tripping the RCP within 20 minutes." Therefore, it appears that the licensee's use of a 60-minute system time window for operator action to trip RCPs in the FPRA to support the LAR dated August 29, 2018 is not consistent with that used in the NRC-accepted RCP seal model (i.e., FPRA RCP seal failure model accepted in the safety evaluation associated with Amendment No. 199, which is based on WCAP-16175-A). Also, the basis for using the 60-minute system time window provided in the response to PRA RAI 03 is unclear to the NRC staff.

- (i) Provide the technical basis for use of a 60-minute system time window for operator action to trip RCPs without seal cooling for the N-9000 RCP seals installed at VCSNS. If results of any tests or performance data are used to support this basis, discuss these results and data, including how this information is used to substantiate the 60-minute system time window and is applicable for the VCSNS RCP seal design and operating conditions that can affect seal performance. Also discuss the sensitivity of the risk results to the system time window for operator action to trip RCPs (e.g., compare the total risk and change-in-risk of using a 60-minute system time window with that used in the FPRA RCP seal failure model accepted in the safety evaluation associated with Amendment No. 199). OR*
- (ii) Alternatively to part (i), provide updated risk results in Table PRA RAI 03-1 of letter dated May 22, 2019 that uses the system time window for operator action to trip RCPs based on the FPRA RCP seal failure model accepted in the safety evaluation associated with Amendment No. 199, and discuss how the updated risk results align with the risk acceptance guidelines of Regulatory Guide 1.205. Propose a mechanism that ensures an NRC-accepted RCP seal failure model is used in the FPRA for self-approval of post-transition changes.*

Supplement to Option (ii) [based on July 23, 2019, teleconference discussion]:

Describe in sufficient detail any additional changes to the VCSNS PRA models (i.e., internal events, internal flooding, seismic, and fire) in support of the updated risk results that were not described in the LAR dated August 29, 2018, as supplemented by letters dated April 29, 2019 and May 22, 2019.

Explain and justify whether the changes are PRA maintenance or PRA upgrades as defined in ASME/ANS RA-Sa-2009, Section 1-5.4, as qualified by Regulatory Guide 1.200, Revision 2.

For all PRA changes that constitute a PRA upgrade, state if a peer review has been performed for any PRA upgrades in accordance with an NRC-accepted process. As applicable, provide the open facts and observations (F&Os) characterized as findings associated with this peer review and explain how the F&Os were dispositioned to Capability Category II for this application.

If a peer review was not performed for PRA upgrades, propose a license condition such that prior to implementing self-approval of post-NFPA-805 transition changes:

- *PRA upgrades will be appropriately peer reviewed and any finding-level F&Os are closed in accordance with an NRC-accepted process (e.g., focused-scope peer review, F&O closure review, direct submittal to the NRC), and,*
- *Confirm that the updated transition change-in-risk estimates for this application align with the risk acceptance guidelines of Regulatory Guide 1.205.*

SCE&G RESPONSE:

As discussed during the public teleconference on July 23, 2019, VCSNS has elected to utilize option (ii) described in PRA RAI 03. The following discusses the associated changes in risk results and modeling associated with utilizing a 20-minute timeline for tripping of the RCPs following a loss of RCP seal cooling.

Updated Risk Results

Updated risk and delta risk results are provided in Attachment 2, Table PRA RAI 03-1(Update), VCSNS Fire Area Risk Summary. These results include changes to the Fire PRA and Seismic PRA, as described below.

The compliant plant modeling, as well as the approach for addressing the additional risk of recovery actions, used the approach described in the VCSNS response to PRA RAI 03, dated May 22, 2019, in the "Updated Risk Results Without Credit for the Reactor Coolant Pump (RCP) Abeyance Seal" section. That is, the model of the compliant plant for the delta risk calculation does not include credit for the Alternate Seal Injection (ASI) plant modification, which is a risk reduction modification that was installed for the transition to NFPA 805. Excluding ASI from the compliant plant model results in negative delta CDF and delta LERF for most fire areas and for the plant overall. The ASI modification may be omitted from the model of the compliant plant because ASI was an NFPA 805 modification that was not required for deterministic compliance.

Delta risk is calculated to compare the post transition plant to the “compliant” plant, as defined in RG 1.205. Delta risk is evaluated to ensure the guidelines of RG 1.205, Revision 1 and RG 1.174, Revision 3 are met. Attachment 2, Table PRA RAI 03-1(Update) provides delta risk for each plant fire area. From Attachment 2, Table PRA RAI 03-1(Update), the change in fire risk for the plant is as follows:

- Delta CDF = $-1.4E-4$ per reactor year
- Delta LERF = $-2.8E-6$ per reactor year

The delta risks are negative due to the way the compliant plant has been modeled as discussed above and in the VCSNS response to PRA RAI 03, dated May 22, 2019. Because the delta risks are negative, they meet the guidelines of RG 1.174, as stated in the following excerpts from RG 1.174, Section 2.4:

- If the application clearly shows a decrease in CDF, the change has satisfied the relevant principle of risk-informed regulation with respect to CDF.
- If the application clearly shows a decrease in LERF, the change has satisfied the relevant principle of risk-informed regulation with respect to LERF.

Changes to the PRA Models

Fire PRA

The following changes were made in support of the updated risk results following submittal of the LAR dated August 29, 2018, and RAI responses dated April 29, 2019 and May 22, 2019.

- The time available for operators to trip the RCPs following a loss of RCP seal cooling was redefined to require tripping of the RCPs within 20 minutes, consistent with WCAP-16175-A. The use of 20 minutes is based on the NRC-accepted RCP seal model accepted in the safety evaluation associated with Amendment No. 199. Therefore, this task is considered a maintenance activity.
- Refueling Water Storage Tank (RWST) depletion timing was incorporated into the timeline for loss of seal injection and the time available for tripping the RCPs during accident sequences involving loss of RCP seal cooling due to RWST draindown. The baseline evaluation assumed that RWST draindown instantaneously resulted in the loss of all seal injection. The RWST depletion analysis provides as-built, as-operated time estimates typical of Human Reliability Analysis (HRA) refinement activities that would be considered a model maintenance item.
- Fire scenario progressions were refined to provide a more-realistic characterization of target damage over time. This includes refined and focused fire modeling target identification and refinement of fire-induced damage states. These changes are characterized as following:
 - Detailed reviews of conduit locations were performed to provide greater precision and assignments to scenarios. This is a refinement of the fire scenario target list similar to other refinement activities performed in the original LAR and the August 2018 LAR. This task is considered a maintenance task given the similarity to the scenario modeling tasks included in the original Fire PRA model which underwent peer review.
 - In addition, applicable heat release rate probability distributions in NUREG-2178, Volume 1, Final Report (December 2015) were utilized. Although NUREG-2178,

- Volume 1 heat release rates were used and described in the August 2018 LAR, additional scenario refinements were performed in support of this RAI response using NUREG-2178, Volume 1. This resulted in applying the NUREG-2178, Volume 1 heat release rates to additional electrical cabinets than previously applied in support of the August 2018 LAR and subsequent RAI responses. Therefore, this task is considered a maintenance activity.
- Although NUREG-2178, Volume 2 (draft) was discussed during the July 23, 2019 call with the NRC as a potential consideration and is referenced in the meeting summary (ML19196A211), it was not utilized in the Fire PRA in support of this RAI response.
 - PRA model refinements and detailed circuit analysis were incorporated to reduce conservatism in cable mapping and to apply appropriate NUREG/CR-7150, Volume 2, Final Report (May 2014) hot-short induced spurious operation probabilities.
 - NUREG/CR-7150, Volume 2 probabilities were used and described in the August 2018 LAR. However, further detailed reviews were performed and additional NUREG/CR-7150, Volume 2 probabilities were applied in the model to attain more realism, in response to this RAI. Therefore, this task is considered a maintenance activity.
 - Additional circuit analysis and reviews have also been performed to ensure the availability of power supplies to support RCP thermal barrier cooling. These detailed reviews demonstrated greater availability of Component Cooling Water (CCW) cooling and reduced the impact of fire scenarios on loss of RCP seal cooling. Circuit analysis was performed using standard industry guidance from NEI 00-01, Revision 2 and NUREG/CR-7150, Volume 2 when failure mode likelihood values were applied. Therefore, this task is considered a maintenance activity.
 - Operator action timelines and modeling associated with actions in the main control room to trip RCPs and local actions to trip RCPs manually have been refined. Fire HRA processes and approaches are consistent with previous HRA analyses in support of the August 2018 LAR and related RAI responses, and is consistent with NUREG-1921, Final Report (July 2012). Therefore, this task is considered a maintenance activity.
 - An Abnormal Operating Procedure (AOP) was revised to move RCP seal monitoring to an earlier step. The HRA was updated to reflect the associated procedure change using the same methods used in the August 2018 LAR and subsequent RAI responses, and is consistent with NUREG-1921. Therefore, this task is considered a maintenance activity.
 - Other minor model/analysis changes to reflect routine plant modifications, address self-assessment findings, cutset reviews, etc. These changes and the methodologies used to implement them were consistent with the methodology used for similar tasks associated with the August 2018 LAR and subsequent RAI responses. Therefore, these tasks are considered maintenance activities.

Assessment of Upgrade versus Maintenance for the Fire PRA Model Changes

ASME/ANS RA-Sa-2009 defines PRA Upgrade as “the incorporation into a PRA model a new methodology or significant changes in scope or capability that impact the significant accident sequences or the significant accident progression sequences”.

The fire model changes were focused on RCP seal treatment and supported modeling. The changes described above are considered PRA maintenance, and reflect refinements and additional detailed analysis. Standard industry fire modeling techniques, including those used in

support of the 2015 NFPA 805 Safety Evaluation and those described in the August 2018 LAR and the subsequent RAI responses, were utilized. Circuit analysis and PRA modeling refinements are consistent with methods and processes used in the 2015 NFPA 805 Safety Evaluation and those described in August 2018 LAR. The changes did not include new methodology, significant changes in the scope or capability impacting significant accident sequences, or significant accident progression sequences. The impact of the changes in the RCP treatment were associated with specific HRA modeling and fire modeling changes to incorporate updates and refinements to the HRA and fire modeling, consistent with methods used in the August 2018 LAR and subsequent RAI responses. Therefore, the analysis supporting the Fire PRA update in response to this RAI is considered a maintenance activity.

Seismic PRA

The Seismic, Internal Events, and Flooding PRA models allow 20 minutes for operators to trip the RCPs following a loss of RCP seal cooling. There were no changes made to the Internal Events or Flooding PRA models following the LAR submittal dated August 29, 2018. The Seismic Risk as described in the LAR dated August 29, 2018, as supplemented by letters dated April 29, and May 22, 2019 has been updated with the following changes:

- Credit for the RCP N9000 Abeyance Seal has been removed. Consistent with the fire PRA, credit for the RCP N9000 abeyance seal has been removed from the seismic PRA. There is a negligible impact on the CDF and LERF.
- Detailed seismic specific human failure event to reset relay groups Relay_0.11AC and Relay_0.11BD for emergency diesel generator (EDG) recovery following seismic-induced relay chatter. The seismic human reliability analysis was developed in accordance with supporting requirement SPR-B2 of ASME/ANS RA-Sb-2013 Section 5. The HRA is supported by operator interviews, plant walkdowns and documentation of cue availability. The recovery action is based on existing emergency operating procedures for loss of all AC power.

The above changes to the Seismic model both meet the definition of maintenance and did not require a peer review.

Assessment of Upgrade versus Maintenance for the Seismic Model Changes

ASME/ANS RA-Sa-2009 defines PRA Upgrade as “the incorporation into a PRA model a new methodology or significant changes in scope or capability that impact the significant accident sequences or the significant accident progression sequences.”

- The removal of abeyance seal credit is a basic event reliability update using the same methods. There is no significant change in capability, accident sequence, or progression. The change is model maintenance.
- The addition of the recovery action uses the same methodology for human reliability analysis used in the peer reviewed seismic model. The EDG recovery is only credited when the turbine driven emergency feedwater pump starts and runs to provide flow to the steam generators. The EDG recovery provides charging to the station batteries as well as other safety related loads. The change models the as-built, as-operated plant. The accident sequence and progression remain the same. The change is model maintenance.

In summary, the PRA model changes summarized above were made to reflect the as-built, as-operated plant within regulatory approved models for the RCP N9000 seals. No new methods were used and the capability of the model was not expanded.

Mechanism to Ensure an NRC-Accepted RCP Seal Model is Used in the Fire PRA

VCSNS makes the following commitment in this letter, which will be governed by its Commitment Management Program.

VCSNS will not credit the RCP abeyance seal in its PRA models until the NRC accepts the RCP abeyance seal model. In addition, VCSNS will not credit RCP operation without seal cooling beyond 20 minutes, as specified in WCAP-16175-A, until the NRC accepts an N9000 seal model with an extended time to trip. Within 60 days of NRC approval of LAR-16-01490, VCSNS will revise its PRA model control procedure to require NRC acceptance of an approved model prior to crediting: (1) the N9000 seal abeyance seal, and/or (2) RCP operation without seal cooling beyond 20 minutes

ATTACHMENT 2

**LAR-16-01490 – NFPA 805 Program Revisions
Table PRA RAI 03-1(Update) – VCSNS Fire Area Risk Summary**

**Virgil C. Summer Nuclear Station – Unit 1
South Carolina Electric and Gas**

SENSITIVE INFORMATION REMOVED

WITHHOLD FROM PUBLIC DISCLOSURE
UNDER 10 CFR 2.390

SENSITIVE INFORMATION REMOVED

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