July 20, 1994

Docket No. 50-311

Mr. Steven E. Miltenberger
Vice President and Chief Nuclear
Officer
Public Service Electric and Gas
Company
Post Office Box 236
Hancocks Bridge, New Jersey 08038

Dear Mr. Miltenberger:

SUBJECT: BORON CONCENTRATION IN BORIC ACID TANKS REDUCED, SALEM NUCLEAR GENERATING STATION, UNIT NO. 2 (TAC NO. M86724)

The Commission has issued the enclosed Amendment No. 133 to Facility Operating License No. DPR-75 for the Salem Nuclear Generating Station, Unit No. 2. The amendment consists of changes to the Technical Specifications (TSs) in response to your application dated June 11, 1993, as supplemented by letters dated July 19, August 3, and September 16, 1993. Because of the requested implementation date for Salem, Unit 2 (restart from the eighth refueling outage, scheduled to begin on September 24, 1994), a separate amendment was issued for Salem, Unit 1 on October 15, 1993.

The amendment allows the boron concentration in the boric acid tanks to be reduced to the point where heat tracing for the associated piping would not be required.

A copy of our safety evaluation is also enclosed. Notice of Issuance will be included in the Commission's biweekly Federal Register notice. You are requested to notify the NRC, in writing, when the amendment has been implemented at Salem 2.

Sincerely,

/S/
James C. Stone, Senior Project Manager
Project Directorate I-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 133 to License No. DPR-75
2. Safety Evaluation

cc w/enclosures:
See next page

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Docket File	MO'Brien(2)	CGrimes, 11E21
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OFC	:PDI-2/LA	:PDI-2/PE	:PDI-2/PM	:OGC	:PDI-2/D	:
NAME	:MO'Brien	:JZimmerman:rb	:JStone	:	:CMiller	:
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 20, 1994

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See next page

Mr. Steven E. Miltenberger
Public Service Electric & Gas
Company

Salem Nuclear Generating Station,
Units 1 and 2

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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. 50-311

SALEM NUCLEAR GENERATING STATION, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 133
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 June 11, 1993 and supplemented by letters dated July 19, August 3, and September 16, 1993, 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. 133 , are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications.

3. This license amendment is effective as of its date of issuance and shall be implemented prior to restart from the eighth refueling outage, currently scheduled to end on December 13, 1994.

FOR THE NUCLEAR REGULATORY COMMISSION

Charles L. Miller

Charles L. Miller, Director
Project Directorate I-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: July 20, 1994

ATTACHMENT TO LICENSE AMENDMENT NO. 133

FACILITY OPERATING LICENSE NO. DPR-75

DOCKET NO. 50-311

Revise Appendix A as follows:

Remove Pages	Insert Pages
3/4 1-1	3/4 1-1
3/4 1-3	3/4 1-3
3/4 1-7	3/4 1-7
3/4 1-8	3/4 1-8
3/4 1-11	3/4 1-11
3/4 1-12	3/4 1-12
-	3/4 1-12a
3/4 9-1	3/4 9-1
3/4 10-1	3/4 10-1
B 3/4 1-3	B 3/4 1-3
B 3/4 1-4	B 3/4 1-4
-	B 3/4 1-5

3/4.1 REACTIVITY CONTROL SYSTEMS

3/4.1.1 BORATION CONTROL

SHUTDOWN MARGIN - T_{avg} > 200°F

LIMITING CONDITION FOR OPERATION

3.1.1.1 The SHUTDOWN MARGIN shall be greater than or equal to 1.6% delta k/k.

APPLICABILITY: MODES 1, 2*, 3, and 4.

ACTION:

With the SHUTDOWN MARGIN less than 1.6% delta k/k, immediately initiate and continue boration at ≥ 33 gpm of a solution containing ≥ 6,560 ppm boron or equivalent until the required SHUTDOWN MARGIN is restored.

SURVEILLANCE REQUIREMENTS

4.1.1.1.1 The SHUTDOWN MARGIN shall be determined to be greater than or equal to 1.6% delta k/k:

a. Within 1 hour after detection of an inoperable control rod(s) and at least once per 12 hours thereafter while the rod(s) is inoperable. If the inoperable control rod is immovable or untrippable, the above required SHUTDOWN MARGIN shall be increased by an amount at least equal to the withdrawn worth of the immovable or untrippable control rod(s).

b. When in MODE 1 or MODE 2 with K_{eff} greater than or equal to 1.0, at least once per 12 hours by verifying that control bank withdrawal is within the limits of Specification 3.1.3.5.

c. When in MODE 2 with K_{eff} less than 1.0, within 4 hours prior to achieving reactor criticality by verifying that the predicted critical control rod position is within the limits of Specification 3.1.3.5.

*See Special Test Exception 3.10.1

SHUTDOWN MARGIN - T_{avg} ≤ 200°F

LIMITING CONDITION FOR OPERATION

3.1.1.2 The SHUTDOWN MARGIN shall be greater than or equal to 1.0% delta k/k.

APPLICABILITY: MODE 5.

ACTION:

With the SHUTDOWN MARGIN less than 1.0% delta k/k, immediately initiate and continue boration at ≥ 33 gpm of a solution containing ≥ 6,560 ppm boron or equivalent until the required SHUTDOWN MARGIN is restored.

SURVEILLANCE REQUIREMENTS

4.1.1.2 The SHUTDOWN MARGIN shall be determined to be greater than or equal to 1.0% delta k/k:

a. Within 1 hour after detection of an inoperable control rod(s) and at least once per 12 hours thereafter while the rod(s) is inoperable. If the inoperable control rod is immovable or untrippable, the SHUTDOWN MARGIN shall be increased by an amount at least equal to the withdrawn worth of the immovable or untrippable control rod(s).

b. At least once per 24 hours by consideration of the following factors:

   1. Reactor coolant system boron concentration,

   2. Control rod position,

   3. Reactor coolant system average temperature,

   4. Fuel burnup based on gross thermal energy generation,

   5. Xenon concentration, and

   6. Samarium concentration.

3/4.1.2 BORATION SYSTEMS

FLOW PATHS - SHUTDOWN

LIMITING CONDITION FOR OPERATION

3.1.2.1 As a minimum, one of the following boron injection flow paths shall be OPERABLE:

a. A flow path from the boric acid tanks via a boric acid transfer pump and charging pump to the Reactor Coolant System if the boric acid storage tank in Specification 3.1.2.5a is OPERABLE, or

b. The flow path from the refueling water storage tank via a charging pump to the Reactor Coolant System if the refueling water storage tank in Specification 3.1.2.5b is OPERABLE.

APPLICABILITY: MODES 5 and 6.

ACTION:

With none of the above flow paths OPERABLE, suspend all operations involving CORE ALTERATIONS or positive reactivity changes until at least one injection path is restored to OPERABLE status.

SURVEILLANCE REQUIREMENTS

4.1.2.1 At least one of the above required flow paths shall be demonstrated OPERABLE:

a. When the boric acid tank is a required water source, by verifying at least once per 7 days that:

(1) The flow path from the boric acid tank to the boric acid transfer pump, the boric acid transfer pump, and the recirculation path from the boric acid transfer pump to the boric acid tank is $\geq$ 63°F, and

(2) The flow path between the boric acid transfer pump recirculation line to the charging pump suction line is $\geq$ 50°F,

b. At least once per 31 days by verifying that each valve (manual, power operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

FLOW PATHS - OPERATING

LIMITING CONDITION FOR OPERATION

3.1.2.2 At least two of the following three boron injection flow paths shall be OPERABLE:

a. The flow path from the boric acid tanks via a boric acid transfer pump and a charging pump to the Reactor Coolant System.

b. Two flow paths from the refueling water storage tank via charging pumps to the Reactor Coolant System.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

With only one of the above required boron injection flow paths to the Reactor Coolant System OPERABLE, restore at least two boron injection flow paths to the Reactor Coolant System to OPERABLE status within 72 hours or be in at least HOT STANDBY and borated to a SHUTDOWN MARGIN equivalent to at least 1% delta k/k at 200°F within the next 6 hours; restore at least two flow paths to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

SURVEILLANCE REQUIREMENTS

4.1.2.2 Each of the above required flow paths shall be demonstrated OPERABLE:

a. By verifying at least once per 7 days that:

(1) The flow path from the boric acid tank to the boric acid transfer pump and from the recirculation line back to the boric acid tank is $\geq$ 63°F, and

(2) The flow path between the boric acid tank recirculation line to the charging pump suction line is $\geq$ 50°F,

b. At least once per 31 days by verifying that each valve (manual, power operated or automatic) in the flow path that is not locked, sealed, or otherwise secured in position, is in its correct position.

c. At least once per 18 months during shutdown by verifying that each automatic valve in the flow path actuates to its correct position on a safety injection test signal.

d. At least once per 18 months by verifying that the flow path required by Specification 3.1.2.2.a delivers at least 33 gpm to the Reactor Coolant System.

BORATED WATER SOURCES - SHUTDOWN

LIMITING CONDITION FOR OPERATION

3.1.2.5 As a minimum, one of the following borated water sources shall be OPERABLE:

a. A boric acid storage system with:

1. A minimum contained volume of 2,600 gallons,
2. Between 6,560 and 6,990 ppm of boron, and
3. A minimum solution temperature of 63°F.

b. The refueling water storage tank with:

1. A minimum contained volume of 37,000 gallons,
2. A minimum boron concentration of 2,300 ppm, and
3. A minimum solution temperature of 35°F.

APPLICABILITY: MODES 5 and 6.

ACTION:

With no borated water source OPERABLE, suspend all operations involving CORE ALTERATIONS or positive reactivity changes until at least one borated water source is restored to OPERABLE status.

SURVEILLANCE REQUIREMENTS

4.1.2.5 The above required borated water source shall be demonstrated OPERABLE:

a. For the boric acid storage system, when it is the source of borated water at least once per 7 days by:

1. Verifying the boron concentration of the water,
2. Verifying the water level of the tank, and
3. Verifying the boric acid storage tank solution temperature when it is the source of borated water.

b. For the refueling water storage tank by:

1. Verifying the boron concentration at least once per 7 days,
2. Verifying the borated water volume at least once per 7 days, and
3. Verifying the solution temperature at least once per 24 hours, when it is the source of borated water and the outside air temperature is less than 35°F.

BORATED WATER SOURCES - OPERATING

LIMITING CONDITION FOR OPERATION

3.1.2.6 As a minimum, the following borated water source(s) shall be OPERABLE as required by Specification 3.1.2.2:

a. A boric acid storage system with:
   1. A contained volume of borated water in accordance with figure 3.1-2,
   2. A Boron concentration in accordance with Figure 3.1-2, and
   3. A minimum solution temperature of 63°F.

b. The refueling water storage tank with:
   1. A contained volume of between 364,500 and 400,000 gallons of water,
   2. A boron concentration of between 2,300 and 2,500 ppm, and
   3. A minimum solution temperature of 35°F.

APPLICABILITY: MODES 1, 2, 3 and 4.

ACTION:

a. With the boric acid storage system inoperable and being used as one of the above required borated water sources, restore the storage system to OPERABLE status within 72 hours or be in at least HOT STANDBY within the next 6 hours and borated to a SHUTDOWN MARGIN equivalent to at least 1% delta k/k at 200°F; restore the boric acid storage system to OPERABLE status within the next 7 days or be in COLD SHUTDOWN within the next 30 hours.

b. With the refueling water storage tank inoperable, restore the tank to OPERABLE status within one hour or be in at least HOT STANDBY within the next 6 hours and in COLD SHUTDOWN within the following 30 hours.

SURVEILLANCE REQUIREMENTS

4.1.2.6 Each borated water source shall be demonstrated OPERABLE:

a. For the boric acid storage system, when it is the source of borated water at least once per 7 days by:
   1. Verifying the boron concentration in each water source.
   2. Verifying the water level of each water source, and
   3. Verifying the boric acid storage system solution temperature.

b. For the refueling water storage tank by:
   1. Verifying the boron concentration at least once per 7 days,
   2. Verifying the borated water volume at least once per 7 days, and
   3. Verifying the solution temperature at least once per 24 hour when the outside air temperature is less than 35°F.

BORIC ACID TANK CONTENTS

BASED ON RWST CONCENTRATION

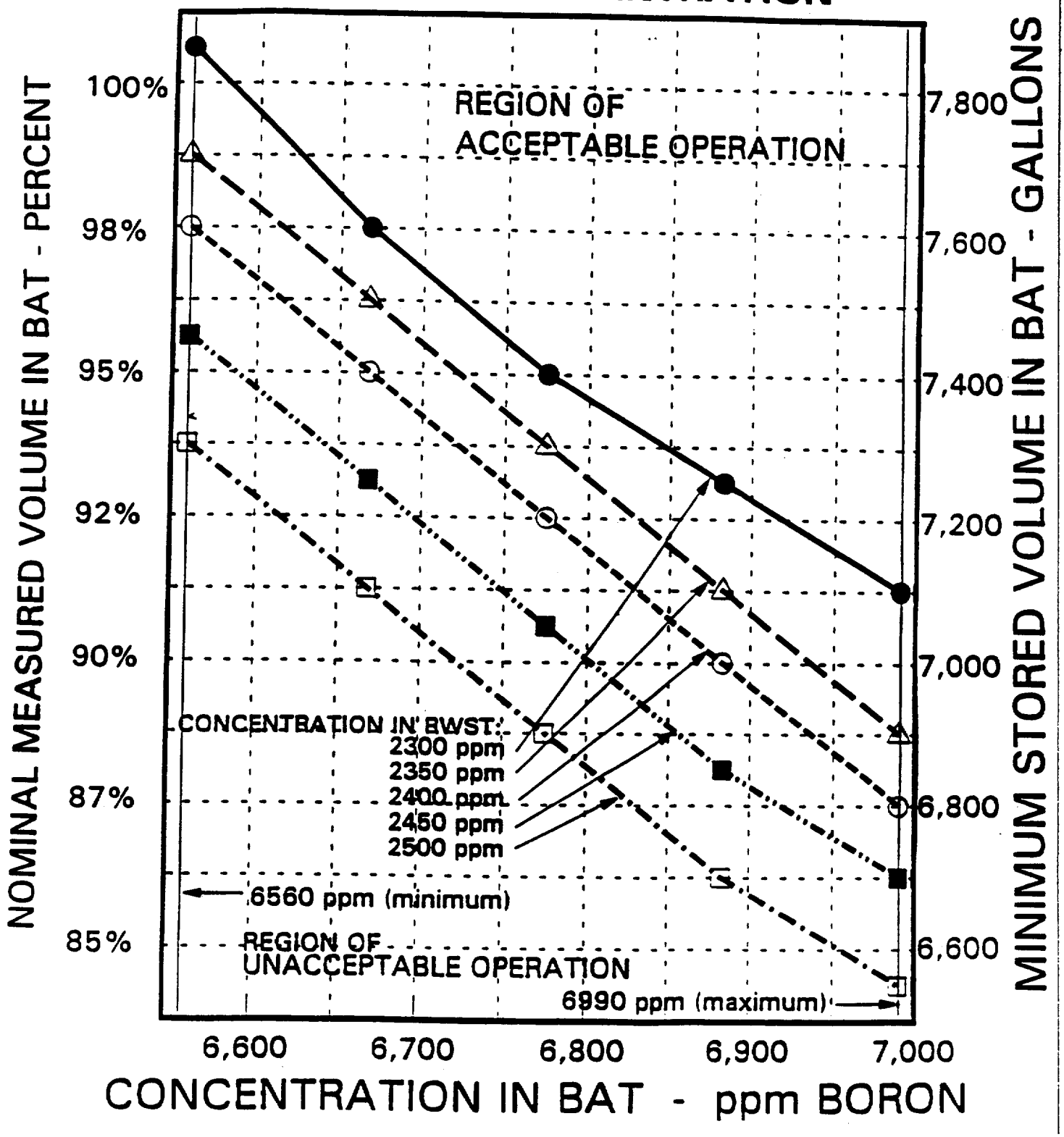

Figure 3.1-2

3/4.9 REFUELING OPERATIONS

3/4.9.1 BORON CONCENTRATION

LIMITING CONDITION FOR OPERATION

3.9.1 With the reactor vessel head closure bolts less than fully tensioned or with the head removed, the boron concentration of all filled portions of the Reactor Coolant System and the refueling canal shall be maintained uniform and sufficient to ensure that the more restrictive of the following reactivity conditions is met:

a. Either a K_{eff} of 0.95 or less, which includes a 1% $\Delta k/k$ conservative allowance for uncertainties, or

b. A boron concentration of greater than or equal to 2000 ppm, which includes a 50 ppm conservative allowance for uncertainties.

APPLICABILITY: MODE 6*

ACTION:

With the requirements of the above specification not satisfied, immediately suspend all operations involving CORE ALTERATIONS or positive reactivity changes and initiate and continue boration at ≥ 33 gpm of a solution containing ≥ 6,560 ppm boron or its equivalent until K_{eff} is reduced to less than or equal to 0.95 or the boron concentration is restored to greater than or equal to 2000 ppm, whichever is the more restrictive. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.9.1.1 The more restrictive of the above two reactivity conditions shall be determined prior to:

a. Removing or unbolting the reactor vessel head, and

b. Withdrawal of any full length control rod in excess of 3 feet from its fully inserted position.

4.9.1.2 The boron concentration of the reactor coolant system and the refueling canal shall be determined by chemical analysis at least once per 72 hours.

* The reactor shall be maintained in MODE 6 whenever fuel is in the reactor with the reactor vessel head closure bolts less than fully tensioned or with the head removed.

3/4.10 SPECIAL TEST EXCEPTIONS

SHUTDOWN MARGIN

LIMITING CONDITION FOR OPERATION

3.10.1 The SHUTDOWN MARGIN requirement of Specification 3.1.1.1 may be suspended for measurement of control rod worth and shutdown margin provided the reactivity equivalent to at least the highest estimated control rod worth is available for trip insertion from OPERABLE control rod(s).

APPLICABILITY: MODE 2.

ACTION:

a. With any full length control rod not fully inserted and with less than the above reactivity equivalent available for trip insertion, immediately initiate and continue boration at ≥ 33 gpm of a solution containing ≥ 6,560 ppm boron or its equivalent until the SHUTDOWN MARGIN required by Specification 3.1.1.1 is restored.

b. With all full length control rods inserted and the reactor subcritical by less than the above reactivity equivalent, immediately initiate and continue boration at ≥ 33 gpm of a solution containing ≥ 6,560 ppm boron or its equivalent until the SHUTDOWN MARGIN required by Specification 3.1.1.1 is restored.

SURVEILLANCE REQUIREMENTS

4.10.1.1 The position of each full length rod either partially or FULLY WITHDRAWN shall be determined at least once per 2 hours.

4.10.1.2 Each full length rod not fully inserted shall be demonstrated capable of full insertion when tripped from at least the 50% withdrawn position within 24 hours prior to reducing the SHUTDOWN MARGIN to less than the limits of Specification 3.1.1.1.

3/4.1.2 BORATION SYSTEMS

The boron injection system ensures that negative reactivity control is available during each mode of facility operation. The components required to perform this function include: 1) borated water sources, 2) charging pumps, 3) separate flow paths, 4) boric acid transfer pumps, and 5) an emergency power supply from OPERABLE diesel generators.

With the RCS average temperature above 200°F, a minimum of two boron injection flow paths are required to ensure single functional capability in the event an assumed failure renders one of the flow paths inoperable. The boration capability of either flow path is sufficient to provide a SHUTDOWN MARGIN from expected operating conditions of 1.6% delta k/k after xenon decay and cooldown to 200°F. The maximum expected boration capability (minimum boration volume) requirement is established to conservatively bound expected operating conditions throughout core operating life. The analysis assumes that the most reactive control rod is not inserted into the core. The maximum expected boration capability requirement occurs at EOL from full power equilibrium xenon conditions and requires borated water from a boric acid tank in accordance with TS Figure 3.1-2, and additional makeup from either: (1) the second boric acid tank and/or batching, or (2) a maximum of 41,800 gallons of 2,300 ppm borated water from the refueling water storage tank. With the refueling water storage tank as the only borated water source, a maximum of 73,800 gallons of 2,300 ppm borated water is required. However, to be consistent with the ECCS requirements, the RWST is required to have a minimum contained volume of 350,000 gallons during operations in MODES 1, 2, 3 and 4.

The boric acid tanks, pumps, valves, and piping contain a boric acid solution concentration of between 3.75% and 4% by weight. To ensure that the boric acid remains in solution, the tank fluid temperature and the process pipe wall temperatures are monitored to ensure a temperature of 63°F, or above is maintained. The tank fluid and pipe wall temperatures are monitored in the main control room. A 5°F margin is provided to ensure the boron will not precipitate out.

Should ambient temperature decrease below 63°F, the boric acid tank heaters, in conjunction with boric acid pump recirculation, are capable of maintaining the boric acid in the tank and in the pump at or about 63°F. A small amount of boric acid in the flowpath between the boric acid recirculation line and the suction line to the charging pump will precipitate out, but it will not cause flow blockage even with temperatures below 50°F.

With the RCS temperature below 200°F, one injection system is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the additional restrictions prohibiting CORE OPERATIONS and positive reactivity change in the event the single injection system becomes inoperable.

The boron capability required below 200°F is sufficient to provide a SHUTDOWN MARGIN of 1% delta k/k after xenon decay and cooldown from 200°F to 140°F. This condition requires either 2,600 gallons of 6,560 ppm borated water from the boric acid storage tanks or 7,100 gallons of 2,300 ppm borated water from the refueling water storage tank.

The 37,000 gallons limit in the refueling water storage tank for Modes 5 and 6 is based upon 21,210 gallons that is undetectable due to lower tap location, 8,550 gallons for instrument error, 7,100 gallons required for shutdown margin, and an additional 140 gallons due to rounding up.

The limits on contained water volume and boron concentration of the RWST also ensure a pH value of between 8.5 and 11.0 for the solution recirculated within containment after a LOCA. This pH band minimizes the evolution of iodine and minimizes the effect of chloride and caustic stress corrosion on mechanical systems and components. The contained water volume limits include allowance for water not available because of discharge line location and other physical characteristics.

The OPERABILITY of one boron injection system during REFUELING ensures that this system is available for reactivity control while in MODE 6.

3/4.1.3 MOVABLE CONTROL ASSEMBLIES

The specifications of this section ensure that (1) acceptable power distribution limits are maintained, (2) the minimum SHUTDOWN MARGIN is maintained, and (3) limit the potential effects of rod mis-alignment on associated accident analyses. OPERABILITY of the control rod position indicators is required to determine control rod positions and thereby ensure compliance with the control rod alignment and insertion limits. OPERABLE condition for the analog rod position indicators is defined as being capable of indicating rod position to within ± 12 steps of the bank demand position for a range of positions. For the Shutdown Banks, and Control Bank A this range is defined as the group demand counter indicated position between 0 and 30 steps withdrawn inclusive, and between 200 and 228 steps withdrawn inclusive. This permits the operator to verify that the control rods in these banks are either fully withdrawn or fully inserted, the normal operating modes for these banks. Knowledge of these banks positions in these ranges satisfies all accident analysis assumptions concerning their position. The range for control Bank B is defined as the group demand counter indicated position between 0 and 30 steps withdrawn inclusive, and between 160 and 228 steps withdrawn inclusive. For Control Banks C and D the range is defined as the group demand counter indicated position between 0 and 228 steps withdrawn. Comparison of the group demand counters to the bank insertion limits with verification of rod position with the analog rod position indicators (after thermal soak after rod motion) is sufficient verification that the control rods are above the insertion limits. The full out position will be specifically established for each cycle by the Reload Safety Analysis for that cycle. This position will be within the band established by "FULL WITHDRAWN" and will be administratively controlled. This band is allowable to minimize RCCA wear, pursuant to Information Notice 87-19.

The ACTION statements which permit limited variation from the basic requirements are accompanied by additional restrictions which ensure that the original criteria are met. Mis-alignment of a rod requires measurement of peaking factors or a restriction in THERMAL POWER; either of these restrictions provide assurance of fuel rod integrity during continued operation. The reactivity worth of a mis-aligned rod is limited for the remainder of the fuel cycle to prevent exceeding the assumption used in the accident analysis.

The maximum rod drop time restriction is consistent with the assumed rod drop time used in the accident analyses. Measurement with T_{avg} >541°F and with all reactor coolant pumps operating ensures that the measured drop times will be representative of insertion times experienced during a reactor trip at operating conditions.

Control rod positions and OPERABILITY of the rod position indicators are required to be verified on a nominal basis of once per 12 hours with more frequent verifications required if an automatic monitoring channel is inoperable. These verification frequencies are adequate for assuring that the applicable LCO's are satisfied.

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 133 TO FACILITY OPERATING

LICENSE NO. DPR-75

PUBLIC SERVICE ELECTRIC & GAS COMPANY

PHILADELPHIA ELECTRIC COMPANY

DELMARVA POWER AND LIGHT COMPANY

ATLANTIC CITY ELECTRIC COMPANY

SALEM NUCLEAR GENERATING STATION, UNIT NO. 2

DOCKET NOS. 50-311

1.0 INTRODUCTION

By letter dated June 11, 1993, as supplemented July 19, 1993, August 3, 1993, and September 16, 1993, the Public Service Electric & Gas Company (the licensee) submitted a request for changes to the Salem Nuclear Generating Station, Unit No. 2 Technical Specifications (TS). The requested change would allow the concentration of boric acid in the boric acid tanks (BATs) to be reduced to the point where heat tracing for the associated piping would not be required. The August 3, 1993, and September 16, 1993, letters provided clarifying information that did not change the initial proposed no significant hazards consideration determination.

At the reduced boron concentration, the normally anticipated ambient room temperatures would be high enough to keep the boric acid from precipitating out of the fluid causing deposits to form. To show that the plant is capable of being shut down safely with the reduced boron concentration in the BATs, the licensee has submitted an ABB Combustion Engineering report entitled, "Boric Acid Concentration Reduction Effort CEN-606, Rev. 00 Technical Basis and Operational Analysis for Salem Nuclear Generating Station Units 1 and 2."

The boric acid concentration in the BATs will be reduced from approximately 12 percent by weight to between 3.75 and 4.0 percent by weight. The high temperature and high boron concentration required presently make the boric acid system less reliable and adversely affect plant availability. Significant maintenance is also required to keep the boric acid system operable. The required 12 percent by weight is based on the ability to provide the required reactor coolant system (RCS) boron concentration to obtain a 1.6% $\Delta k/k$ shutdown margin at 200°F from the BATs through a feed and bleed operation before the plant starts to cool down. The boron concentration is then kept constant during cooldown with makeup water being provided for RCS shrinkage with the temperature reduction. The BAT boron concentration necessary for this type of operation is very high.

The proposed change in shutdown methodology allows for a much lower boron concentration in the BATs. Rather than borate the primary system before cooldown, the new methodology in boration and cooldown enables the RCS to be borated while the cooldown is in progress. As the RCS contracts with the dropping temperature, borated water is added keeping the pressurizer level constant. To compensate for the lost boron in the feed and bleed operation, a much higher boron concentration is required for the present methodology. In the proposed methodology, to compensate for the lower boron content in the BAT water, the volume and the delivered flowrate are increased accordingly.

2.0 EVALUATION

2.1 Supporting Calculations

There were two sets of calculations that were carried out to support boron concentration reduction in the BATs. The first is the required boron concentration to maintain a sufficient shutdown margin throughout the cooldown process. For a series of RCS average temperatures a corresponding set of required RCS boron concentrations were calculated. The second set of calculations determines the boron delivery into the RCS through the boric acid system from the BATs and the refueling water storage tank (RWST) for a set of cooldown scenarios. The shutdown margin is maintained throughout the cooldown as long as the minimum required boron concentration is present in the core. The following is the NRC staff's evaluation of the licensee's calculation.

2.1.2 Required Boron Concentration

These calculations were performed using codes previously approved by the NRC, as discussed in the licensee's letter dated September 16, 1993. The shutdown margins required in the calculations are specified by the Salem Technical Specifications. The requirements are 1.6% $\Delta k/k$ when the reactor is above 200°F and 1.0% $\Delta k/k$ when the reactor is below 200°F. The reactivity balance included positive reactivity insertion from the plant cooldown as a result of the moderator temperature coefficient and from the xenon decaying from the core. Conservative core physics assumptions were made to bound the analysis for any point in the fuel cycle. The following assumptions were intended to maximize the boron demand:

- End-of-life (EOL) initial boron concentration in the RCS, assumed to be zero.
- EOL moderator cooldown effects.
- EOL inverse boron worth (IBW) values.
- Most negative moderator temperature coefficient of reactivity.

- Conservative (slow) cooldown rate of 10°F/hr, to allow for the greatest xenon reactivity insertion rates.

- Prior to plant shutdown the reactor has a 100% power equilibrium xenon inventory.

- Most reactive control rod stuck in the fully withdrawn position.

2.1.3 Boron Delivery to the RCS

These calculations establish the new minimum BAT boron concentration, and the new minimum required BAT and RWST volumes. These calculations are separated into two sets. The first is for the cooldown from 200°F to 135°F in Modes 5 and 6. The second is for the cooldown when RCS temperature is between 547°F and 200°F in Modes 1, 2, 3, and 4. In Modes 5 and 6, the cooldown process was calculated with boron being delivered to the RCS from the residual heat removal (RHR) pumps. Calculations were made with the pump taking suction from either the BAT or the RWST. In Modes 1, 2, 3, and 4, the charging pump suction was taken initially from the BATs and then from the RWST. Transition from the charging pumps to the RHR pumps occurs at 350°F and 350 psi in the primary system. The inventory in the RHR system is then included as part of the total mass of the system in the mass balance equations. In Modes 1, 2, 3, and 4, the borated water delivered to the core was only to replace water shrinkage due to cooldown. Conservative assumptions were utilized in the use of system volumes, boron mixing, and initial boron concentrations.

The licensee has demonstrated that there is sufficient boron present in the core at any given temperature for the given cooldown scenarios. There is also enough boron in the supplied water sources to provide enough boron to maintain the required shutdown margins as calculated earlier.

Based on the above, we find the licensee's calculation of actual boron concentration during cooldown to be acceptable and provides an adequate basis for determining the required volumes for the RWST and the BATs.

2.2 Response to Emergency Situations

2.2.1 Transient and Accident Analysis

Accidents and transients addressed in Chapter 15 of the Updated Final Safety Analysis Report (UFSAR) do not take credit for borated water delivered to the RCS from the BATS. The charging pumps are aligned to the RWST during safety injection, so reduction of the boric acid concentration in the BATs has no effect on the accident analysis covered in the FSAR.

2.2.2 Shutdown Margin Recovery

Current Technical Specifications 3.1.1, 3.1.2, 3.9.1, and 3.10.1 require RCS boration at a rate of 10 gpm to commence when the shutdown margin is lost. The new Technical Specifications with the reduced concentration in the BATs will require boration at a higher rate of 33 gpm. The increased flowrate makes up for the reduction in the injected boron concentration. Technical Surveillance Requirement 4.1.2.2 requires verification that the injected flowrate is above the current requirement of 33 gpm. We find these modifications acceptable.

2.2.3 Emergency Boration

The licensee has examined the ability to borate the core in an emergency situation given that one or more rod cluster control assemblies are not fully inserted into the core. In this event the boric acid transfer pumps are aligned directly to the suction of the charging pumps. The lower concentration of boron in the BATs requires that BAT volume be increased to be able to provide sufficient boron to the core. The licensee has adequately provided for this.

2.3 Technical Specification Changes

The planned reduction of the minimum boric acid concentration from 20,000 ppm to 6,560 ppm and the increase in delivery capacity from 10 gpm to 33 gpm require all the applicable TS and the associated Bases sections to be changed accordingly. The minimum BAT and the minimum RWST volumes for modes 5 and 6 are increased to 2600 gallons and 37000 gallons respectively. Figure 3.1-2 has been added to the TS to define the minimum BAT requirements for boron concentration and volume. Heat tracing requirements to prevent boric acid precipitation are eliminated completely from the TS.

The proposed surveillance requirements for the Technical Specifications have also been changed to reflect the new concentrations, flowrates, and volumes stated above. The requirements for heat tracing have been eliminated and the temperature in the BATs is monitored so that it will remain above 63°F rather than 145°F. The temperature in the pipe from the recirculation line to the charging pump will be monitored to assure it remains above 50°F.

In addition, TS 3/4.1.1 note (**) has been deleted. This note increased the shutdown margin requirement from 1.6% delta k/k to 1.85% delta k/k during cycle 7 of operation. Salem 2 is currently in Cycle 8 of operation and therefore, the note is not applicable. This deletion was not addressed in the licensee's submittal or supplements: however, it was discussed in a telephone conversation with the licensee and they agreed to the change. The staff has reviewed the change and finds it acceptable.

The staff has reviewed the proposed reduction in boric acid concentration, the removal of heat tracing elements from the associated piping, the resulting Technical Specification changes, and the analytical basis for the change, as described in the licensee submittal and supplements. Based on the evaluation provided, we find the proposed changes to the plant and the Technical Specification modifications acceptable.

3.0 STATE CONSULTATION

In accordance with the Commission's regulations, the New Jersey State official was notified of the proposed issuance of the amendments. The State official had no comments.

4.0 ENVIRONMENTAL CONSIDERATION

The amendments change 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 change surveillance requirements. The NRC staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration, and there has been no public comment on such finding (58 FR 43932). Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendments.

5.0 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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Date: July 20, 1994