April 9, 1999

Mr. Gary J. Taylor
Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88
Jenkinsville, South Carolina 29065

SUBJECT: ISSUANCE OF AMENDMENT NO. 142 TO FACILITY OPERATING LICENSE NO. NPF-12 REGARDING BEST ESTIMATE ANALYZER FOR CORE OPERATIONS--NUCLEAR (BEACON), VIRGIL C. SUMMER NUCLEAR STATION, UNIT NO. 1 (TAC NO. MA3997)

Dear Mr. Taylor:

The Nuclear Regulatory Commission has issued the enclosed Amendment No. 142 to Facility Operating License No. NPF-12 for the Virgil C. Summer Nuclear Station (VCSNS), Unit No. 1. This amendment is in response to your September 18, 1998, application, as supplemented by your February 5, 1999, letter. The amendment changes the VCSNS Technical Specifications to permit you to use the BEACON core power distribution monitoring and support system with moveable in-core detectors to augment the VCSNS flux mapping system when power is greater than 25% rated thermal power.

Enclosed is a copy of our Safety Evaluation. Notice of Issuance will be included in the Commission's Bi-weekly Federal Register notice. This completes our work on TAC No. MA3997.

Sincerely,
Original signed by:
L. Mark Padovan, Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-395

Enclosures: 1. Amendment No.142to NPF-12
2. Safety Evaluation

cc w/enclosures: See next page

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

April 9, 1999

Mr. Gary J. Taylor
Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88
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L. Mark Padovan, Project Manager, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-395

Enclosures: 1. Amendment No.142to NPF-12
2. Safety Evaluation

cc w/enclosures: See next page

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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 FACILITY OPERATING LICENSE

Amendment No. 142
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 September 18, 1998, as supplemented by letter dated February 5, 1999, 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. 142 , 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 120 days of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Richard L. Emch, Jr.

Richard L. Emch, Chief, Section 1
Project Directorate II
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: April 9, 1999

ATTACHMENT TO LICENSE AMENDMENT NO. 142

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 areas are indicated by marginal lines.

Remove Pages	Insert Pages
Index page IV	Index page IV
3/4 1-15	3/4 1-15
3/4 2-4	3/4 2-4
3/4 2-5	3/4 2-5
3/4 2-6	3/4 2-6
3/4 2-6a	3/4 2-6a
3/4 2-6b	3/4 2-6b
3/4 2-6c	3/4 2-6c
3/4 2-8	3/4 2-8
3/4 2-9	3/4 2-9
3/4 2-14	3/4 2-14
3/4 3-46	3/4 3-46
	3/4 3-73
	3/4 3-74
	3/4 3-75
B3/4 2-4	B3/4 2-4
B3/4 2-5	B3/4 2-5
B3/4 3-4	B3/4 3-4
	B3/4 3-5
6-16	6-16
6-16a	6-16a

INDEX

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

LIMITING CONDITION FOR OPERATION (Continued)

a) A reevaluation of each accident analysis of Table 3.1-1 is performed within 5 days; this reevaluation shall confirm that the previously analyzed results of these accidents remain valid for the duration of operation under these conditions.

b) The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 is determined at least once per 12 hours.

c) A core power distribution measurement is obtained and $F_Q(z)$ and $F_{\Delta H}^N$ are verified to be within their limits within 72 hours, and

d) The THERMAL POWER level is reduced to less than or equal to 75% of RATED THERMAL POWER within the next hour and within the following 4 hours the high neutron flux trip setpoint is reduced to less than or equal to 85% of RATED THERMAL POWER.

SURVEILLANCE REQUIREMENTS

4.1.3.1.1 The position of each full length rod shall be determined to be within the group demand limit by verifying the individual rod positions at least once per 12 hours except during time intervals when the Rod Position Deviation Monitor is inoperable, then verify the group positions at least once per 4 hours.

4.1.3.1.2 Each full length rod not fully inserted in the core shall be determined to be OPERABLE by movement of at least 10 steps in any one direction at least once per 31 days.

3/4.2.2 HEAT FLUX HOT CHANNEL FACTOR - $F_Q(z)$

LIMITING CONDITION FOR OPERATION

3.2.2 $F_Q(z)$ shall be limited by the following relationships:

$$F_Q(z) \leq \frac{[F_Q^{RTP}]}{P} [K(z)] \text{ for } P > 0.5$$

$$F_Q(z) \leq \left[\frac{F_Q^{RTP}}{0.5}\right] [K(z)] \text{ for } P \leq 0.5$$

where F_Q^{RTP} = the F_Q limit at RATED THERMAL POWER (RTP) specified in the CORE OPERATING LIMITS REPORT (COLR),

P = $\frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$, and

K(z) = the normalized $F_Q(z)$ for a given core height specified in the COLR.

APPLICABILITY: MODE 1.

ACTION:

With $F_Q(z)$ exceeding its limit:

a. Reduce THERMAL POWER at least 1% for each 1% $F_Q(z)$ exceeds the limit within 15 minutes and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours; POWER OPERATION may proceed for up to a total of 72 hours; subsequent POWER OPERATION may proceed provided the Overpower delta T Trip Setpoints have been reduced at least 1% for each 1% $F_Q(z)$ exceeds the limit.

b. Identify and correct the cause of the out of limit condition prior to increasing THERMAL POWER above the reduced limit required by a, above; THERMAL POWER may then be increased provided $F_Q(z)$ is demonstrated through core power distribution measurement to be within its limit.

SURVEILLANCE REQUIREMENTS

4.2.2.1 The provisions of Specification 4.0.4 are not applicable.

4.2.2.2 For RAOC operation, $F_Q(z)$ shall be evaluated to determine if $F_Q(z)$ is within its limit by:

a. Using the movable incore detectors to obtain a power distribution map

1. When THERMAL POWER is ≤ 25%, but > 5% of RATED THERMAL POWER, or

2. When the Power Distribution Monitoring System (PDMS) is inoperable;

and increasing the Measured $F_Q(z)$ by the applicable manufacturing and measurement uncertainties as specified in the COLR.

b. Using the PDMS when THERMAL POWER is > 25% of RATED THERMAL POWER, and increasing the measured $F_Q(z)$ by the applicable manufacturing and measurement uncertainties as specified in the COLR.

c. Satisfying the following relationship:

$$F_Q^M(z) \leq \frac{F_Q^{RTP} \times K(z)}{P \times W(z)} \text{ for } P > 0.5$$

$$F_Q^M(z) \leq \frac{F_Q^{RTP} \times K(z)}{W(z) \times 0.5} \text{ for } P \leq 0.5$$

where $F_Q^M(z)$ is the measured $F_Q(z)$ increased by the applicable allowances for manufacturing tolerances and measurement uncertainty as specified in the COLR, F_Q^{RTP} is the F_Q limit, K(z) is the normalized $F_Q(z)$ as a function of core height, P is the relative THERMAL POWER, and W(z) is the cycle dependent function that accounts for power distribution transients encountered during normal operation. F_Q^{RTP}, K(z) and W(z) are specified in the CORE OPERATING LIMITS REPORT as per Specification 6.9.1.11.

d. Measuring $F_Q^M(z)$ according to the following schedule:

1. Upon achieving equilibrium conditions after exceeding by 10% or more of RATED THERMAL POWER, the THERMAL POWER at which $F_Q(z)$ was last determined, * or

2. At least once per 31 Effective Full Power Days, whichever occurs first.

* During power escalation at the beginning of each cycle, power level may be increased until a power level for extended operation has been achieved and the core power distribution measurement is obtained.

e. With the maximum value of

$$\frac{F_Q^M(z)}{K(z)}$$

over the core height (z) increasing since the previous determination of $F_Q^M(z)$ either of the following actions shall be taken:

(1) $F_Q^M(z)$ shall be increased by 2% over that specified in Specification 4.2.2.2c. or

(2) $F_Q^M(z)$ shall be measured at least once per 7 Effective Full Power Days until two successive power distribution measurements indicate that the maximum value of

$$\frac{F_Q^M(z)}{K(z)}$$

over the core height (z) is not increasing.

f. With the relationships specified in Specification 4.2.2.2c. above not being satisfied:

(1) Calculate the maximum percent over the core height (z) that $F_Q(z)$ exceeds its limit by the following expression:

$$\left\{\left[\frac{F_Q^M(z) \times W(z)}{\frac{F_Q^{RTP}}{P} \times K(z)}\right] - 1\right\} \times 100 \text{ for } P \geq 0.5$$

$$\left\{\left[\frac{F_Q^M(z) \times W(z)}{\frac{F_Q^{RTP}}{0.5} \times K(z)}\right] - 1\right\} \times 100 \text{ for } P < 0.5$$

SURVEILLANCE REQUIREMENTS (Continued)

(2) One of the following actions shall be taken:

(a) Within 15 minutes, control the AFD to within new AFD limits which are determined by reducing the applicable AFD limits by 1% AFD for each percent $F_Q(z)$exceeds its limits as determined in Specification 4.2.2.2f.1). Within 8 hours, reset the AFD alarm setpoints to these modified limits, or

(b) Comply with the requirements of Specification 3.2.2 for $F_Q(z)$ exceeding its limit by the percent calculated above, or

(c) Verify that the requirements of Specification 4.2.2.3 for Base Load operation are satisfied and enter Base Load operation.

g. The limits specified in Specifications 4.2.2.2c., 4.2.2.2e., and 4.2.2.2f. above are not applicable in the following core plane regions:

1. Lower core region from 0 to 15%, inclusive.
2. Upper core region from 85 to 100%, inclusive.

4.2.2.3 Base Load operation is permitted at powers above APL^{ND} if the following conditions are satisfied:

a. Prior to entering Base Load operation, maintain THERMAL POWER above APL^{ND} and less than or equal to that allowed by Specification 4.2.2.2 for at least the previous 24 hours. Maintain Base Load operation surveillance (AFD within applicable target band about the target flux difference) during this time period. Base Load operation is then permitted providing THERMAL POWER is maintained between APL^{ND} and APL^{BL} or between APL^{ND} and 100% (whichever is most limiting) and F_Q surveillance is maintained pursuant to Specification 4.2.2.4. APL^{BL} is defined as the minimum value of:

$$APL^{BL} = \frac{F_Q^{RTP} \times K(z)}{F_Q^M(z) \times W(z)_{BL}} \times 100\%$$

over the core height (z) where: $F_Q^M(z)$ is the measured $F_Q(z)$ increased by the applicable allowances for manufacturing tolerances and measurement uncertainty as specified in the COLR. The F_Q limit is F_Q^{RTP}. $W(z)_{BL}$ is the cycle dependent function that accounts for limited power distribution transient encountered during base load operation. F_Q^{RTP}, K(z), and $W(z)_{BL}$ are specified in the CORE OPERATING LIMITS REPORT as per Specification 6.9.1.11.

SURVEILLANCE REQUIREMENTS (Continued)

b. During Base Load operation, if the THERMAL POWER is decreased below APL^{ND} then the conditions of 4.2.2.3.a shall be satisfied before re-entering Base Load operation.

4.2.2.4 During Base Load Operation $F_Q(z)$ shall be evaluated to determine if $F_Q(z)$ is within its limit by:

a. Using the movable incore detectors to obtain a power distribution map at any THERMAL POWER above APL^{ND} when the Power Distribution Monitoring System (PDMS) is inoperable; and increasing the measured $F_Q(z)$ by the applicable manufacturing and measurement uncertainties as specified in the COLR.

b. Using the PDMS at any THERMAL POWER greater than APL^{ND}; and increasing the measured $F_Q(z)$ by the applicable manufacturing and measurement uncertainties as specified in the COLR.

c. Satisfying the following relationship:

$$F_Q^M(z) \leq \frac{F_Q^{RTP} \times K(z)}{P \times W(z)_{BL}} \text{ for } P > APL^{ND}$$

where: $F_Q^M(z)$ is the measured $F_Q(z)$ increased by the applicable allowances for manufacturing and measurement uncertainties as specified in the COLR. The F_Q limit is F_Q^{RTP}. P is the relative THERMAL POWER. $W(z)_{BL}$ is the cycle dependent function that accounts for limited power distribution transients encountered during normal operation. F_Q^{RTP}, K(z) and $W(z)_{BL}$ are specified in the CORE OPERATING LIMITS REPORT as per Specification 6.9.1.11.

d. Measuring $F_Q^M(z)$ in conjunction with target flux difference determination according to the following schedule:

1. Prior to entering BASE LOAD operation after satisfying Section 4.2.2.3 unless a core power distribution measurement has been obtained in the previous 31 EFPD with the relative thermal power having been maintained above APL^{ND} for the 24 hours prior to measurement, and

2. At least once per 31 Effective Full Power Days.

e. With the maximum value of

$$\frac{F_Q^M(z)}{K(z)}$$

over the core height (z) increasing since the previous determination of $F_Q^M(z)$ either of the following actions shall be taken:

1. $F_Q^M(z)$ shall be increased by 2 percent over that specified in 4.2.2.4.c, or

2. $F_Q^M(z)$ shall be measured at least once per 7 Effective Full Power Days until 2 successive power distribution measurements indicate that the maximum value of

$$\frac{F_Q^M(z)}{K(z)}$$

over the core height (z) is not increasing.

f. With the relationship specified in 4.2.2.4.c above not being satisfied, either of the following actions shall be taken:

1. Place core in an equilibrium condition where the limit in 4.2.2.2.c is satisfied, and remeasure $F_Q^M(z)$, or

2. Comply with the requirements of Specification 3.2.2 for $F_Q(z)$ exceeding its limit by the maximum percent calculated over the core height (z) with the following expression:

$$\left\{\left[\frac{F_Q^M(z) \times W(z)_{BL}}{\frac{F_Q^{RTP}}{P} \times K(z)}\right] - 1\right\} \times 100 \text{ for } P \geq APL^{ND}$$

g. The limits specified in 4.2.2.4.c, 4.2.2.4.e, and 4.2.2.4.f above are not applicable in the following core plane regions:

1. Lower core region 0 to 15 percent, inclusive.

2. Upper core region 85 to 100 percent, inclusive.

4.2.2.5 When $F_Q(z)$ is measured for reasons other than meeting the requirements of Specification 4.2.2.2 an overall measured $F_Q(z)$ shall be obtained:

a. from a power distribution map

1. when THERMAL POWER is ≤ 25%, but > 5% of RATED THERMAL POWER, or

2. when the Power Distribution Monitoring System (PDMS) is inoperable;

and increasing the measured $F_Q(z)$ by the applicable manufacturing and measurement uncertainties as specified in the COLR.

b. from the PDMS when THERMAL POWER is > 25% of RATED THERMAL POWER; and increasing the measured $F_Q(z)$ by the applicable manufacturing and measurement uncertainties as specified in the COLR.

POWER DISTRIBUTION LIMITS

3/4.2.3 RCS FLOW RATE AND NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR

LIMITING CONDITION FOR OPERATION

3.2.3 The combination of indicated Reactor Coolant System (RCS) total flow rate and R shall be maintained within the region of allowable operation as specified in the CORE OPERATING LIMITS REPORT (COLR) figure entitled RCS Total Flow Rate Versus R For Three Loop Operation.

Where:

a. $R = \frac{F_{\Delta H}^{N}}{F_{\Delta H}^{RTP}\left[1.0 + PF_{\Delta H}(1.0 - P)\right]}$,

b. $P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$,

c. $F_{\Delta H}^{N}$ = Measured values of $F_{\Delta H}^{N}$ obtained by

1. Using the movable incore detectors to obtain a power distribution map when THERMAL POWER is ≤ 25% but > 5% of RATED THERMAL POWER, or when PDMS is inoperable, and

2. Using the PDMS when THERMAL POWER is > 25% of RATED THERMAL POWER.

The measured values of $F_{\Delta H}^{N}$ shall be increased by the applicable $F_{\Delta H}^{N}$ measurement uncertainties as specified in the COLR, and used to calculate R since the RCS Total Flow Rate Versus R figure in the COLR includes measurement uncertainties of 2.1% (includes 0.1% for feedwater venturi fouling) for flow,

d. $F_{\Delta H}^{RTP}$ = The $F_{\Delta H}^{N}$ limit at RATED THERMAL POWER specified in the COLR, and

e. $PF_{\Delta H}$ = The Power Factor Multiplier specified in the COLR.

APPLICABILITY: MODE 1.

ACTION:

With the combination of RCS total flow rate and R outside the region of acceptable operation specified in the COLR:

a. Within 2 hours either:

1. Restore the combination of RCS total flow rate and R to within the above limits, or

2. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER and reduce the Power Range Neutron Flux - High trip setpoint to less than or equal to 55% of RATED THERMAL POWER within the next 4 hours.

b. Within 24 hours of initially being outside the above limits, verify through a core power distribution measurement and RCS total flow rate comparison that the combination of R and RCS total flow rate are restored to within the above limits, or reduce THERMAL POWER to less than 5% of RATED THERMAL POWER within the next 2 hours.

LIMITING CONDITION FOR OPERATION

ACTION: (Continued)

c. Identify and correct the cause of the out-of-limit condition prior to increasing THERMAL POWER above the reduced THERMAL POWER limit required by ACTION items a.2. and/or b. above; subsequent POWER OPERATION may proceed provided that the combination of R and indicated RCS total flow rate are demonstrated, through a core power distribution measurement and RCS total flow rate comparison, to be within the region of acceptable operation specified in the COLR prior to exceeding the following THERMAL POWER levels:

1. A nominal 50% of RATED THERMAL POWER,

2. A nominal 75% of RATED THERMAL POWER, and

3. Within 24 hours of attaining greater than or equal to 95% of RATED THERMAL POWER.

SURVEILLANCE REQUIREMENTS

4.2.3.1 The provisions of Specification 4.0.4 are not applicable.

4.2.3.2 The combination of indicated RCS total flow rate and R shall be determined to be within the region of acceptable operation specified in the COLR.

a. Prior to operation above 75% of RATED THERMAL POWER after each fuel loading, and

b. At least once per 31 Effective Full Power Days.

4.2.3.3 The indicated RCS total flow rate shall be verified to be within the region of acceptable operation specified in the COLR at least once per 12 hours when the most recently obtained value of R, obtained per Specification 4.2.3.2, is assumed to exist.

4.2.3.4 The RCS total flow rate indicators shall be subjected to a CHANNEL CALIBRATION at least once per 18 months.

4.2.3.5 The RCS total flow rate shall be determined by heat balance measurement at ≥90% RATED THERMAL POWER at least once per 18 months.

LIMITING CONDITION FOR OPERATION

ACTION: (Continued)

2. Reduce THERMAL POWER to less than 50% of RATED THERMAL POWER within 2 hours and reduce the Power Range Neutron Flux-High Trip Setpoints to less than or equal to 55% of RATED THERMAL POWER within the next 4 hours.

3. Identify and correct the cause of the out of limit condition prior to increasing THERMAL POWER; subsequent POWER OPERATION above 50% of RATED THERMAL POWER may proceed provided that the QUADRANT POWER TILT RATIO is verified within its limit at least once per hour for 12 hours or until verified at 95% or greater RATED THERMAL POWER.

d. The provisions of Specification 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.2.4.1 The QUADRANT POWER TILT RATIO shall be determined to be within the limit above 50% of RATED THERMAL POWER by:

a. Calculating the ratio at least once per 7 days when the alarm is OPERABLE.

b. Calculating the ratio at least once per 12 hours during steady state operation when the alarm is inoperable.

4.2.4.2 The QUADRANT POWER TILT RATIO shall be determined to be within the limit when above 75 percent of RATED THERMAL POWER with one Power Range Channel inoperable by using the movable incore detectors to confirm that the normalized symmetric power distribution, obtained from 2 sets of 4 symmetric thimble locations or a core power distribution measurement, is consistent with the indicated QUADRANT POWER TILT RATIO at least once per 12 hours.

INSTRUMENTATION

MOVABLE INCORE DETECTORS

LIMITING CONDITION FOR OPERATION

3.3.3.2 The movable incore detection system shall be OPERABLE with:

a. At least 75% of the detector thimbles,

b. A minimum of 2 detector thimbles per core quadrant, and

c. Sufficient movable detectors, drive, and readout equipment to map these thimbles.

APPLICABILITY: When the movable incore detection system is used for:

a. Recalibration of the excore neutron flux detection system,

b. Monitoring the QUADRANT POWER TILT RATIO using a full-core flux map per Specification 4.2.4.2, or

c. Measurement of $F^N_{\Delta H}$ and $F_Q(z)$.

ACTION:

With the movable incore detection system inoperable, do not use the system for the above applicable monitoring or calibration functions. The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3.2 The movable incore detection system shall be demonstrated OPERABLE at least once per 24 hours, by normalizing each detector output when required for:

a. Recalibration of the excore neutron flux detection system, or

b. Monitoring the QUADRANT POWER TILT RATIO, or

c. Measurement of $F^N_{\Delta H}$ and $F_Q(z)$.

INSTRUMENTATION

POWER DISTRIBUTION MONITORING SYSTEM

LIMITING CONDITION FOR OPERATION

3.3.3.11 The Power Distribution Monitoring System (PDMS) shall be OPERABLE with:

a. A minimum of the following inputs from the plant available for use by the PDMS as defined in Table 3.3-14.

1. Control Bank Position

2. T_{cold}

3. Reactor Power Level

4. NIS Power Range Detector Section Signals

b. Core Exit Thermocouples (T/C) meeting the criteria:

1. At least 25% operable T/C with at least 2 T/C per quadrant, and

2. The T/C pattern has coverage of all interior fuel assemblies (no face along the baffle), within a chess knight's move, radially, from a responding, calibrated T/C, or

3. At least 25% operable T/C with at least 2 T/C per quadrant, and the installed PDMS calibration was determined within the last 31 Effective Full Power Days (EFPD).

4. The T/C temperatures used by the PDMS are calibrated via cross calibration with the loop temperature measurement RTDs, and using the T/C flow mixing factors determined during installed PDMS calibration.

c. An installed PDMS calibration satisfying the criteria:

1. The initial calibration in each operating cycle is determined using measurements from at least 75% of the incore movable detector thimbles obtained at a THERMAL POWER greater than 25% of RATED THERMAL POWER.

2. The calibration is determined using measurements from at least 50% of the incore movable detector thimbles at any time except as specified in 3.3.3.11.c.1, and

3. The calibration is determined using a minimum of 2 detector thimbles per core quadrant.

LIMITING CONDITION FOR OPERATION (Continued)

APPLICABILITY: MODE 1, above 25% RATED THERMAL POWER (RTP)

ACTION:

With any of the operability criteria listed in 3.3.3.11.a, 3.3.3.11.b, or 3.3.3.11.c not met, either correct the deficient operability condition, or declare the PDMS inoperable and use the incore movable detector system, satisfying the OPERABILITY requirements listed in Specification 3.3.3.2, to obtain any required core power distribution measurements. Increase the measured core peaking factors using the values listed in the COLR for the PDMS inoperable condition.

The provisions of Specifications 3.0.3 and 3.0.4 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3.11.1 The operability criteria listed in 3.3.3.11.a, 3.3.3.11.b, and 3.3.3.11.c shall be verified to be satisfied prior to acceptance of the PDMS core power distribution measurement results.

4.3.3.11.2 Calibration of the PDMS is required:

a. at least once every 180 Effective Full Power Days when the minimum number and core coverage criteria as defined in 3.3.3.11.b.1 and 3.3.3.11.b.2 are satisfied, or

b. at least once every 31 Effective Full Power Days when only the minimum number criterion as defined in 3.3.3.11.b.3 is satisfied.

TABLE 3.3-14

REQUIRED PDMS PLANT INPUT INFORMATION

	PLANT INPUT INFORMATION	AVAILABLE INPUTS	MINIMUM NO. OF VALID INPUTS	APPLICABLE MODES
1.	Control Bank Position	4	4[a]	1[c]
2.	T_{cold}	3	2	1[c]
3.	Reactor Power Level	3	1[b]	1[c]
4.	NIS Power Range Excore Detector Section Signals	8	6[d]	1[c]

TABLE NOTATIONS

a. Determined from either valid Demand Position or the average of the valid individual RCCA position indications for all RCCAs in the Control Bank.

b. Determined from either the reactor THERMAL POWER derived using a valid secondary calorimetric measurement, the average NIS Power Range Detector Power, or the average RCS Loop ΔT.

c. Greater than 25% RTP.

d. Comprised of an upper and lower detector section signal per Power Range Channel; a minimum of 3 OPERABLE channels required.

HEAT FLUX HOT CHANNEL FACTOR and RCS FLOWRATE and NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR (Continued)

For measurements obtained using the Power Distribution Monitoring System (PDMS), the appropriate measurement uncertainty is determined using the measurement uncertainty methodology contained in WCAP-12472-P-A. The cycle and plant specific uncertainty calculation information needed to support the PDMS calculation is contained in the COLR. The PDMS will automatically calculate and apply the correct measurement uncertainty, and apply a 3% allowance for manufacturing tolerance.

The hot channel factor $F_Q^M(z)$ is measured periodically and increased by a cycle and height dependent power factor appropriate to either RAOC or Base Load operation, W(z) or $W(z)_{BL}$, to provide assurance that the limit on the hot channel factor, $F_Q(z)$ is met. W(z) accounts for the effects of normal operation transients and was determined from expected power control maneuvers over the full range of burnup conditions in the core. $W(z)_{BL}$ accounts for the more restrictive operating limits allowed by Base Load operation which result in less severe transient values. The W(z) and $W(z)_{BL}$ functions described above for normal operation are specified in the CORE OPERATING LIMITS REPORT (COLR) per Specification 6.9.1.11.

When RCS flow rate is measured, no additional allowances are necessary prior to comparison with the limits of the RCS Total Rate Versus R figure in the COLR. Measurement errors of 2.1% for RCS total flow rate, including 0.1% for feedwater venturi fouling, have been allowed for in determining the RCS Total Flow Rate Versus R Figure in the COLR.

For $F_{\Delta H}^N$ measurements obtained from a full core flux map taken with the incore detector flux mapping system, a 4% measurement uncertainty allowance should be applied to the measured $F_{\Delta H}^N$ value prior to comparison with the limits of the RCS Total Flow Rate Versus R Figure in the COLR. The appropriate measurement uncertainty for $F_{\Delta H}^N$ measurements obtained using the Power Distribution Monitoring System (PDMS) is determined using the uncertainty methodology described in WCAP-12472-P-A. The cycle and plant specific uncertainty calculation information needed to support the PDMS uncertainty calculation is contained in the COLR. The PDMS will automatically calculate and apply the correct measurement uncertainty to the measured $F_{\Delta H}^N$ value.

The 12-hour periodic surveillance of indicated RCS flow is sufficient to detect only flow degradation which would lead to operation outside the acceptable region of operation specified on the RCS Total Flow Rate Versus R figure in the COLR.

3/4.2.4 QUADRANT POWER TILT RATIO

The quadrant power tilt power ratio limit assures that the radial power distribution satisfies the design values used in the power capability analysis. Radial power distribution measurements are made during startup testing and periodically during power operation.

QUADRANT POWER TILT RATIO (Continued)

The limit of 1.02, at which corrective action is required, provides DNB and linear heat generation rate protection with x-y plane power tilts. A limiting tilt of 1.025 can be tolerated before the margin for uncertainty in F_Q is depleted. The limit of 1.02 was selected to provide an allowance for the uncertainty associated with the indicated power tilt.

The two hour time allowance for operation with a tilt condition greater than 1.02 but less than 1.09 is provided to allow identification and correction of a dropped or misaligned control rod. In the event such action does not correct the tilt, the margin for uncertainty on F_Q is reinstated by reducing the maximum allowed power by 3 percent for each percent of tilt in excess of 1.0.

For purposes of monitoring QUADRANT POWER TILT RATIO when one excore detector is inoperable, the movable incore detectors or a core power distribution measurement are used to confirm that the normalized symmetric power distribution is consistent with the QUADRANT POWER TILT RATIO. The incore detector monitoring is done with a full incore flux map or two sets of 4 symmetric thimbles. These locations are C-8, E-5, E-11, H-3, H-13, L-5, L-11, N-8.

3/4.2.5 DNB PARAMETERS

The limits on the DNB related parameters assure that each of the parameters are maintained within the normal steady state envelope of operation assumed in the transient and accident analyses. The limits are consistent with the initial FSAR assumptions and have been analytically demonstrated adequate to maintain a minimum of DNBR in the core at or above the design limit throughout each analyzed transient. The maximum indicated T_{avg} limit of 589.2°F and the minimum indicated pressure limit of 2206 psig correspond to analytical limits of 591.4°F and 2185 psig respectively, read from control board indications.

The 12-hour periodic surveillance of these parameters through instrument readout is sufficient to ensure that the parameters are restored within their limits following load changes and other expected transient operation.

3/4.3.3.9 EXPLOSIVE GAS MONITORING INSTRUMENTATION

This instrumentation includes provisions for monitoring and controlling the concentrations of potentially explosive gas mixtures in the waste gas holdup system. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63 and 64 of Appendix A to 10 CFR Part 50.

3/4.3.3.10 LOOSE-PART DETECTION INSTRUMENTATION

The OPERABILITY of the loose-part detection instrumentation ensures that sufficient capability is available to detect loose metallic parts in the primary system and avoid or mitigate damage to primary system components. The allowable out-of-service times and surveillance requirements are consistent with the recommendations of Regulatory Guide 1.133, "Loose-Part Detection Program for the Primary System of Light-Water-Cooled Reactors," May 1981.

3/4.3.3.11 POWER DISTRIBUTION MONITORING SYSTEM (PDMS)

The Power Distribution Monitoring System (PDMS) provides core monitoring of the limiting parameters. The PDMS continuous core power distribution measurement methodology begins with the periodic generation of a highly accurate 3-D nodal simulation of the current reactor power distribution. The simulated reactor power distribution is then continuously adjusted by nodal and thermocouple calibration factors derived from an incore power distribution measurement obtained using the incore movable detectors to produce a highly accurate power distribution measurement. The nodal calibration factors are updated at least once every 180 Effective Full Power Days (EFPD). Between calibrations, the fidelity of the measured power distribution is maintained via adjustment to the calibrated power distribution provided by continuously input plant and core condition information. The plant and core condition data utilized by the PDMS is cross checked using redundant information to provide a robust basis for continued operation. The loop inlet temperature is generated by averaging the respective temperatures from each of the loops, excluding any bad data. The core exit thermocouples provide many readings across the core and by the nature of their usage with the PDMS, smoothing of the measured data and elimination of bad data is performed with the Surface Spline fit. PDMS uses the NIS Power Range excore detectors to provide information on the axial power distribution. Hence, the PDMS averages the data from the four Power Range excore detectors and eliminates any bad excore detector data.

The bases for the operability requirements of the PDMS is to provide assurance of the accuracy and reliability of the core parameters measured and calculated by the PDMS core power distribution monitor function. These requirements fall under four categories:

1. Assure an adequate number of operable critical sensors.
2. Assure sufficiently accurate calibration of these sensors.
3. Assure an adequate calibration data base regarding the number of data sets.
4. Assure the overall accuracy of the calibration.

POWER DISTRIBUTION MONITORING SYSTEM (PDMS) (Continued)

The minimum number of required plant and core condition inputs includes the following:

1. Control Bank Positions.
2. At least 50% of the cold leg temperatures.
3. At least 75% of the signals from the Power Range excore detector channels (comprised of a top and bottom detector section).
4. Reactor Power Level.
5. A minimum number and distribution of operable core exit thermocouples.
6. A minimum number and distribution of measured fuel assembly power distribution information obtained using the incore movable detectors is incorporated in the nodal model calibration information.

The sensor calibration of items 1., 2., 3., and 4. above are covered under other specifications. Calibration of the core exit thermocouples is accomplished in two parts. The first being a sensor specific correction to K-type thermocouple temperature indications based on data from a cross calibration of the thermocouple temperature indications to the average RCS temperature measured via the RTDs under isothermal RCS conditions. The second part of the thermocouple calibration is the generation of thermocouple flow mixing factors which cause the radial power distribution measured via the thermocouples to agree with the radial power distribution from a full core flux map measured using the incore movable detectors. This calibration is updated at least once every 180 EFPD.

6.9.1.9 Not used.

MONTHLY OPERATING REPORT

6.9.1.10 Routine reports of operating statistics and shutdown experience, including documentation of all challenges to the PORV's or safety valves, shall be submitted on a monthly basis to the Director, Office of Resource Management, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, with a copy to the Regional Office of Inspection and Enforcement, no later than the 15th of each month following the calendar month covered by the report.

A report of any major changes to the radioactive waste treatment systems shall be submitted with the Monthly Operating Report for the period in which the evaluation was reviewed and accepted as set forth in 6.5 above.

CORE OPERATING LIMITS REPORT

6.9.1.11 Core operating limits shall be established and documented in the CORE OPERATING LIMITS REPORT prior to each reload cycle, or prior to any remaining portion of a reload cycle, for the following:

a. Moderator Temperature Coefficient BOL and EOL Limits and 300 ppm surveillance limit for Specification 3/4.1.1.3,

b. Shutdown Rod Insertion Limit for Specification 3/4.1.3.5,

c. Control Rod Insertion Limits for Specification 3/4.1.3.6,

d. Axial Flux Difference Limits, target band, and APL^{ND} for Specification 3/4.2.1,

e. Heat Flux Hot Channel Factor, F_Q^{RTP}, K(z), W(z), APL^{ND}, $W(z)_{BL}$, and $F_Q(z)$ manufacturing/measurement uncertainties for Specification 3/4.2.2,

f. Nuclear Enthalpy Rise Hot Channel Factor, $F_{\Delta H}^{RTP}$, Power Factor Multiplier, $PF_{\Delta H}$, and $F_{\Delta H}^{N}$ measurement uncertainties limits for Specification 3/4.2.3.

The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

a. WCAP-9272-P-A, "WESTINGHOUSE RELOAD SAFETY EVALUATION METHODOLOGY," July 1985 (W Proprietary).

CORE OPERATING LIMITS REPORT (Continued)

(Methodology for Specification 3.1.1.3 - Moderator Temperature Coefficient, 3.1.3.5 - Shutdown Rod Insertion Limit, 3.1.3.6 - Control Rod Insertion Limit, 3.2.1 - Axial Flux Difference, 3.2.2 - Heat Flux Hot Channel Factor, and 3.2.3 - RCS Flow Rate and Nuclear Enthalpy Rise Hot Channel Factor.)

b. WCAP-10216-P-A, Rev. 1A, "RELAXATION OF CONSTANT AXIAL OFFSET CONTROL F_Q SURVEILLANCE TECHNICAL SPECIFICATION", February 1994 (W Proprietary).

(Methodology for Specifications 3.2.1 - Axial Flux Difference (Relaxed Axial Offset Control) and 3.2.2 - Heat Flux Hot Channel Factor (F_Q Methodology for W(z) surveillance requirements)).

c. WCAP-10266-P-A, Rev. 2, "THE 1981 VERSION OF WESTINGHOUSE EVALUATION MODEL USING BASH CODE", March 1987; Including Addendum 2-A, "BASH METHODOLOGY IMPROVEMENTS AND RELIABILITY ENHANCEMENTS", May 1988, (W Proprietary).

(Methodology for Specification 3.2.2 - Heat Flux Hot Channel Factor).

d. WCAP-12472-P-A, "BEACON CORE MONITORING AND OPERATIONS SUPPORT SYSTEM", August 1994, (W Proprietary).

(Methodology for Specification 3.2.2 - Heat Flux Hot Channel Factor, 3.2.3 - RCS Flow Rate and Nuclear Enthalpy Rise Hot Channel Factor, and 3.2.4 - Quadrant Power Tilt Ratio).

The core operating limits shall be determined so that all applicable limits (e.g., fuel thermal-mechanical limits, core thermal-hydraulic limits, nuclear limits such as shutdown margin, and transient and accident analysis limits) of the safety analysis are met.

The CORE OPERATING LIMITS REPORT, including any mid-cycle revisions or supplements there to shall be provided upon issuance, for each reload cycle, to the NRC Document Control Desk with copies to the Regional Administrator and Resident Inspector.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 142 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 September 18, 1998, as supplemented by letter dated February 5, 1999, South Carolina Electric & Gas Company (SCE&G) requested Technical Specifications (TS) changes to the Virgil C. Summer Nuclear Station (VCSNS) to incorporate a new reactor core power distribution monitoring system (PDMS). The new system uses an NRC-approved Westinghouse proprietary computer system, the best estimate analyzer for core operation-nuclear (BEACON), to augment the flux mapping system when performing a core power distribution surveillance. The proposed TS changes allow the use of the PDMS at power ranges greater than 25% rated thermal power (RTP). At ranges less than or equal to 25% RTP, the licensee must declare the PDMS inoperable. The existing TS will continue to require the licensee to perform a surveillance using the present movable incore detector system when the PDMS is declared inoperable.

The February 5, 1999, submittal contained clarifying information only and did not change the initial no significant hazards consideration determination.

2.0 EVALUATION

In a submittal dated September 18, 1998, SCE&G proposed changing the current VCSNS TS associated with the BEACON monitoring system as follows:

- change Limiting Condition for Operations (LCO) 3.1.3 and 3.2.2 to show when to use the PDMS or when to use the movable incore detectors to obtain power distribution information
- change LCO 3.2.3 to 1) show when to use the PDMS or when to use the movable incore detectors to obtain power distribution information, and 2) to properly consider measurement uncertainty when determining $F^N_{\Delta H}$
- change Surveillance Requirements (SR) 4.2.2
  - — show using the PDMS above 25% RTP to obtain power distribution information, rather than using the movable incore detectors

  - specify using the movable incore detectors to obtain power distribution information when the PDMS is inoperable
  - properly incorporate measured $F_Q(z)$ manufacturing and measurement uncertainties

- change several TS to replace "incore mapping," "incore flux mapping," "power distribution map," "full core flux map," "flux map" or "flux mapping," with "core power distribution measurement(s)"

- make editorial changes to LCO 3.3.3.2 and SR 4.3.3.2 deleting incorrect references to F_{xy}, since all reference to F_{xy} should have been deleted as part of the Amendment 75 TS change associated with Vantage 5 Fuel

- change LCO 3.3.3 to add PDMS TS

- update TS Bases sections 3/4.2 and 3/4.3 to discuss the uncertainties used for the measurements obtained using the PDMS and to add the bases for the new PDMS operability requirements

- update Administrative Controls Section 6.9.1
  - add $F_Q(z)$ and $F^N_{\Delta H}$ manufacturing/measurement uncertainties to the core operating limits report (COLR)
  - add WCAP-12472-P-A to document the analytical methods used to determine the core operating limits
  - correct editorial errors

In the COLR, the licensee added the definitions and the equations which the PDMS or the flux mapping system use to determine the applicable measurement uncertainties associated with the core peaking factors. The constants placed in the COLR are used as coefficients in the uncertainties calculations and are determined using NRC-approved methodology. These constants are typically revised periodically to reflect cycle-specific requirements.

The NRC-approved BEACON Topical Report WCAP-12472-P-A (Ref. 1) is acceptable for use at VCSNS, and it describes a greatly improved on-line power distribution monitoring system. This system provides direct, continuous core power distribution determination and directly relates power distribution to fuel safety limits for Westinghouse plants. At VCSNS, the licensee will use the BEACON system for measuring power distribution instead of using the moveable in-core flux mapping system when power is greater than 25% RTP. All existing power distribution limits remain unchanged. SCE&G will continue to perform power distribution surveillances at the current frequency (every 31 effective full power days). The NRC staff has confirmed that the licensee has referenced and adhered to any restrictions and/or conditions the NRC imposed on WCAP-12472-P-A approval. SCE&G will use the BEACON system only with moveable in-core detectors, as the Westinghouse Topical Report does not apply to fixed in-core detectors.

The proposed TS 6.9.1.11 revision to add WCAP-1247-P-A, "BEACON Core Monitoring and Operations Support System," August 1994, will ensure the values for cycle-specific parameters are maintained within the applicable limits of the plant safety analysis, thus ensuring

conformance to 10 CFR 50.36. The COLR will document the specific parameter limits resulting from VCSNS calculations, including mid-cycle or other revisions to parameter values and including the NRC-approved methodologies.

Since the proposed change to BEACON as a PDMS does not impact plant operation or safety and implementing the PDMS will continue to require operation within the core operational limits determined by NRC-approved methodologies, the staff finds that the proposed change is acceptable. Based on its review of the VCSNS analysis, the staff finds that SCE&G's request to implement the BEACON monitoring system and the proposed TS is acceptable.

3.0 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.

4.0 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 (1) 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 (2) 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 (63 FR 64121). The amendment also changes recordkeeping or reporting requirements. Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9) and (c)(10). 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.

5.0 CONCLUSION

The staff has reviewed the licensee's proposed VCSNS TS changes. Based on the staff's evaluation of the TS changes and the implementation requirements for using BEACON for measuring power distributions with moveable in-core detectors, the staff approves the proposed request to use BEACON at VCSNS to augment the flux mapping system when power is greater than 25% RTP.

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.

6.0 REFERENCE

1. Westinghouse Electric Corporation, WCAP-12472-P-A, "BEACON Core Monitoring and Operations Support System" Topical Report, August 1994.

Principal Contributor: A. Attard

Date: April 9, 1999