June 19, 1997

Mr. Leon R. Eliason
Chief Nuclear Officer & President-
Nuclear Business Unit
Public Service Electric & Gas
Company
Post Office Box 236
Hancocks Bridge, NJ 08038

SUBJECT: SALEM NUCLEAR GENERATING STATION, UNIT NOS. 1 AND 2 (TAC NOS. M96926 AND M96927)

Dear Mr. Eliason:

The Commission has issued the enclosed Amendment Nos. 196 and 179 to Facility Operating License Nos. DPR-70 and DPR-75 for the Salem Nuclear Generating Station, Unit Nos. 1 and 2. These amendments consist of changes to the Technical Specifications (TSs) in response to your application dated October 25, 1996, as supplemented December 11, 1996, January 28, March 27, April 24, June 3, and June 12, 1997.

These amendments change Technical Specification Table 3.3-5, "Engineered Safety Features Response Time," to extend the Containment Fan Cooler Unit response time from less than or equal to 45 seconds to less than or equal to 60 seconds.

A copy of our safety evaluation is also enclosed. Notice of Issuance will be published in the Federal Register.

Sincerely,
/S/
Leonard N. Olshan, Senior Project Manager
Project Directorate I-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Docket Nos. 50-272/311

Enclosures:
1. Amendment No. 196 to License No. DPR-70
2. Amendment No. 179 to License No. DPR-75
3. Safety Evaluation
4. Notice of Issuance



DF01

cc w/encls: See next page

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

PUBLIC SERVICE ELECTRIC & GAS COMPANY

PHILADELPHIA ELECTRIC COMPANY

DELMARVA POWER AND LIGHT COMPANY

ATLANTIC CITY ELECTRIC COMPANY

DOCKET NO. 50-272

SALEM NUCLEAR GENERATING STATION, UNIT NO. 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 196
License No. DPR-70

1. The Nuclear Regulatory Commission (the Commission or the NRC) has found that:

   A. The application for amendment filed by the Public Service Electric & Gas Company, Philadelphia Electric Company, Delmarva Power and Light Company and Atlantic City Electric Company (the licensees) dated October 25, 1996, as supplemented December 11, 1996, January 28, March 27, April 24, June 3, and June 12, 1997, 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 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 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. DPR-70 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 196 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

In addition, the license is amended by changes to Appendix C as indicated in the attachment to this license amendment, and paragraph 2.C.(10) of the Facility Operating License No. DPR-70 is amended to read as follows:

(10) Additional Conditions

The Additional Conditions contained in Appendix C, as revised through Amendment No. 196, are hereby incorporated into this license. Public Service Electric and Gas Company shall operate the facility in accordance with the Additional Conditions.

3. This license amendment is effective as of its date of issuance, to be implemented prior to entry into Mode 3 from the current outage.

FOR THE NUCLEAR REGULATORY COMMISSION

Chester Poslusny for

John F. Stolz, Director
Project Directorate I-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachments: 1. Page 1 to Appendix C of License* DPR-70
2. Changes to the Technical Specifications

Date of Issuance: June 19, 1997

* Page 1 of Appendix C is attached, for convenience, for the composite license to reflect this change.

ATTACHMENT TO LICENSE AMENDMENT NO. 196

FACILITY OPERATING LICENSE NO. DPR-70

DOCKET NO. 50-272

1. Remove

   Appendix C, page 1

   Insert

   Appendix C, page 1

2. Revise Appendix A as follows:

| Remove Pages | Insert Pages |
|---|---|
| 3/4 3-27 | 3/4 3-27 |
| 3/4 3-31 | 3/4 3-31 |

## APPENDIX C

## ADDITIONAL CONDITIONS
## OPERATING LICENSE NO. DPR-70

Public Service Electric and Gas Company, Philadelphia Electric Company, Delmarva Power and Light Company, and Atlantic City Electric Company shall comply with the following conditions on the schedules noted below:

| Amendment Number | Additional Condition | Implementation Date |
|---|---|---|
| 192 | The licensee is authorized to relocate certain Technical Specification requirements to licensee-controlled documents. Implementation of this amendment shall include the relocation of these technical specification requirements to the appropriate documents, as described in the licensee's application dated January 11, 1996, as supplemented by letters dated February 26, May 22, June 27, July 12, December 23, 1996, and March 17, 1997, and evaluated in the staff's safety evaluation attached to this amendment. | The amendment shall be implemented within 60 days from March 21, 1997. |
| 194 | The licensee is authorized to upgrade the initiation circuitry for the power operated relief valves, as described in the licensee's application dated January 31, 1997, as supplemented by letters dated March 14, April 8, and April 28, 1997, and evaluated in the staff's safety evaluation attached to this amendment. | The amendment shall be implemented prior to entry into Mode 3 from the current outage for Salem, Unit 1. |
| 196 | Containment Fan Cooler Units<br>The licensee shall complete all modifications associated with the amendment request concerning Containment Fan Cooler Unit (CFCU) response time dated October 25, 1996, as described in the letters supplementing the amendment request dated December 11, 1996, January 28, March 27, April 24, June 3, and June 12, 1997, prior to entry into Mode 3 following refueling outage 12. All modifications made in support of this amendment request and described in the referenced submittals shall be in conformance with the existing design basis for Salem Unit 1, and programmatic controls for tank monitoring instrumentation shall be as described in the letter dated April 24, 1997. Post modification testing and confirmatory analyses shall be as described in the letter dated March 27, 1997. Future changes to the design described in these submittals may be made in accordance with the provisions of 10 CFR 50.59. Further, the administrative controls associated with CFCU operability and containment integrity described in the letters dated March 27 and April 24, 1997, shall not be relaxed or changed without prior staff review until such time as the license has been amended to include the administrative controls as technical specification requirements. | The amendment shall be implemented prior to entry into Mode 3 from the current outage for Salem, Unit 1. |

TABLE 3.3-5

ENGINEERED SAFETY FEATURES RESPONSE ITEMS

| INITIATING SIGNAL AND FUNCTION | | RESPONSE TIME IN SECONDS |
|---|---|---|
| 1. Manual | | |
| a. | Safety Injection (ECCS) | Not Applicable |
| | Feedwater Isolation | Not Applicable |
| | Reactor Trip (SI) | Not Applicable |
| | Containment Isolation-Phase "A" | Not Applicable |
| | Containment Ventilation Isolation | Not Applicable |
| | Auxiliary Feedwater Pumps | Not Applicable |
| | Service Water System | Not Applicable |
| | Containment Fan Cooler | Not Applicable |
| b. | Containment Spray | Not Applicable |
| | Containment Isolation-Phase "B" | Not Applicable |
| | Containment Ventilation Isolation | Not Applicable |
| c. | Containment Isolation-Phase "A" | Not Applicable |
| | Containment Ventilation Isolation | Not Applicable |
| d. | Steam Line Isolation | Not Applicable |
| 2. Containment Pressure-High | | |
| a. | Safety Injection (ECCS) | ≤27.0(1) |
| b. | Reactor Trip (from SI) | ≤2.0 |
| c. | Feedwater Isolation | ≤10.0 |
| d. | Containment Isolation-Phase "A" | ≤17.0(2)/27.0(3) |
| e. | Containment Ventilation Isolation | Not Applicable |
| f. | Auxiliary Feedwater Pumps | ≤60 |
| g. | Service Water System | ≤13.0(2)/45.0(3) |
| h. | Containment Fan Coolers | ≤60.0 (7) |

TABLE 3.3-5 (Continued)

TABLE NOTATION

(1) Diesel generator starting and sequence loading delays included. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps, SI and RHR pumps.

(2) Diesel generator starting and sequence loading delays not included. Offsite power available. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps.

(3) Diesel generator starting and sequence loading delays included. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps.

(4) On 2/3 in any steam generator.

(5) On 2/3 in 2/4 steam generators.

(6) The response time is the time the isolation circuitry input reaches the isolation setpoint to the time the Isolation Valves are fully shut.

(7) The response time includes the time to automatically align the service water flow to the CFCUs following an accident coincident with a loss of offsite power, and also includes the time delays associated with isolation of the Turbine Generator Area service water header.

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

PUBLIC SERVICE ELECTRIC & GAS COMPANY

PHILADELPHIA ELECTRIC COMPANY

DELMARVA POWER AND LIGHT COMPANY

ATLANTIC CITY ELECTRIC COMPANY

DOCKET NO. 50-311

SALEM NUCLEAR GENERATING STATION, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No.179
License No. DPR-75

1. The Nuclear Regulatory Commission (the Commission or the NRC) has found that:

   A. The application for amendment filed by the Public Service Electric & Gas Company, Philadelphia Electric Company, Delmarva Power and Light Company and Atlantic City Electric Company (the licensees) dated October 25, 1996, as supplemented December 11, 1996, January 28, March 27, April 24, June 3, and June 12, 1997, 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 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 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. DPR-75 is hereby amended to read as follows:

TABLE 3.3-5

ENGINEERED SAFETY FEATURES RESPONSE ITEMS

| INITIATING SIGNAL AND FUNCTION | | RESPONSE TIME IN SECONDS |
|---|---|---|
| 1. Manual | | |
| a. | Safety Injection (ECCS) | Not Applicable |
| | Feedwater Isolation | Not Applicable |
| | Reactor Trip (SI) | Not Applicable |
| | Containment Isolation-Phase "A" | Not Applicable |
| | Containment Ventilation Isolation | Not Applicable |
| | Auxiliary Feedwater Pumps | Not Applicable |
| | Service Water System | Not Applicable |
| | Containment Fan Cooler | Not Applicable |
| b. | Containment Spray | Not Applicable |
| | Containment Isolation-Phase "B" | Not Applicable |
| | Containment Ventilation Isolation | Not Applicable |
| c. | Containment Isolation-Phase "A" | Not Applicable |
| | Containment Ventilation Isolation | Not Applicable |
| d. | Steam Line Isolation | Not Applicable |
| 2. Containment Pressure-High | | |
| a. | Safety Injection (ECCS) | ≤27.0(1) |
| b. | Reactor Trip (from SI) | ≤2.0 |
| c. | Feedwater Isolation | ≤10.0 |
| d. | Containment Isolation-Phase "A" | ≤17.0(2)/27.0(3) |
| e. | Containment Ventilation Isolation | Not Applicable |
| f. | Auxiliary Feedwater Pumps | ≤60 |
| g. | Service Water System | ≤13.0(2)/45.0(3) |
| h. | Containment Fan Coolers | ≤60.0 (7) |

TABLE 3.3-5 (Continued)

TABLE NOTATION

(1) Diesel generator starting and sequence loading delays included. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps, SI and RHR pumps.

(2) Diesel generator starting and sequence loading delays not included. Offsite power available. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps.

(3) Diesel generator starting and sequence loading delays included. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps.

(4) On 2/3 in any steam generator.

(5) On 2/3 in 2/4 steam generators.

(6) The response time is the time the isolation circuitry input reaches the isolation setpoint to the time the Isolation Valves are fully shut.

(7) The response time includes the time to automatically align the service water flow to the CFCUs following an accident coincident with a loss of offsite power, and also includes the time delays associated with isolation of the Turbine Generator Area service water header.

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

PUBLIC SERVICE ELECTRIC & GAS COMPANY

PHILADELPHIA ELECTRIC COMPANY

DELMARVA POWER AND LIGHT COMPANY

ATLANTIC CITY ELECTRIC COMPANY

DOCKET NO. 50-311

SALEM NUCLEAR GENERATING STATION, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No.179
License No. DPR-75

1. The Nuclear Regulatory Commission (the Commission or the NRC) has found that:

   A. The application for amendment filed by the Public Service Electric & Gas Company, Philadelphia Electric Company, Delmarva Power and Light Company and Atlantic City Electric Company (the licensees) dated October 25, 1996, as supplemented December 11, 1996, January 28, March 27, April 24, June 3, and June 12, 1997, 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 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 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. DPR-75 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendices A and B, as revised through Amendment No. 179 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

In addition, the license is amended by changes to Appendix C as indicated in the attachment to this license amendment, and paragraph 2.C.(26) of the Facility Operating License No. DPR-75 is amended to read as follows:

(26) Additional Conditions

The Additional Conditions contained in Appendix C, as revised through Amendment No. 179 , are hereby incorporated into this license. Public Service Electric and Gas Company shall operate the facility in accordance with the Additional Conditions.

3. This license amendment is effective as of its date of issuance, to be implemented prior to entry into Mode 3 from the current outage.

FOR THE NUCLEAR REGULATORY COMMISSION

Chester Poslusny for

John F. Stolz, Director
Project Directorate I-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachments: 1. Page 1 to Appendix C of License* DPR-75
2. Changes to the Technical Specifications

Date of Issuance: June 19, 1997

* Page 1 of Appendix C is attached, for convenience, for the composite license to reflect this change.

ATTACHMENT TO LICENSE AMENDMENT NO. 179

FACILITY OPERATING LICENSE NO. DPR-75

DOCKET NO. 50-311

1. Remove

   Appendix C, page 1

   Insert

   Appendix C, page 1

2. Revise Appendix A as follows:

| Remove Pages | Insert Pages |
|---|---|
| 3/4 3-28 | 3/4 3-28 |
| 3/4 3-32 | 3/4 3-32 |

## APPENDIX C

## ADDITIONAL CONDITIONS
## OPERATING LICENSE NO. DPR-75

Public Service Electric and Gas Company, Philadelphia Electric Company, Delmarva Power and Light Company, and Atlantic City Electric Company shall comply with the following conditions on the schedules noted below:

| Amendment Number | Additional Condition | Implementation Date |
|---|---|---|
| 175 | The licensee is authorized to relocate certain Technical Specification requirements to licensee-controlled documents. Implementation of this amendment shall include the relocation of these technical specification requirements to the appropriate documents, as described in the licensee's application dated January 11, 1996, as supplemented by letters dated February 26, May 22, June 27, July 12, December 23, 1996, and March 17, 1997, and evaluated in the staff's safety evaluation attached to this amendment. | The amendment shall be implemented within 60 days from March 21, 1997. |
| 177 | The licensee is authorized to upgrade the initiation circuitry for the power operated relief valves, as described in the licensee's application dated January 31, 1997, as supplemented by letters dated March 14, April 8, and April 28, 1997, and evaluated in the staff's safety evaluation attached to this amendment. | The amendment shall be implemented prior to entry into Mode 3 from the current outage for Salem, Unit 2. |
| 179 | Containment Fan Cooler Units<br>All modifications made in support of the amendment request concerning Containment Fan Cooler Unit (CFCU) response time dated October 25, 1996, as described in the letters supplementing the amendment request dated December 11, 1996, January 28, March 27, April 24, June 3, and June 12, 1997, shall be in conformance with the existing design basis for Salem Unit 2, and programmatic controls for tank monitoring instrumentation shall be as described in the letter dated April 24, 1997. Post modification testing and confirmatory analyses shall be as described in the letter dated March 27, 1997. Future changes to the design described in these submittals may be made in accordance with the provisions of 10 CFR 50.59. Further, the administrative controls associated with CFCU operability and containment integrity described in the letters dated March 27 and April 24, 1997, shall not be relaxed or changed without prior staff review until such time as the license has been amended to include the administrative controls as technical specification requirements. | The amendment shall be implemented prior to entry into Mode 3 from the current outage for Salem, Unit 2. |

TABLE 3.3-5

ENGINEERED SAFETY FEATURES RESPONSE TIMES

| INITIATING SIGNAL AND FUNCTION | RESPONSE TIME IN SECONDS |
|---|---|
| 1. Manual | |
| a. Safety Injection (ECCS) | Not Applicable |
| Feedwater Isolation | Not Applicable |
| Reactor Trip (SI) | Not Applicable |
| Containment Isolation-Phase "A" | Not Applicable |
| Containment Ventilation Isolation | Not Applicable |
| Auxiliary Feedwater Pumps | Not Applicable |
| Service Water System | Not Applicable |
| Containment Fan Cooler | Not Applicable |
| b. Containment Spray | Not Applicable |
| Containment Isolation-Phase "B" | Not Applicable |
| Containment Ventilation Isolation | Not Applicable |
| c. Containment Isolation-Phase "A" | Not Applicable |
| Containment Ventilation Isolation | Not Applicable |
| d. Steam Line Isolation | Not Applicable |
| 2. Containment Pressure-High | |
| a. Safety Injection (ECCS) | $\leq 27.0^{(1)}$ |
| b. Reactor Trip (from SI) | $\leq 2.0$ |
| c. Feedwater Isolation | $\leq 10.0$ |
| d. Containment Isolation-Phase "A" | $\leq 17.0^{(2)}/27.0^{(3)}$ |
| e. Containment Ventilation Isolation | Not Applicable |
| f. Auxiliary Feedwater Pumps | $\leq 60$ |
| g. Service Water System | $\leq 13.0^{(2)}/45.0^{(3)}$ |
| h. Containment Fan Coolers | $\leq 60.0^{(7)}$ |

TABLE 3.3-5 (Continued)

TABLE NOTATION

(1) Diesel generator starting and sequence loading delays included. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps, SI and RHR pumps.

(2) Diesel generator starting and sequence loading delays not included. Offsite power available. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps.

(3) Diesel generator starting and sequence loading delays included. Response time limit includes opening of valves to establish SI path and attainment of discharge pressure for centrifugal charging pumps.

(4) On 2/3 in any steam generator.

(5) On 2/3 in 2/4 steam generators.

(6) The response time is the time the isolation circuitry input reaches the isolation setpoint to the time the Isolation Valves are fully shut.

(7) The response time includes the time to automatically align the service water flow to the CFCUs following an accident coincident with a loss of offsite power, and also includes the time delays associated with isolation of the Turbine Generator Area service water header.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NOS. 196 AND 179 TO FACILITY OPERATING

LICENSE NOS. DPR-70 AND DPR-75

PUBLIC SERVICE ELECTRIC & GAS COMPANY

PHILADELPHIA ELECTRIC COMPANY

DELMARVA POWER AND LIGHT COMPANY

ATLANTIC CITY ELECTRIC COMPANY

SALEM NUCLEAR GENERATING STATION, UNIT NOS. 1 AND 2

DOCKET NOS. 50-272 AND 50-311

## 1.0 INTRODUCTION

In a letter dated October 25, 1996, Public Service Electric and Gas Company (PSE&G or the licensee) requested that the NRC approve a change to the response time for the containment fan coil units (CFCUs) that was specified in the Technical Specifications (TSs) for Salem Unit Nos. 1 and 2. The licensee's request relies in part on modifications that are being made to the service water system to resolve the water hammer concerns discussed in Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions," dated September 30, 1996. Therefore, the staff's evaluation of the licensee's amendment request includes a review of the modifications that are being made. In completing this effort, the staff reviewed PSE&G's submittals including the TS amendment request of October 25, 1996, as supplemented by letter dated December 11, 1996, and the licensee's responses to GL 96-06 dated January 28, 1997, as supplemented by letters dated March 27, April 24, June 3, and June 12, 1997. The letters dated December 11, 1996, and Janaury 28, March 27, April 24, June 3, and June 12, 1997, contained supplementary and clarifying information that did not expand the scope of the November 21, 1997 (62 FR 59249) Federal Register notice.

## 2.0 BACKGROUND

During an internal engineering review, PSE&G identified that service water flow to the CFCUs could not be fully established within 45 seconds as specified by the Salem TS requirements, Table 3.3-5, "Engineering Safety Feature Response Time." This discrepancy in the TSs resulted during plant startup testing when a change was made to delay the valve sequence timing for isolating non-essential turbine generator area (TGA) service water loads during accident conditions. This delay was necessary in order to minimize the occurrence of water hammer in the service water piping when the turbine plant loads were being isolated. In order to bring the TSs in conformance with the

actual plant response and to correct this deficiency, the licensee requested NRC approval to change the CFCU response time requirement from ≤45 seconds to ≤60 seconds.

Other design-related deficiencies associated with the service water system and the CFCUs have also been identified at Salem. As reported in Licensee Event Report (LER) 272/96-020 dated September 18, 1996, PSE&G determined that following a loss of coolant accident (LOCA) or a main steam line break (MSLB) with concurrent loss of off-site power (LOOP), the CFCU response time did not satisfy TS requirements (as discussed above); short periods of two-phase flow can exist in the vicinity of the CFCUs while the TGA isolation valves are going closed; and the service water piping in the vicinity of the CFCUs is subject to thermally induced overpressurization during a very short period of time (about 14 seconds) before the CFCU control valves open to restore service water flow through the CFCUs. Additionally, in response to GL 96-06, the licensee identified certain accident scenarios where water hammer and two-phase flow conditions could occur and jeopardize the integrity and operability of the CFCUs and service water system piping.

The licensee's submittal of October 25, 1996, addressed the problems associated with delayed CFCU response and thermal overpressurization, but did not address water hammer vulnerabilities and only partially addressed two-phase flow vulnerabilities. Because vulnerabilities associated with water hammer and two-phase flow could invalidate the licensee's evaluation of delayed CFCU response, the staff requested that the licensee address these concerns. The licensee's response of December 1996 was only partially complete in that the licensee's assessment did not include single-failure considerations. The licensee's submittals of January 28, March 27, April 24, June 3, and June 12, 1997, responding to GL 96-06 and supplementing the amendment request of October 1996, provided the additional information that was needed to address water hammer and two-phase flow considerations, making the amendment request package complete. While the licensee initially concluded that an additional 15-second delay in CFCU response time would not compromise the accident mitigation function of the CFCUs, further analysis addressing GL 96-06 issues found that modifications to the service water system were necessary to eliminate water hammer and two-phase flow vulnerabilities.

## 3.0 EVALUATION

The licensee's request to delay CFCU response time involves several areas of review, and the areas associated with containment performance (e.g., temperature and pressure response) and dose assessment are not included within the scope of this evaluation. Review areas that are addressed by the staff in this evaluation include core performance, containment structure, environmental qualification (EQ) of equipment, service water, and station blackout (SBO).

3.1 Core Performance

The Updated Final Safety Analysis Report (UFSAR), Section 15.4, describes the core response analysis. Table 15.4-3 lists 22 seconds as a lower limit for CFCU response (i.e., minimum time within which the CFCUs can respond). The minimum response time is considered in evaluating the blowdown rate of the reactor coolant system (RCS) during a LOCA, with faster CFCU response times corresponding to faster blowdown rates. A delay in the CFCU response time as requested by the licensee will not affect the minimum response time assumption contained in the UFSAR, and the licensee's evaluation confirms that physical limitations prevent CFCU response from occurring before 22 seconds have elapsed. The physical limitations include time delays associated with switching the CFCUs to accident mode, which includes realignment of the CFCU flow control valves and isolation of the non-essential (TGA) heat loads. Therefore, the staff concludes that the proposed delay in CFCU response time will have no effect on core performance.

3.2 Structural Considerations

The licensee has reevaluated containment temperature response for LOCA and MSLB conditions assuming a 60-second CFCU response time. The licensee's analysis determined that the peak LOCA temperature remains below the licensing basis value of 271 °F, but that the peak MSLB temperature exceeds the licensing basis value. This condition was reported by the licensee in LER 272/95-016. Actions being taken to address the effects of increased temperatures on structures are discussed in amendment request LCR S96-06, dated June 18, 1996. The staff concludes that the structures are adequate to allow operation with the 60-second CFCU response time and the increased temperature resulting from the MSLB based on the following:

a. The structural integrity of the concrete containment is maintained because it is governed by the LOCA pressure loading, which is greater than the pressure loading of the MSLB.

b. Prior to restart, modifications will be completed on the reactor coolant pump platforms (both units) and the containment spray piping supports (Unit 1 only).

c. Testing was performed to demonstrate the adequacy of the liner and liner-anchor system. The test results provide the staff with reasonable assurance that the liner will maintain its leaktight integrity following the MSLB.

Additionally, by letter dated June 11, 1997, in connection with LCR S96-06, the licensee has committed to perform an evaluation of the containment liner anchorage by November 30, 1997, for the loading induced on the containment liner during an MSLB event to confirm the assumptions provided in the preliminary Safety Analysis Report and the Updated Final Safety Analysis Report.

3.3 Equipment Qualification

The licensee has determined that delayed CFCU response during the MSLB event results in a peak containment temperature of 351 °F, which exceeds the current design basis temperature for equipment qualification by 2.81 °F; the existing containment pressure profile was not exceeded by delayed CFCU response. The licensee has reviewed the revised containment temperature profiles contained in Westinghouse Safety Evaluation SECL-96-178, and has determined that safety-related equipment located inside containment remains qualified under the new temperature profile.

A 2.81 °F temperature increase is generally of little or no consequence. Accordingly, the staff finds that the increase to 60 seconds in the CFCU response time is acceptable regarding equipment qualification. Further, the licensee's evaluation provides adequate assurance that safety-related electrical equipment will function as required during accident conditions. However, as a separate initiative outside the scope of this evaluation, the NRC staff may review the adequacy of the licensee's analytical methodology.

3.4 Service Water

The service water system for each of the two Salem units is an open-loop cooling water system that consists of two separate headers that are normally cross connected. Each unit has six service water pumps, with three pumps aligned to each of the service water headers. There are five CFCUs for each unit and each service water header provides cooling water to two of the CFCUs; the fifth CFCU receives cooling water from both of the service water headers.

Upon accident initiation, the CFCU fans shift to slow speed, the CFCU flow control valves (on the outlet) go from a throttled position to full open, and the TGA isolation valves close (after a 30-second delay) to isolate the non-essential heat loads. Should a LOOP occur concurrent with a LOCA or MSLB, the service water pumps stop within about 2 seconds; the CFCU flow control valves initially go closed in about 9 seconds (consequently, the CFCU outlet piping will drain); the service water pumps are repowered at about 25 seconds into the event; the CFCU fans receive power at about 35 seconds into the event; the CFCU flow control valves receive an open signal at about 40 seconds into the event; and the TGA isolation valves go fully closed at about 56 seconds into the event. Assuming the worst-case single failure, at least three CFCUs and two service water pumps should be available for accident mitigation.

The licensee has determined that the CFCU service water piping is susceptible to the water hammer and two-phase flow concerns discussed in GL 96-06. During a LOOP scenario without accident conditions, the CFCU outlet piping drains and column separation occurs. When the service water pumps are repowered and service water flow is restored, a water hammer occurs as the separated water columns rejoin. Similarly, if a LOOP occurs concurrent with an MSLB or LOCA, heat transfer through the CFCU coils can flash the service water to steam and create a steam pocket in the CFCUs and in the service water piping. When the service water pumps are subsequently repowered and service water flow through

the CFCUs is restored, a water hammer can occur as the steam pocket is condensed. The severity of these water hammer events depends in part on initial system conditions and component failure scenarios.

Another potential failure scenario that was identified by the licensee is thermally-induced overpressurization of the CFCU service water piping. Following the MSLB/LOCA water hammer scenario, during the short time interval after the service water pumps start but before the CFCU flow control valves open (about 10 seconds), sufficient heat can be transferred through the CFCU coils to cause the trapped service water inside the CFCUs to expand and challenge the integrity of the service water piping inside containment.

Although the service water system was susceptible to water hammer, two-phase flow, and thermal overpressurization even without consideration of the 15-second CFCU delay that has been identified, this additional delay will tend to make these scenarios even worse. Therefore, the staff required PSE&G to address the water hammer and two-phase flow concerns as part of the October 1996 TS amendment request to delay CFCU response time; it is the staff's view that these issues are related and cannot be handled separately.

As discussed in the submittal of March 27, 1997, PSE&G determined that modifications to the service water system should be made to eliminate the potential for water hammer, two-phase flow, and thermal overpressurization, thus preserving existing design and safety margins and assuring the reliability of the CFCUs for post-accident cooling. The staff's review focused primarily on the design objectives and functional criteria that were established for the system modifications to assure that they were consistent with the existing licensing basis for the Salem units.

3.4.1 General Design Objectives and Criteria

As an overall objective, it is the licensee's intent to modify the service water system such that the fluid conditions in the system (as they support the CFCU containment cooling function) will conform to the original licensing basis assumptions. The general design objectives established by the licensee include the following:

- Voids or column separation induced by siphoning effects or changes in elevation must be reduced to the greatest extent practical. Those portions of the service water system located inside containment should remain water solid during all operating and abnormal conditions. Local cavitation at valves or other restrictions is acceptable if it can be shown that voiding of the piping system and/or unnecessary flow restriction does not occur.

- The pressure in the affected piping loop must remain above fluid saturation pressure for all operating and abnormal conditions.

- The service water containment piping penetrations and the closed piping loop inside containment should be protected from postulated overpressure conditions associated with MSLB/LOCA.

To the degree that the licensee is not proposing a change to the original licensing basis for the Salem units, the staff is in agreement with these objectives. However, the occurrence of local cavitation (other than short, intermittent episodes) may represent a change to the licensing basis of the plant and must be considered.

3.4.2 System Modifications

In order to eliminate vulnerabilities associated with water hammer, two-phase flow, and thermally induced overpressurization, the following changes are being made to the service water system:

- A 15,000 gallon capacity water storage tank, including parallel discharge isolation valves and nitrogen pressurization capability, will be added to each of the service water headers to provide continued service water flow through the CFCUs until the service water pumps are repowered following a LOOP event. Each tank is sized to contain sufficient water and nitrogen to maintain water filled, subcooled fluid conditions in three CFCU cooling loops in response to a LOOP, without injecting nitrogen into the CFCU cooling loops assuming the most limiting single active failure. The tanks are lined with a protective coating which will be inspected periodically to assure its integrity. The two air-operated isolation valves in the tank discharge piping are normally closed, and are arranged in a parallel configuration to assure that the tank volume will discharge in the event of an accident. The valves are equipped with a timer and a dedicated supply of air such that the valves are returned to the closed position before the contained nitrogen can expand into the tank discharge piping. The dedicated air supply is sufficient to keep the valves closed until service water flow is restored following a station blackout event, which is the most limiting case. The opening time of the valves must be fast enough to prevent water column separation from occurring following a LOOP condition. The response time requirements for these valves will be included in the response time testing procedures for the CFCUs.

- Relief valves will be added to each CFCU service water system cooling loop with set points that are low enough to prevent overpressurization during accident conditions, and high enough to prevent saturation conditions from being achieved.

- Volume boosters will be added to the CFCU inlet pressure control valves (SW57) and to the CFCU outlet flow control valves (SW223) to improve valve performance and reliability.

- The CFCU flow control valves (SW223) currently fail open on a loss of power, and the loss of one DC control power channel could affect two CFCUs. The control logic for the CFCU flow control valves will be modified so that the valves fail closed on a loss of power. This failure mode will tend to preserve the water volume in the water storage tanks to assure an adequate supply for accident mitigation purposes, and will tend to keep the CFCU outlet piping charged with water thus preventing column separation and

water hammer scenarios. The modification will include remote operating capability to satisfy 10 CFR Part 50, Appendix R requirements for fire protection.

- Another check valve will be added in the CFCU service water supply piping in series with the existing check valve (SW51) to eliminate the possibility of any back-leakage and drain-down on the supply side of the CFCUs, thereby minimizing the amount of water needed in the service water storage tanks.

- The pressure control valves on the service water inlet piping to the CFCUs (SW57) normally modulate to maintain service water pressure at 50 psig at the inlet to the CFCU flow control valves (SW223). To eliminate potential failure scenarios, the circuit for the air solenoid valve for the pressure control valves will be modified to be deenergized (to vent air pressure) to assure that the pressure control valves are full open when their associated CFCU is off or operating in slow speed (accident mode), and a new interlock will be added in the CFCU start circuit that requires its associated pressure control valve to be full open before the CFCU can be started in the accident mode.

- Upon loss of a DC control power channel, the flow control valve (SW122) for one of the component cooling water (CCW) heat exchangers could remain in the modulated position, diverting service water flow from the CFCUs. To eliminate this vulnerability, the dual coil solenoid for the CCW flow control valves will be replaced with a single coil solenoid such that the CCW flow control valves will fail in the closed position and preserve service water flow to the CFCUs.

- For certain failure scenarios (e.g., failure of a service water pump to start), the service water pressure at the outlet of the CFCUs will be insufficient to prevent boiling until both of the CCW flow control valves (SW122) are closed. In order to assure timely closing of the CCW flow control valves, a volume booster will be added to both of these valves.

- The Agastat relays for the motor-operated TGA isolation valves (21 & 23 SW20 and SW26) are being eliminated and new gear sets are being installed in the motor operators of these valves (along with other internal modifications) to accomplish the TGA isolation function in a more reliable manner. Valve timing requirements will be included in the CFCU response time surveillance procedures.

- The licensee has determined that if a CFCU flow control valve (SW223) were left in the throttled position during an accident because the high speed fan breaker failed to open (postulated single failure), the affected CFCU outlet temperature could reach 221 °F before gradually decreasing to 200 °F. This failure scenario was not recognized in the previous analysis, which had calculated a maximum CFCU outlet temperature of 195 °F. The licensee's submittal of March 1997 states that this increased temperature condition has been evaluated and is of no consequence to the cooling loop valves, valve internals, valve operators, penetration seal materials, and

Instrumentation and Control components. However, as discussed in the licensee's evaluation (May 27, 1997, Accession No. 9705300064), the licensee found that several of the service water system pipe supports required modification to accommodate the increased piping loads that result due to the higher service water temperature conditions. The modifications were designed to restore the supports to the design basis criteria specified in the UFSAR and have been completed.

- Misoperation of the CFCU header isolation valves (SW20 & SW 22) and containment isolation valves (SW58 & SW72) could result in two-phase flow in the CFCU cooling loops. None of these valves are required to be operated to mitigate the consequences of a LOCA or MSLB, and the valve control bezels are discretely arranged on the control board and are not in close proximity with other controls which are required to be manipulated in response to a LOCA or MSLB. Therefore, the licensee concluded that it would be appropriate to establish operator aids to reinforce the need to stop, think, act, and review when manipulating these particular control bezels.

The modifications discussed above are more fully described in the licensee's submittals of March 27 and April 24, 1997, which include a listing of the functional criteria for the components involved. As discussed in the referenced submittals, the licensee will complete integrated and component level testing to confirm that the modifications will perform as designed and are adequate for resolving the water hammer and two-phase flow vulnerabilities that have been identified. The results of the integrated testing will also be used to validate and benchmark the transient hydraulic model that was used for predicting system performance during the design process. Finally, the modifications that are being made will be evaluated for inclusion into the appropriate design basis maintenance program to assure continued operability over time, and periodic testing will be completed in accordance with the applicable design basis maintenance program requirements. The actions being taken by PSE&G, as described in the referenced submittals, to address the service water system vulnerabilities that have been identified and to assure that the service water system will function in accordance with the original licensing basis assumptions, are acceptable to the staff. As discussed in Section 3.7 of this evaluation, a condition will be added to Appendix C of the License to assure that all actions are completed as described and to require that all modifications conform to the design basis for the Salem units.

3.4.3 Cavitation at the CFCU Flow Control Valves (SW223)

The CFCU control valves are located outside containment in the 10" CFCU discharge piping. This piping connects to the 16" combined CFCU discharge header piping within several pipe diameters of the valve. During normal plant operation, the CFCU control valves are known to experience some degree of cavitation, and following a LOCA, the relatively hot fluid conditions exiting the CFCUs could result in cavitation that is slightly more severe. As

discussed in the licensee's submittal dated June 3, 1997, PSE&G has concluded that cavitation at the CFCU control valves is not a problem for the following reasons:

- the valves have operated in this condition for many years with no indication of fatigue failure;
- based on information contained in NUREG/CR 6031, "Cavitation Guide for Control Valves," the level of cavitation during accident conditions is expected to be nominally the same as that which has been experienced during normal plant operation;
- vendor information indicates that these valves are suited for two-phase and three-phase flow conditions, the valves are rugged, and have stainless steel bodies and balls with stellite-clad wear areas;
- the system piping is erosion resistant;
- the valves are routinely disassembled and inspected in accordance with program requirements to assure that the valves are not degraded; and
- the system temperature and pressure conditions are such that any steam vapor that forms will be condensed within a few pipe diameters of the valve, well before the fluid stream enters the 16" combined CFCU discharge header.

The licensee's assessment provides sufficient justification for the staff to conclude that operation with the 60-second CFCU response time is acceptable. However, in order to more fully assess policy implications and to assure consistency among the various plants, the staff will continue to review this item as a follow-up to the licensee's response to GL 96-06.

3.4.4 Cavitation at the CFCU Outlet Valves (SW65)

The CFCU outlet valves are located inside containment in the 10" CFCU discharge piping upstream of the flow control valves (discussed in 3.4.3 above). During normal operation, the SW65 valves are throttled to provide a flow resistance at the outlet of each CFCU to assure adequate cooling water flow to its respective CFCU motor cooler. During accident conditions, these valves get a signal to go full open. The licensee has determined that fluid conditions at the outlet of one of the SW65 valves could result in cavitation should the valve fail "as is" (in the throttled position) during an accident. As discussed in the licensee's submittal of June 12, 1997, PSE&G has concluded that cavitation at the CFCU outlet valves is not a problem for the following reasons:

- the fluid pressure downstream of the SW65 valves, fluid mixing that occurs shortly beyond the SW65 valves, and the piping arrangement in the vicinity of the SW65 valves promotes the rapid collapse of any vapor bubbles that may form;

- quarterly response time testing of the SW65 valves provides a high level of assurance that degraded valve performance will be detected and corrected prior to the occurrence of a functional failure;

- the system piping is erosion resistant;

- normal operating conditions at the SW65 valves do not predispose these valves, piping, or branch connections to accelerated wastage of material or to fatigue induced failures;

- Salem control valves similar in design to the SW65 valves are known to experience severe cavitation during normal plant operation and no catastrophic failures of the piping or of the control valves have been experienced in these other applications;

- should SW65 fail in the throttled position during a design-basis LOCA, severe cavitation would be of short duration (about 30 minutes for the large break LOCA) and, based on years of plant operating experience with severe cavitation of control valves that are similar in design to the SW65 valves, catastrophic failure of the piping and valves should not occur during this relatively short duration; and

- substantial margins to allowable stresses exist in the SW65 piping and support structure.

The licensee's assessment provides sufficient justification for the staff to conclude that operation with the 60-second CFCU response time is acceptable. However, in order to more fully assess policy implications and to assure consistency among the various plants, the staff will continue to review this item as a follow-up to the licensee's response to GL 96-06.

3.4.5 Interim Administrative Controls

As discussed in the March 27 and April 24, 1997, submittals, the licensee has determined that additional TS surveillance requirements are warranted to assure CFCU operability and containment integrity requirements are satisfied during power operation. Pending the submittal and NRC approval of additional TS surveillance requirements, the licensee will implement the following administrative requirements:

- Daily logs on storage tank temperature, pressure, and level will be maintained.

- 18-Month time response test of the storage tank discharge valves and the associated sensing and control circuitry will be performed.

It is important to monitor these parameters to assure that the water volume contained in the service water storage tanks will be maintained in accordance with the applicable design criteria and assumptions, such as water inventory, nitrogen overpressure, and amount of dissolved nitrogen. If it is determined

that a service water storage tank is inoperable, plant operators will be directed to comply with the applicable TS requirements for maintaining primary containment integrity and for maintaining five CFCUs operable. Until such time that these administrative controls are incorporated into the TSs, PSE&G will notify the NRC in advance of any changes. The licensee has committed to propose new TS requirements within 90 days of entering Mode 2 on each unit. These measures are acceptable to the staff.

3.5 Station Blackout

Attachment 2 of the supplemental information that was provided in support of this amendment request and GL 96-06, dated March 27, 1997, provides the licensee's evaluation concerning station blackout. The licensee has determined that irrespective of CFCU delay time, the station blackout scenario is such that column separation will occur in the CFCU outlet piping and steam pockets will form in the tubes of the CFCUs. Upon restoration of service water flow through the CFCUs, the integrity of the CFCU service water piping may be challenged by the water hammer that will occur as the steam pockets and voids are collapsed. The licensee's evaluation discusses measures that may be taken to isolate the service water system and assure containment integrity should the service water piping fail due to water hammer. The staff generally has not accepted postulated failures of safety-related systems during SBO event scenarios, and further analysis and resolution of this problem may be required by the licensee to demonstrate compliance with the requirements stated in 10 CFR 50.63, "Loss of Alternating Current Power." However, because this issue is independent of CFCU response time considerations, it will be pursued, outside the scope of this amendment request, as a follow-up action to the licensee's response to GL 96-06.

3.6 Dose Evaluation

The doses have already been evaluated and approved by the staff. In support of Amendment No. 190 for Unit 1 and Amendment No. 173 for Unit 2, issued February 6, 1997, the staff performed its own analysis of the offsite and control room doses resulting from a Loss of Coolant Accident, fuel handling accident, locked rotor accident, and steam generator tube rupture accident. The staff's analysis was performed using the proposed CFCU response time and the staff concluded that the doses are within the applicable dose acceptance criteria of 10 CFR Part 100 and General Design Criterion 19, and are therefore acceptable.

3.7 Condition Added to Appendix C of License

In order to assure that the modifications are completed prior to restart, that all modifications that are made in support of the amendment request will satisfy the existing design basis requirements for the Salem units, and that the administrative controls described in Section 3.4.5 are established pending amendment of the TSs, an appropriate license condition will be included in

Appendix C of the Operating Licenses for the Salem units. By a telephone call on June 18, 1997, the licensee requested that the application be amended to include these license conditions.

## 4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the New Jersey State official was notified of the proposed issuance of the amendments. By letter dated December 2, 1996, the State official had no comments.

## 5.0 ENVIRONMENTAL CONSIDERATION

Pursuant to 10 CFR 51.21, 51.32, and 51.35, an environmental assessment and finding of no significant impact have been prepared and published in the Federal Register on May 14, 1997 (62 FR 26573). Accordingly, based upon the environmental assessment, the staff has determined that the issuance of this amendment will not have a significant effect on the quality of the human environment.

## 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) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendments will not be inimical to the common defense and security or to the health and safety of the public.

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