

March 18, 1993

Docket No. 50-395

Mr. John L. Skolds
Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88
Jenkinsville, South Carolina 29065

Dear Mr. Skolds:

SUBJECT: ISSUANCE OF AMENDMENT NO. 111 TO FACILITY OPERATING LICENSE NO. NPF-12 REGARDING 18% PERCENT STEAM GENERATOR TUBE PLUGGING - VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1, (TAC NO. M84726)

The Nuclear Regulatory Commission has issued the enclosed Amendment No. 111 to Facility Operating License No. NPF-12 for the Virgil C. Summer Nuclear Station, Unit No. 1. The amendment consists of changes to the Technical Specifications (TS) in response to your application dated October 6, 1992.

The amendment changes the Technical Specifications to permit an increase in the maximum permissible average level of steam generator tube plugging (SGTP) from 15 percent to 18 percent. Although no value for SGTP is specified in the TS, the increase in SGTP would result in a 1.7 percent decrease in the minimum measured flow (MMF) value which is referenced in TS 3/4.2.3. The proposed reduction in MMF will, in turn, require changes to Table 2.2.-1. Specifically, the overtemperature delta T values for total allowance and the statistical summation of errors (Z) would be changed.

A copy of the related Safety Evaluation is enclosed. Notice of Issuance will be included in the Commission's Bi-weekly Federal Register notice.

Sincerely,

ORIGINAL SIGNED BY:
George F. Wunder, Project Manager
Project Directorate II-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:

- 1. Amendment No. 111 to NPF-12
- 2. Safety Evaluation

cc w/enclosures:
See next page

OFC	LA: PD21:DRPE	PM: PD21:DRPE	AD: PD21:DRPE	OGC
NAME	PDAnderson	GFWunder:tmw	JAMitchell	Walden
DATE	03/4/93	03/04/93	03/18/93	3/1/93

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Mr. John L. Skolds
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Virgil C. Summer Nuclear Station

cc:

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AMENDMENT NO. 111 TO FACILITY OPERATING LICENSE NO. NPF-12 - SUMMER, UNIT NO. 1

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

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

DOCKET NO. 50-395

VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No.111
License No. NPF-12

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by South Carolina Electric & Gas Company (the licensee), dated October 6, 1992, 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;
 - 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 amended by changes to the Technical Specifications, as indicated in the attachment to this license amendment; and paragraph 2.C.(2) of Facility Operating License No. NPF-12 is hereby amended to read as follows:

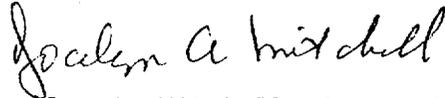
(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 111, 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.

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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



Jocelyn A. Mitchell, Acting Director
Project Directorate II-1
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: March 18, 1993

ATTACHMENT TO LICENSE AMENDMENT NO.111
TO FACILITY OPERATING LICENSE NO. NPF-12
DOCKET NO. 50-395

Replace the following pages of the Appendix A Technical Specifications with the enclosed pages. The revised pages are indicated by marginal lines.

Remove Pages

2-5

2-8

2-9

Insert Pages

2-5

2-8

2-9

TABLE 2.2-1
REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS

Functional Unit	Total Allowance (TA)	Z	S	Trip Setpoint	Allowable Value
1. Manual Reactor Trip	Not Applicable	NA	NA	NA	NA
2. Power Range, Neutron Flux High Setpoint Low Setpoint	7.5 8.3	4.56 4.56	0 0	<109% of RTP <25% of RTP	<111.2% of RTP <27.2% of RTP
3. Power Range, Neutron Flux High Positive Rate	1.6	0.5	0	<5% of RTP with a time constant ≥ 2 seconds	<6.3% of RTP with a time constant ≥ 2 seconds
4. Power Range, Neutron Flux High Negative Rate	1.6	0.5	0	<5% of RTP with a time constant ≥ 2 seconds	<6.3% of RTP with a time constant ≥ 2 seconds
5. Intermediate Range, Neutron Flux	17.0	8.4	0	<25% of RTP	<31% of RTP
6. Source Range, Neutron Flux	17.0	10.0	0	$\leq 10^5$ cps	$\leq 1.4 \times 10^5$ cps
7. Overtemperature ΔT	10.3	7.8	1.6 & 1.2**	See note 1	See note 2
8. Overpower ΔT	5.2	1.96	1.6	See note 3	See note 4
9. Pressurizer Pressure-Low	3.1	0.71	1.5	≥ 1870 psig	≥ 1859 psig
10. Pressurizer Pressure-High	3.1	0.71	1.5	≤ 2380 psig	≤ 2391 psig
11. Pressurizer Water Level-High	5.0	2.18	1.5	$\leq 92\%$ of instrument span	$\leq 93.8\%$ of instrument span
12. Loss of Flow	2.5	1.48	.6	$\geq 90\%$ of loop design flow*	$\geq 88.9\%$ of loop design flow*

*Loop design flow = 94,870 gpm

RTP - RATED THERMAL POWER

**1.6% span for Delta-T (RTDs) and 1.2% for Pressurizer Pressure.

TABLE 2.2-1 (Continued)

REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTSNOTATIONNOTE 1: OVERTEMPERATURE ΔT

$$\Delta T \leq \Delta T_o \left[K_1 - K_2 \frac{(1 + \tau_1 S)}{(1 + \tau_2 S)} \right] \left[T - T' \right] + K_3 (P - P') - f_1(\Delta T)$$

Where:	ΔT	=	Measured ΔT by RTD Instrumentation
	ΔT_o	\leq	Indicated ΔT at RATED THERMAL POWER
	K_1	\leq	1.195
	K_2	\geq	0.03006
	$\frac{1 + \tau_1 S}{1 + \tau_2 S}$	=	The function generated by the lead-lag controller for T_{avg} dynamic compensation
	τ_1, τ_2	=	Time constants utilized in lead-lag controller for T_{avg} , $\tau_1 \geq 28$ secs., $\tau_2 \leq 4$ secs.
	T	=	Average temperature, °F
	T'	\leq	587.4°F Reference T_{avg} at RATED THERMAL POWER
	K_3	\geq	0.00147
	P	=	Pressurizer pressure, psig
	P'	\geq	2235 psig, Nominal RCS operating pressure
	S	=	Laplace transform operator, sec^{-1} .

TABLE 2.2-1 (Continued)
REACTOR TRIP SYSTEM INSTRUMENTATION TRIP SETPOINTS
NOTATION (Continued)

NOTE 1: (Continued)

and $f_1(\Delta I)$ is a function of the indicated difference between top and bottom detectors of the power-range nuclear ion chambers; with gains to be selected based on measured instrument response during plant startup tests such that:

- (i) for $q_t - q_b$ between - 24 percent and + 4 percent $f_1(\Delta I) = 0$ where q_t and q_b are percent RATED THERMAL POWER in the top and bottom halves of the core respectively, and $q_t + q_b$ is total THERMAL POWER in percent of RATED THERMAL POWER.
- (ii) for each percent that the magnitude of $q_t - q_b$ exceeds -24 percent, the ΔT trip setpoint shall be automatically reduced by 2.27 percent of its value at RATED THERMAL POWER.
- (iii) for each percent that the magnitude of $q_t - q_b$ exceeds +4 percent, the ΔT trip setpoint shall be automatically reduced by 2.34 percent of its value at RATED THERMAL POWER.

NOTE 2: The channel's maximum trip setpoint shall not exceed its computed trip point by more than 2.2 percent ΔT Span.

NOTE 3: OVERPOWER ΔT

$$\Delta T \leq \Delta T_o \left[K_4 - K_5 \frac{(\tau_1 S)}{(1 + \tau_3 S)} T - K_6 \left[T - T'' \right] \right]$$

- Where: ΔT = as defined in Note 1
- ΔT_o = as defined in Note 1
- K_4 \leq 1.0875
- K_5 \geq 0.02/°F for increasing average temperature and 0 for decreasing average temperature
- $\frac{\tau_3 S}{1 + \tau_3 S}$ = The function generated by the rate-lag controller for T_{avg} dynamic compensation



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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 111 TO FACILITY OPERATING LICENSE NO. NPF-12

SOUTH CAROLINA ELECTRIC & GAS COMPANY

SOUTH CAROLINA PUBLIC SERVICE AUTHORITY

VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1

DOCKET NO. 50-395

1.0 INTRODUCTION

By letter dated October 6, 1992, South Carolina Electric & Gas Company (the licensee) submitted a request for changes to the Virgil C. Summer Nuclear Station, Unit No. 1 (Summer Station), Technical Specifications (TS).

The amendment request proposed to revise Table 2.2-1, "Reactor Trip System Instrumentation Trip Setpoints," to allow an increase in the maximum permissible average level of steam generator tube plugging (SGTP) from 15 percent to 18 percent. An increase in SGTP reduces reactor coolant system minimum measured flow (MMF) and, therefore, requires (1) changes to a constant and a setpoint reduction penalty in the overtemperature delta T (OT delta T) setpoint equation, (2) changes to the OT delta T trip allowance and the value for column Z of Table 2.2-1 for the affected channel (Z), and (3) a revised loop design flow listed in Table 2.2-1.

2.0 EVALUATION

Currently, the licensing basis analyses for Summer Station, as documented in their Final Safety Analysis Report (FSAR), are bounding for a minimum average SGTP of up to 15 percent. Summer Station has experienced tube corrosion problems in the D3 steam generators and as a result an increasing number of tubes have been plugged during the last several outages. The increased plugging may affect the reactor coolant system (RCS) in several ways; specifically, (1) the RCS flow may be reduced to a value below the currently analyzed value in the licensing basis, and (2) the reactor vessel outlet temperature (T_{hot}) may increase and exceed the assumed value in the non-LOCA (non-loss of coolant accident) and structural evaluations.

The licensee has evaluated the impact on the Summer Station licensing basis for plant operation with an increase in the maximum permissible level of average SGTP from 15 percent to 18 percent. Their evaluation also permits the maximum level of SGTP in one steam generator to reach, but not exceed 20 percent provided the average level of plugging between the three steam generators does not exceed 18 percent. For asymmetric events involving a flow or coolant temperature change in one loop, operating conditions for the three

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loops based on SGTP of 20, 20 and 14 percent were assumed. These initial conditions maximize loop asymmetries while maintaining average SGTP at 18 percent to minimize core inlet flow.

2.1 Non-LOCA Events

2.2.1 Departure from Nucleate Boiling (DNB) Events

The events listed below are affected by the proposed 18 percent average SGTP in that the reduction in RCS flow could potentially impact the DNB ratio (DNBR). Therefore, to address the reduction in the MMF, DNBR penalties of 2.2 percent for the typical fuel cells and 2.0 percent for the thimble fuel cells were calculated to compensate for the 1.7 percent decrease in the MMF.

The licensee indicated that based on the preliminary Cycle 8 reload design and given the allocation of the penalties shown above, there will be more than 6 percent generic DNBR margin for the limiting fuel cell type available for future use. Therefore, the DNB licensing basis criteria will continue to be met and the conclusions in the FSAR remain valid for the transients listed below.

<u>FSAR Section</u>	<u>Event</u>
15.2.2	Uncontrolled Rod Cluster Control Assembly Bank Withdrawal at Power
15.2.3	Rod Cluster Control Assembly Misoperation
15.2.10	Excessive Heat Removal Due to Feedwater System Malfunctions
15.2.11	Excessive Load Increase Incident
15.2.12	Accidental Depressurization of the RCS
15.2.13	Accidental Depressurization of the Main Steam System
15.3.2	Minor Secondary System Pipe Breaks
15.3.4	Complete Loss of Forced Reactor Coolant Flow
15.3.6	Single Rod Cluster Control Assembly Withdrawal at Full Power
15.4.2.1	Major Rupture of a Main Steam Line

The staff finds that the DNB events remain bounded by the Summer Station FSAR with 18 percent SGTP.

2.1.2 Long-Term Heat Removal and Reactivity Excursion Events

The events listed below are impacted by the 18 percent average SGTP by a reduction in RCS flow. In the case of 18 percent average SGTP the total dynamic flow (TDF) is reduced from 94,500 gpm/loop to 92,900 gpm/loop and the RCS is maintained at 587.4°F during full power operation and at 557 °F during hot zero power operation. The FSAR analysis is based on 92,600 gpm/loop and an RCS temperature of 587.4°F.

Additionally, the minimal reduction in RCS volume (less than 1 percent), due to the increase in SGTP, will not adversely affect these transients. Therefore, the staff finds acceptable the licensee's conclusion that the increase in maximum average SGTP level will not invalidate the assumptions used in these analyses and finds that the results and conclusions presented in the FSAR remain valid for the following events:

<u>FSAR Section</u>	<u>Event</u>
15.2.8	Loss of Normal Feedwater
15.2.9	Loss of Offsite Power to the Station Auxiliaries
15.4.2.4	Major Rupture of a Main Feedwater Line
15.2.1	Uncontrolled Rod Cluster Control Assembly Bank Withdrawal from a Subcritical Condition
15.4.6	Rupture of a Control Rod Drive Mechanism Housing

2.1.3 Remaining Non-LOCA Events

The licensee assumed the worst case scenario for SGTP with regard to evaluating the remaining non-LOCA events - either the maximum SGTP of 18 percent or the minimum SGTP of 14 percent. In all cases, it was determined that the impact of the 18 percent average SGTP on the original licensing basis analysis was negligible and, for the reasons indicated, the conclusions in the FSAR remain valid.

Uncontrolled Boron Dilution (15.2.4)

During an uncontrolled boron dilution event, the current licensing basis still remains valid and sufficient time exists for operator action (15 minutes during Modes 1 and 2 and 13.4 minutes during Mode 3/4 based on Reference 3). Also Mode 3/4 was initially analyzed for 20 percent SGTP.

Partial Loss of Forced Reactor Coolant Flow (15.2.5)

This event remains bounded by the complete loss-of-flow event (15.3.4) discussed previously in section 2.2.1.

Startup of an Inactive Reactor Coolant Loop (15.2.6)

A sufficient DNBR margin exists (25 percent) to accommodate the competing DNBR effects caused by the increase in total dynamic flow and power.

Loss of External Electrical Load and/or Turbine Trip (15.2.7)

The analysis supporting the current FSAR is based on 92,600 TDF. The TDF for 18 percent SGTP is 92,900 TDF which is bounded by the more conservative current FSAR analysis.

Inadvertent Operation of the Emergency Core Cooling System During Power Operation (15.2.14)

The change in RCS steady state flow is not enough to impact the the peak RCS pressure or the margin to pressurizer fill.

Inadvertent Loading of a Fuel Assembly Into an Improper Position (15.3.3)

This event would affect the core power shape and not the total power generated, therefore the analysis in the current FSAR remains unchanged.

Single Reactor Coolant Pump Locked Rotor (15.4.4)

Based on existing sensitivity studies, applicable to Summer Station, with the 1.7 percent increase in TDF the peak RCS pressure remains at 2605 psia and the peak cladding temperature (PCT) margin is decreased by approximately 10°F. Both remain well within the limits.

The staff has reviewed the licensee's evaluation and finds this conclusion acceptable.

2.1.4 Setpoint Impact

Another area that may be impacted by the 18 percent average/20 percent peak SGTP is the effect of asymmetrical tube plugging on the delta T calculation. The asymmetrical SGTP can create flow and inlet temperature asymmetries between RCS loops. Each loop has only one channel and it is used to determine the delta T in the individual coolant loops under specific loop inlet and outlet conditions. The delta T may vary from loop to loop, but the K-terms in the OT delta T and the overpressure delta T (OP delta T) setpoint equations remain constant for all three loops. Since the delta T setpoints are based on a fraction of the individual loop delta T and the loop channels are individually calibrated based on the loop temperatures, the OT delta T/OP delta T reactor trip functions will continue to remain effective under the asymmetric conditions.

The licensee performed an analysis to determine the adequacy of the actual OT delta T and OP delta T protection setpoints. It was concluded that changes to the K_1 , TA, and Z terms along with the slope of the positive portion of the F(delta I) penalty function of the OT delta T setpoint equation were necessary due to the reduction in the MMF. The new values - 1.195 from 1.203 for K_1 , 10.3 from 9.8 for TA, 7.8 from 7.21 for Z, and 2.34 from 3.13 for the positive portion of F(delta I) - were calculated by approved methods. The reduction in MMF did not have an impact on the OP delta T setpoint, therefore, the current OP delta T setpoint remains sufficient.

In addition, the licensee has committed to the following in their station procedures to preserve the reactor protection system's ability to ensure that the core safety limits are not violated in the presence of a potential asymmetry in the loop temperatures:

The overtemperature delta T reactor trip channels will be calibrated during power operation in terms of both the delta T and T_{avg} indicated by each channel at nominal full power.

The staff finds the identified changes acceptable and agrees that the FSAR analyses and conclusions will remain valid.

2.2 Loss-of-Coolant Accident (LOCA) Analyses

2.2.1 Large and Small Break LOCA

The current analyses for both large break (LB) and small break (SB) LOCA (LBLOCA and SBLOCA) assumes 20 percent plugging in each steam generator. Summer Station operation with the proposed 18 percent average SGTP is bounded

by the current LOCA analyses. The proposed change will not adversely impact the FSAR LBLOCA and SBLOCA analyses results provided the plugging is limited to equal to or less than 20 percent in any one steam generator.

2.2.2 Post-LOCA Long Term Core Cooling

In post-LOCA cooling, the core remains shutdown by the borated emergency core cooling system (ECCS) water in the RCS sump. The analysis does not take credit for control rods, therefore, the boron concentration of the ECCS must be such that when mixed with other water sources the reactor core will remain shutdown. Since the RCS is a net dilution source for the mixed sump, maximizing the RCS volume is conservative - increased SGTP results in reduced RCS flow. The post-LOCA core cooling was calculated assuming 20 percent SGTP and, therefore, bounds the case of 18 percent average SGTP.

3.0 SUMMARY

The staff has reviewed the SCE&G submittal proposing to increase the steam generator tube plugging from 15 percent to 18 percent average and 20 percent peak. The submittal considered the effect the increased plugging would have on non-LOCA and LOCA accidents, and the asymmetrical SGTP on OT delta T and OP delta T setpoints.

It was determined by the licensee that slight changes in the K_1 value for the OT delta T setpoint equation and the $F(\Delta I)$ function were necessary to preserve the results of the current non-LOCA analyses. The licensee also added an OT delta T trip channel calibration to their Core Operability Limits Report to preserve the core safety limits in the event of the loop temperature asymmetry. Both the LOCA and non-LOCA accident analyses for the proposed steam generator tube plugging are bounded by the current analyses and conclusions in the Summer Station FSAR.

The staff has reviewed the submittal and finds the 18 percent average/20 percent peak SGTP acceptable and all related analyses and conclusion in the FSAR remain valid.

The described changes to the ESF response times will not invalidate the analyses or subsequent conclusions in the FSAR for any LOCA or non-LOCA transient. The proposed amendment to the Summer Station TS is, therefore, acceptable.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the State of South Carolina official was notified of the proposed issuance of the amendment. The State official had no comments.

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. 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 (57 FR 58251). 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.

7.0 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) 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.

Principal Contributor: S. Brewer

Date: March 18, 1993

REFERENCES

1. Letter from J.L. Skolds, South Carolina Electric & Gas Company, to USNRC, "TS Change Request - Increase in Steam Generator Tube Plugging from 15% to 18%", dated October 6, 1992.
2. UFSAR, "Virgil C. Summer Nuclear Power Station, Unit 1", South Carolina Electric & Gas Company.
3. NUREG-0717, "SER Related to the Operation Of V.C. Summer Nuclear Station Unit 1", Supplement 3, dated January 1982.