



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 30, 2019

Mr. George A. Lippard, III
Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
P.O. Box 88, Mail Code 800
Jenkinsville, SC 29065

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1 – ISSUANCE OF
AMENDMENT RE: TECHNICAL SPECIFICATION 3.8.2, "D.C. SOURCES -
OPERATING" (EPID L-2018-LLA-0259)

Dear Mr. Lippard:

The U.S. Nuclear Regulatory Commission (the Commission) has issued the enclosed Amendment No. 215 to Renewed Facility Operating License No. NPF-12 for the Virgil C. Summer Nuclear Station, Unit No. 1, in response to your application dated September 27, 2018, as supplemented by letter dated March 11, 2019.

The amendment corrects a non-conservative Technical Specification by revising the inter-cell resistance value listed in Surveillance Requirements 4.8.2.1.b.2 and 4.8.2.1.c.3.

A copy of the related Safety Evaluation is also enclosed. Notice of Issuance will be included in the Commission's biweekly *Federal Register* notice.

Sincerely,

A handwritten signature in cursive script that reads "Shawn Williams".

Shawn A. Williams, Senior Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-395

Enclosures:

1. Amendment No. 215 to NPF-12
2. Safety Evaluation

cc: Listserv



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

DOCKET NO. 50-395

VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 215
Renewed License No. NPF-12

1. The U.S. Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment to the Virgil C. Summer Nuclear Station, Unit No. 1 (the facility), Renewed Facility Operating License No. NPF-12 filed by the South Carolina Electric & Gas Company (the licensee), dated September 27, 2018, as supplemented by letter dated March 11, 2019, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;
 - B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;
 - C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations as set forth in 10 CFR Chapter I;
 - D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and
 - E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

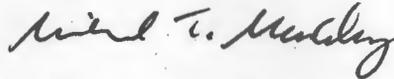
2. Accordingly, the license is hereby amended by a page change to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Renewed Facility Operating License No. NPF-12 is hereby amended to read as follows:

- (2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 215, and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. South Carolina Electric & Gas Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This amendment is effective as of its date of issuance and shall be implemented within 60 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Michael T. Markley, Chief
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to Renewed Facility Operating
License and Technical Specifications

Date of Issuance: April 30, 2019

VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1
ATTACHMENT TO LICENSE AMENDMENT NO. 215
RENEWED FACILITY OPERATING LICENSE NO. NPF-12
DOCKET NO. 50-395

Replace the following pages of the Renewed Facility Operating License and Appendix A, Technical Specifications (TSs), with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Remove

Insert

License
Page 3

License
Page 3

TS
3/4 8-10

3/4 8-10

- (3) SCE&G, pursuant to the Act and 10 CFR Part 70, to receive, possess and use at any time special nuclear material as reactor fuel, in accordance with the limitations for storage and amounts required for reactor operation, as described in the Final Safety Analysis Report, as amended through Amendment No. 33;
- (4) SCE&G, pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess and use at any time any byproduct, source and special nuclear material as sealed neutron sources for reactor startup, sealed neutron sources for reactor instrumentation and radiation monitoring equipment calibration, and as fission detectors in amounts as required;
- (5) SCE&G, pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components; and
- (6) SCE&G, pursuant to the Act and 10 CFR Parts 30, 40 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.

C. This renewed license shall be deemed to contain, and is subject to, the conditions specified in the Commission's regulations set forth in 10 CFR Chapter I and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

SCE&G is authorized to operate the facility at reactor core power levels not in excess of 2900 megawatts thermal in accordance with the conditions specified herein and in Attachment 1 to this renewed license. The preoperational tests, startup tests and other items identified in Attachment 1 to this renewed license shall be completed as specified. Attachment 1 is hereby incorporated into this license.

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 215, and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. South Carolina Electric & Gas Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

ELECTRICAL POWER SYSTEMS

SURVEILLANCE REQUIREMENTS (Continued)

b. At least once per 92 days and within 7 days after a battery discharge with battery terminal voltage below 110-volts, or battery overcharge with battery terminal voltage above 150-volts, by verifying that:

1. The parameters in Table 4.8-2 meet the Category B limits,
2. There is no visible corrosion at either terminals or connectors, or the battery connection resistance is less than or equal to the individual connection resistance for the connection types listed below or total battery resistance is less than or equal to 2890 $\mu\Omega$:

Maximum Individual Battery Connection Resistances		
Connection Type	Number of Connections	Individual Connection Resistance ($\mu\Omega$)
Inter-cell	56	45
Jumper	3	100
Terminal Plate	2	35

, and

3. The average electrolyte temperature of 10 of the connected cells is $\geq 60^\circ\text{F}$.

c. At least once per 18 months by verifying that:

1. The cells; cell plates and battery racks show no visual indication of physical damage or abnormal deterioration,
2. The cell-to-cell and terminal connections are clean, tight, and coated with anti-corrosion material,
3. The battery connection resistance is less than or equal to the individual connection resistance for the connection types listed below or total battery resistance is less than or equal to 2890 $\mu\Omega$:

Maximum Individual Battery Connection Resistances		
Connection Type	Number of Connections	Individual Connection Resistance ($\mu\Omega$)
Inter-cell	56	45
Jumper	3	100
Terminal Plate	2	35

, and

4. The battery charger will supply at least 300 amperes at 132 volts for at least 8 hours.

d. At least once per 18 months, during shutdown, by verifying that the battery capacity is adequate to supply and maintain in OPERABLE status all of the actual or simulated emergency loads for the design duty cycle when the battery is subjected to a battery service test.

e. At least once per 60 months, during shutdown, by verifying that the battery capacity is at least 80% of the manufacturer's rating when subjected to a performance discharge test. This performance discharge test may be performed in lieu of the battery service test required by Surveillance Requirement 4.8.2.1.d.

f. Annual performance discharge tests of battery capacity shall be given to any battery that shows signs of degradation or has reached 85% of the service life expected for the application. Degradation is indicated when the battery capacity drops more than 10% of rated capacity from its average on previous performance tests, or is below 90% of the manufacturer's rating.



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 215 TO

RENEWED FACILITY OPERATING LICENSE NO. NPF-12

SOUTH CAROLINA ELECTRIC & GAS COMPANY

VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-395

1.0 INTRODUCTION

By letter dated September 27, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML18270A360), as supplemented by letter dated March 11, 2019 (ADAMS Accession No. ML19071A357) South Carolina Electric & Gas Company (SCE&G, the licensee) requested changes to the Technical Specifications (TSs) for Virgil C. Summer Nuclear Station (VCSNS), Unit No. 1.

The licensee proposed to correct a non-conservative safety related battery inter-cell resistance of 150 micro-ohms ($\mu\Omega$) currently listed in TS Surveillance Requirements (SRs) 4.8.2.1.b.2 and SR 4.8.2.1.c.3 with calculated individual connection average resistance values for inter-cell, jumper, and terminal plate connections or a maximum measured resistance.

The supplement dated March 11, 2019, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the Nuclear Regulatory Commission (NRC or the Commission) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on November 20, 2018 (83 FR 58607).

2.0 REGULATORY EVALUATION

2.1 System Description

In its letter dated September 27, 2018, the licensee stated:

The Class 1E 125-volt [V] direct current (DC) Electrical System is required to provide a source of reliable, uninterruptible DC power for essential control and instrumentation during normal operation and for orderly shutdown of Engineered Safety Features [ESF] equipment. The Class 1E ED System consists of two independent, redundant ungrounded 125V DC power distribution load groups/trains. Each Class 1E battery consists of 60 battery cells, battery racks,

and accessories, including spacers and hardware for interconnection of cells. Each redundant sub-system also consists of a normal 125 Volt static battery charger, a main 125 Volt distribution panel bus, and three 125 Volt sub-distribution panel buses. The train 'A' and 'B' battery chargers are supplied from separate, redundant diesel backed 480-volt alternating current (AC) motor control centers.

During normal plant operation, the Class 1E ED System loads are supplied from the battery chargers with the batteries floating on the system. Upon loss of station AC power, the entire load is powered from the batteries until AC power is restored by the emergency diesel generator or the preferred power source.

Two redundant 125-volt DC nominal station batteries with chargers are required such that each battery and associated charger are used to supply two of the four protection instrument power supply inverters. Both redundant 125-volt DC systems are capable of supporting/operating normal and required emergency DC loads in the event of a loss of all offsite power with a coincident loss of coolant accident (LOOP/LOCA) for a minimum duration of 10.25 seconds following loss of AC power until emergency AC power is restored by the associated diesel generator.

One of the redundant 125-volt DC systems shall be capable of supporting/operating normal (non-accident) loads necessary to ensure that the reactor core is cooled and containment integrity is maintained in the event of a station blackout (SBO) for a 4-hour duration.

2.2 Description of the Proposed Change

The licensee proposes to remove the non-conservative safety-related battery inter-cell resistance of 150 $\mu\Omega$ currently listed in TS SRs 4.8.2.1.b.2 and 4.8.2.1.c.3.

TS SR 4.8.2.1.b.2 currently states:

There is no visible corrosion at either terminals or connectors, or the connection resistance of these items is less than 150×10^{-6} ohms

Revised TS SR 4.8.2.1.b.2 would state:

There is no visible corrosion at either terminals or connectors, or the battery connection resistance is less than or equal to the individual connection resistance for the connection types listed below or total battery resistance is less than or equal to 2890 $\mu\Omega$:

Maximum Individual Battery Connection Resistances		
Connection Type	Number of Connections	Individual Connection Resistance ($\mu\Omega$)
Inter-cell	56	45
Jumper	3	100
Terminal Plate	2	35

TS SR 4.8.2.1.c.3 currently states:

The resistance of each cell-to-cell and termination connection is less than or equal to 150×10^{-6} ohms

Revised TS SR 4.8.2.1.c.3 would state:

The battery connection resistance is less than or equal to the individual connection resistance for the connection types listed below or total battery resistance is less than or equal to 2890 $\mu\Omega$:

Maximum Individual Battery Connection Resistances		
Connection Type	Number of Connections	Individual Connection Resistance ($\mu\Omega$)
Inter-cell	56	45
Jumper	3	100
Terminal Plate	2	35

2.3 Regulatory Requirements

The regulations at 10 *Code of Federal Regulations* (CFR) 50.36, "Technical specifications," establish the requirements related to the content of the TS. Pursuant to 10 CFR 50.36(c), TS are required to include items in five specific categories related to station operation: (1) Safety limits, limiting safety system settings, and limiting control settings, (2) Limiting conditions of operation, (3) Surveillance requirements (SRs), (4) Design features; and (5) Administrative controls.

Regulations in 50.36(c)(3) states, "Surveillance requirements are requirements relating to test, calibration, or inspection to assure that the necessary quality of systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met.

Regulations in 10 CFR 50.63, "Loss of all alternating current power," requires, in part, that each light-water cooled nuclear power plant licensed to operate must be able to withstand for a specified duration and recover from a station blackout (SBO).

Regulations in 10 CFR Part 50, Appendix A, General Design Criterion (GDC) 17, "Electric power systems," requires, in part, that nuclear power plants have onsite and offsite electric power systems to permit the functioning of structures, systems, and components (SSCs) important to safety. The onsite system is required to have sufficient independence, redundancy, and testability to perform their safety function assuming a single failure.

GDC 18, "Inspection and testing of electric power systems," requires, in part, that electric power systems that are important to safety shall be designed to permit appropriate periodic inspection and testing.

3.0 TECHNICAL EVALUATION

3.1 Reason for the Proposed Change

During its review of industry operating experience, the licensee determined VCSNS, Unit No. 1, had less than conservative TS regarding SRs for safety-related battery inter-cell resistances. In accordance with NRC Administrative Letter 98-10, "Dispositioning of Technical Specifications that are Insufficient to Assure Plant Safety," the licensee established administrative controls that provided assurance that the batteries remain operable pending submittal of a license amendment request. During a Design Bases Assurance Inspection (DBAI) in 2017 (ADAMS Accession No. ML17335A032), the NRC identified the resolution of this nonconforming condition was not timely. The licensee worked with a vendor to develop a calculation that provides a design basis for the maximum allowable total connection resistance of the Class 1E batteries.

3.2 Licensee Calculations Performed to Establish Proposed Battery Resistances

In its letter dated September 27, 2018, and in the supplement dated March 11, 2019, the licensee described the design calculations performed and the approach taken to establish design basis for the maximum allowable total connection resistance of Class 1E batteries, as well as maximum connection resistance for each type of connection.

The licensee provided the following analysis:

- 1) Identify the loads/circuits required to mitigate a LOOP/LOCA and/or an SBO.

Based on their Calculation No. DC08320-005, "ESF 1A & 1B [Battery] Capacity," the licensee identified maximum battery load profiles, bounding the design basis events, as follows:

Time (minute)	Train A Battery Maximum Duty Cycle Load (Adc)	Train B Battery Maximum Duty Cycle Load (Adc)
0-1	410.9	436.9
1-239	200.2	215.8
239-240	246.2	261.8

- 2) Determine the minimum available, and minimum required voltage for each required load/circuit.

Based on their Calculation No. DC08320-010, "Class 1E 125 V DC System Voltages and Voltage Drop," the licensee determined the minimum battery terminal voltages as follows:

Time (minute)	Train A Battery Minimum Terminal Voltage (Vdc)	Train B Battery Minimum Terminal Voltage (Vdc)
0-1	110.81	110.51
1+	112.71	112.53
239-	109.19	108.20
239-240	108.58 (approx. 108.6 V)	107.52 (approx. 107.5 V)

The above voltages are conservative lowest battery terminal voltages since they are based on 58-cell discharge analyses. The batteries consist of 60-cell configuration, but can be operated with 60-cell, 59-cell, and 58-cell connection configuration. The batteries are sized, in accordance with Institute of Electrical and Electronics Engineers (IEEE) Standard 485, " IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications," to a minimum voltage of 108 Vdc.

The limiting case is Train B battery. The above calculation shows that with a battery terminal voltage of approximately 107.5 V, all loads have adequate voltage. Limiting voltage requirement is for inverters which require a minimum voltage of 104 V at their terminals.

- 3) Calculate the voltage margin between the minimum voltage available and the minimum required voltage for each required load/circuit. Determine the overall voltage margin for each train.

For Train A battery, the minimum battery terminal voltage is approximately 108.6 Vdc. Since the batteries are designed for a minimum voltage of 108.0 V, to be conservative, all Train A voltages are reduced by 0.6 Vdc to determine the available voltage margin.

After applying the above 0.6 Vdc adjustment to the most limiting component in Train A (Inverter XIT5901), the final voltage available at the terminal of the inverter is $105.64 - 0.6 =$ approximately 105 Vdc. The margin for this component/Train A is $105 \text{ V} - 104 \text{ V} = 1.0 \text{ Vdc}$. No adjustment is made for Train B. The margin for most limiting component in Train B (Inverter XIT5904) is calculated as $104.62 \text{ V} - 104 =$ approximately 0.6 V dc. Thus, overall voltage margin for Train A is calculated as 1.0 V and for Train B as 0.6 V.

- 4) Calculate the amount of equivalent battery connection resistances based on above voltage margins given the bounding discharge current rate of the battery for each train.

The batteries have an intrinsic connection resistance of average $10 \mu\Omega$ per cell (conservatively low), for a total of $600 \mu\Omega$ intrinsic resistance of 60-cell battery, which is already accounted for in the battery terminal voltage calculations. The maximum allowable battery connection resistances above the intrinsic connection resistance are calculated as follows:

Train	Limiting Time of Duty Cycle And the corresponding Max Duty Load	Limiting Component	Component/Train Voltage Margin (Vdc)	Maximum Allowable Resistance Above Intrinsic ($\mu\Omega$)	Maximum Allowable Measured Resistance ($\mu\Omega$)
A	0-1 minute; 410.9 A	Inverter XIT5901	1.0	Approx. 2430 [$1 \times 10^6 / 410.9$]	3030 [2430+600]
B	239-240 minute; 261.8 A	Inverter XIT5904	0.6	Approx. 2290 [$0.6 \times 10^6 / 261.8$]	2890 [2290+600]

- 5) Determine a combination of allowable individual connection type resistances.

In its letter dated September 27, 2018, the licensee stated that the configuration of each Class 1E station battery is 56 inter-cell connections, 3 jumpers, and 2 terminal plate connectors for a 60-cell battery. Based on resistance test data, the licensee has proposed the following

combination of individual connection type resistances that would not exceed the maximum allowable measured connection resistance of 2890 $\mu\Omega$, as determined above (limiting value for Train B).

Connection Type	Number of Connections	Individual Connection Average Measured Resistance ($\mu\Omega$)	Total Connection Maximum Measured Resistance ($\mu\Omega$)	Maximum Measured Resistance ($\mu\Omega$)
Inter-cell	56	45	2520	2890
Jumper	3	100	300	
Terminal Plate	2	35	70	

3.2 NRC Staff Evaluation

The NRC staff reviewed the information provided in the licensee's letter dated September 27, 2018, and supplement dated March 11, 2019. The NRC staff finds the calculations and approach adopted by the licensee to determine the inter-cell resistance, jumper resistance, terminal plate resistance, and the total maximum resistance of the battery, as proposed in SRs 4.8.2.1.b.2 and 4.8.2.1.c.3, reasonable and conservative. The NRC staff verified independently that the minimum required battery terminal voltage bounds the design basis accident most limiting voltage required. Maintaining the total battery connection resistance at or below the maximum allowable resistance calculated by the licensee will ensure that all DC components necessary to mitigate a 4-hour SBO event and all Class 1E DC components necessary to mitigate the initial seconds of a LOOP with a coincident LOCA have adequate voltage to perform their design basis functions.

3.3 NRC Staff Conclusion

Based on the above, the NRC staff concludes the proposed changes to the VCSNS, Unit No. 1, TS SR 4.8.2.1.b.2 and SR 4.8.2.1.c.3, provide reasonable assurance of the continued availability of the electrical power required to shut down the reactor and to maintain the reactor in a safe condition in a design basis accident. The NRC staff concludes that the safety-related equipment required to operate during a design basis accident scenario will be provided with adequate voltage. The proposed SR changes will assure that the necessary quality of the Class 1E Batteries is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met in accordance with 10 CFR 50.36(c)(3). Also, the batteries will continue to support the requirements of 10 CFR 50.63 for SBO and LOOP/LOCA conditions, and meet the intent of GDC 17 and GDC 18. The NRC staff concludes the proposed changes to TS SRs 4.8.2.1.b.2 and 4.8.2.1.c.3 are, therefore, acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the State of South Carolina official was notified of the proposed issuance of the amendment on April 3, 2019. On April 15, 2019, the State official confirmed that the State of South Carolina had no comments.

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 and changes surveillance requirements. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration, and there has been no public comment on such finding as published in the *Federal Register* on November 20, 2018 (83 FR 58607). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) there is reasonable assurance that 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.

Principle Contributor: V. Goel, NRR

Date: April 30, 2019

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1 - ISSUANCE OF AMENDMENT RE: TECHNICAL SPECIFICATION 3.8.2, "D.C. SOURCES - OPERATING" (EPID L 2018 LLA 0259) DATED

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***By Memo *By E-mail**

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