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

APR 23 1985

Docket Nos.: 50-387
and 50-388

Mr. Norman W. Curtis
Vice President
Engineering and Construction - Nuclear
Pennsylvania Power and Light Company
2 North Ninth Street
Allentwon, Pennsylvania 18101

Dear Mr. Curtis:

SUBJECT: AMENDMENT NOS. 39 AND 10 TO FACILITY OPERATING LICENSE NO. NPF-14 AND NPF-22, SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2 RESPECTIVELY

The Nuclear Regulatory Commission has issued the enclosed Amendment Nos. 39 and 10 to Facility Operating License Nos. NPF-14 and NPF-22 for the Susquehanna Steam Electric Station, Units 1 and 2 respectively. The amendment is in response to your letter dated September 6, 1984. This amendment revises the Susquehanna Unit 1 and Unit 2 Technical Specifications to 1) add an additional rod block monitor (RBM) setpoint of 108%, creating a dual RBM setpoint to allow additional operating flexibility within the power flow map, 2) change the labels associated with Figures 3.2.2-1 and redesignate as Figure 3.2.3-1a and 3) add Figure 3.2.3-1b. In addition, this amendment revises Susquehanna Unit 1 Technical Specifications to update Figure 3.2.3-1 as a result of actual startup test data relating to recirculation pump coastdown.

A copy of the related safety evaluation supporting Amendment Nos. 39 and 10 is enclosed.

Sincerely,

A. Schwencer

A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing

Enclosures:
1. Amendment No. 39 to NPF-14
2. Amendment No. 10 to NPF-22
3. Safety Evaluation

cc w/enclosures:
See next page

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AMENDMENT NO. 39 TO FACILITY OPERATING LICENSE NO. NPF-14 AMENDMENT NO. 10 TO FACILITY OPERATING LICENSE NO. NPF-22 - SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2 RESPECTIVELY

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

PENNSYLVANIA POWER & LIGHT COMPANY
ALLEGHENY ELECTRIC COOPERATIVE, INC.
DOCKET NO. 50-387
SUSQUEHANNA STEAM ELECTRIC STATION, UNIT 1
AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 39
License No. NPF-14

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

   A. The application for the amendment filed by the Pennsylvania Power & Light Company, dated September 6, 1984, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's 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 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 the Facility Operating License No. NPF-14 is hereby amended to read as follows:

   (2) Technical Specifications and Environmental Protection Plan

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 39 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. The licensee shall operate the facilities in accordance with the Technical Specifications and the Environmental Protection Plan.

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3. This amendment is effective as of thirty (30) days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

A. Schwencer

A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing

Enclosure:
Changes to the Technical
Specifications

Date of Issuance: APR 23 1985

ENCLOSURE TO LICENSE AMENDMENT NO. 39
FACILITY OPERATING LICENSE NO. NPF-14
DOCKET NO. 50-387

Replace the following pages of the Appendix "A" Technical Specifications with the enclosed pages. The revised pages are identified by Amendment number and contain a vertical line indicating the area of change.

REMOVE	INSERT
3/4 2-5	3/4 2-5
3/4 2-6	3/4 2-6
3/4 2-7	3/4 2-7
3/4 2-8	3/4 2-8
	3/4 2-8.a
3/4 3-53	3/4 3-53
3/4 3-54	3/4 3-54
B 3/4 2-3	B 3/4 2-3
B 3/4 2-4	B 3/4 2-4
B 3/4 2-5	B 3/4 2-5

3/4.2.2 APRM SETPOINTS

LIMITING CONDITION FOR OPERATION

3.2.2 The APRM flow biased simulated thermal power-upscale scram trip setpoint (S) and flow biased neutron flux-upscale control rod block trip setpoint (S_{RB}) shall be established according to the following relationships:

Trip Setpoint	Allowable Value
$S \leq (0.58W + 59\%)T$	$S \leq (0.58W + 62\%)T$
$S_{RB} \leq (0.58W + 50\%)T$	$S_{RB} \leq (0.58W + 53\%)T$

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where: S and S_{RB} are in percent of RATED THERMAL POWER,
W = Loop recirculation flow as a percentage of the loop recirculation flow which produces a rated core flow of 100 million lbs/hr,
T = Lowest value of the ratio of FRACTION OF RATED THERMAL POWER divided by the MAXIMUM FRACTION OF LIMITING POWER DENSITY. T is always less than or equal to 1.0.

APPLICABILITY: OPERATIONAL CONDITION 1, when THERMAL POWER is greater than or equal to 25% of RATED THERMAL POWER.

ACTION:

With the APRM flow biased simulated thermal power-upscale scram trip setpoint and/or the flow biased neutron flux-upscale control rod block trip setpoint less conservative than the value shown in the Allowable Value column for S or S_{RB}, as above determined, initiate corrective action within 15 minutes and adjust S and/or S_{RB} to be consistent with the Trip Setpoint value* within 2 hours or reduce THERMAL POWER to less than 25% of RATED THERMAL POWER within the next 4 hours.

SURVEILLANCE REQUIREMENTS

4.2.2 The FRTP and the MFLPD shall be determined, the value of T calculated, and the most recent actual APRM flow biased simulated thermal power-upscale scram and flow biased neutron flux-upscale control rod block trip setpoints verified to be within the above limits or adjusted, as required:

a. At least once per 24 hours,

b. Within 12 hours after completion of a THERMAL POWER increase of at least 15% of RATED THERMAL POWER, and

c. Initially and at least once per 12 hours when the reactor is operating with MFLPD greater than or equal to FRTP.

d. The provisions of Specification 4.0.4 are not applicable.

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*With MFLPD greater than the FRTP during power ascension up to 90% of RATED THERMAL POWER, rather than adjusting the APRM setpoints, the APRM gain may be adjusted such that APRM readings are greater than or equal to 100% times MFLPD, provided that the adjusted APRM reading does not exceed 100% of RATED THERMAL POWER, the required gain adjustment increment does not exceed 10% of RATED THERMAL POWER, and a notice of the adjustment is posted on the reactor control panel.

3/4.2.3 MINIMUM CRITICAL POWER RATIO

LIMITING CONDITION FOR OPERATION

3.2.3 The MINIMUM CRITICAL POWER RATIO (MCPR) shall be equal to or greater than the MCPR limit determined from Figure 3.2.3-1a or Figure 3.2.3.1b, as applicable, times the K_f shown in Figure 3.2.3-2, provided that the end-of-cycle recirculation pump trip (EOC-RPT) system is OPERABLE per Specification 3.3.4.2 and the turbine bypass system is OPERABLE per Specification 3.7.8, with:

$$\tau = \frac{(\tau_{ave} - \tau_B)}{\tau_A - \tau_B}$$

τ_A = 0.86 seconds, control rod average scram insertion time limit to notch 39 per Specification 3.1.3.3,

$$\tau_B = 0.688 + 1.65 \left[\frac{N_1}{\sum_{i=1}^{n} N_i}\right]^{\frac{1}{2}}(0.052),$$

$$\tau_{ave} = \frac{\sum_{i=1}^{n} N_i \tau_i}{\sum_{i=1}^{n} N_i},$$

where:

n = number of surveillance tests performed to date in cycle,

N_i = number of active control rods measured in the ith surveillance tests,

τ_i = average scram time to notch 39 of all rods measured in the ith surveillance test, and

N_1 = total number of active rods measured in Specification 4.1.3.2.a.

APPLICABILITY:

OPERATIONAL CONDITION 1, when THERMAL POWER is greater than or equal to 25% of RATED THERMAL POWER.

LIMITING CONDITION FOR OPERATION (Continued)

ACTION:

a. With the end-of-cycle recirculation pump trip system inoperable per Specification 3.3.4.2, operation may continue and the provisions of Specification 3.0.4 are not applicable provided that, within 1 hour, MCPR is determined to be greater than or equal to the MCPR limit as a function of average scram time as shown in Figure 3.2.3-1a or Figure 3.2.3.1b, as applicable, EOC-RPT inoperable curve, times the K_f shown in Figure 3.2.3-2.

b. With the turbine bypass system inoperable per Specification 3.7.8, operation may continue and the provisions of Specification 3.0.4 are not applicable provided that within 1 hour, MCPR is determined to be greater than or equal to the MCPR limit as a function of average scram time as shown in Figure 3.2.3-1a or Figure 3.2.3.1b, as applicable, turbine bypass inoperable curve, times the K_f shown in Figure 3.2.3-2.

c. With MCPR less than the applicable MCPR limit determined from Figure 3.2.3-1a or Figure 3.2.3.1b, as applicable, and Figure 3.2.3-2, initiate corrective action within 15 minutes and restore MCPR to within the required limit within 2 hours or reduce THERMAL POWER to less than 25% of RATED THERMAL POWER within the next 4 hours.

SURVEILLANCE REQUIREMENTS

4.2.3 MCPR, with

a. $\tau = 1.0$ prior to performance of the initial scram time measurements for the cycle in accordance with Specification 4.1.3.2, or

b. τ as defined in Specification 3.2.3 used to determine the limit within 72 hours of the conclusion of each scram time surveillance test required by Specification 4.1.3.2,

shall be determined to be equal to or greater than the applicable MCPR limit determined from Figure 3.2.3-1a or Figure 3.2.3.1b, as applicable, and Figure 3.2.3-2:

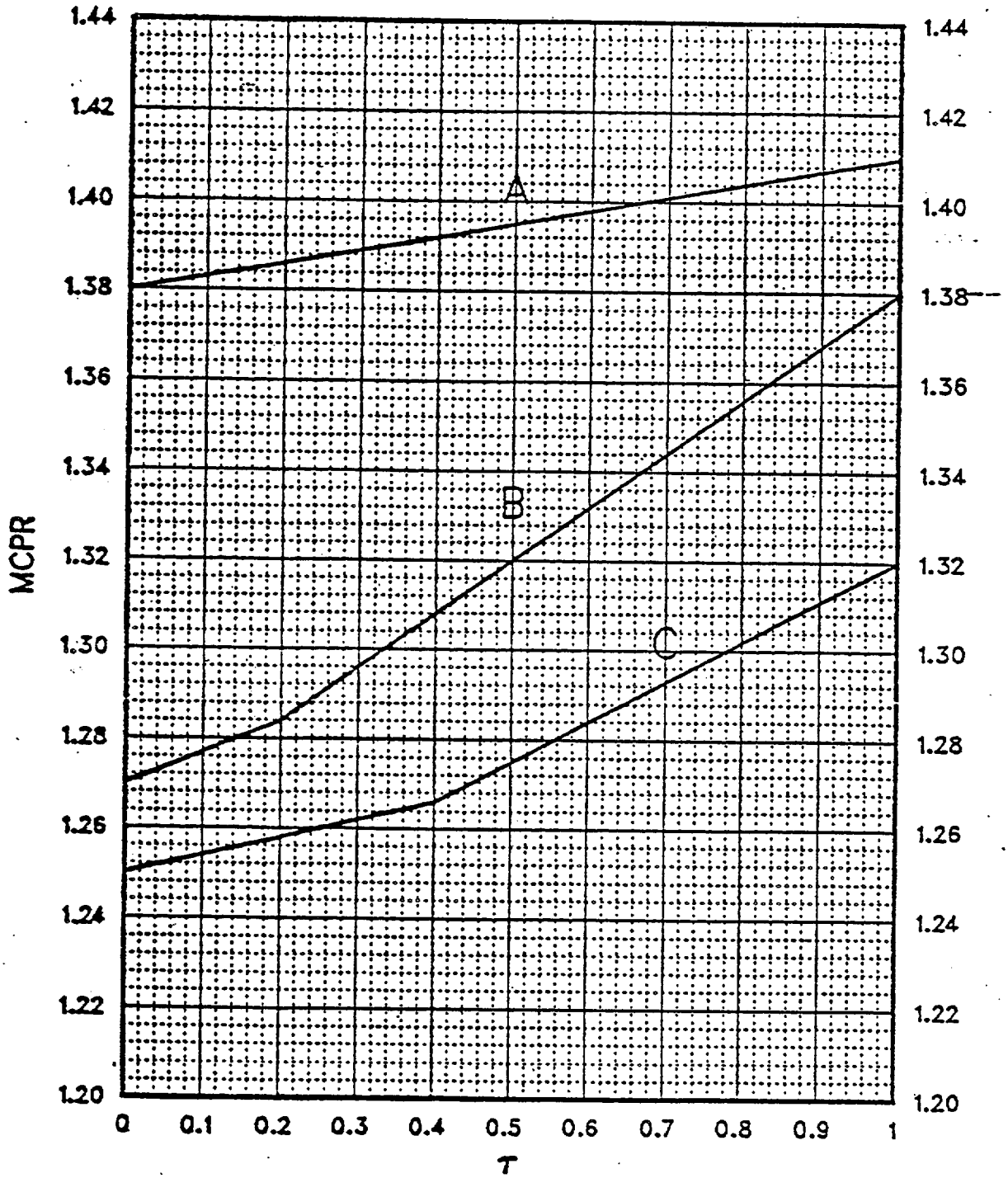
a. At least once per 24 hours,

b. Within 12 hours after completion of a THERMAL POWER increase of at least 15% of RATED THERMAL POWER, and

c. Initially and at least once per 12 hours when the reactor is operating with a LIMITING CONTROL ROD PATTERN FOR MCPR.

d. The provisions of Specification 4.0.4 are not applicable.

MINIMUM CRITICAL POWER RATIO (MCPR) VERSUS τ AT RATED FLOW*

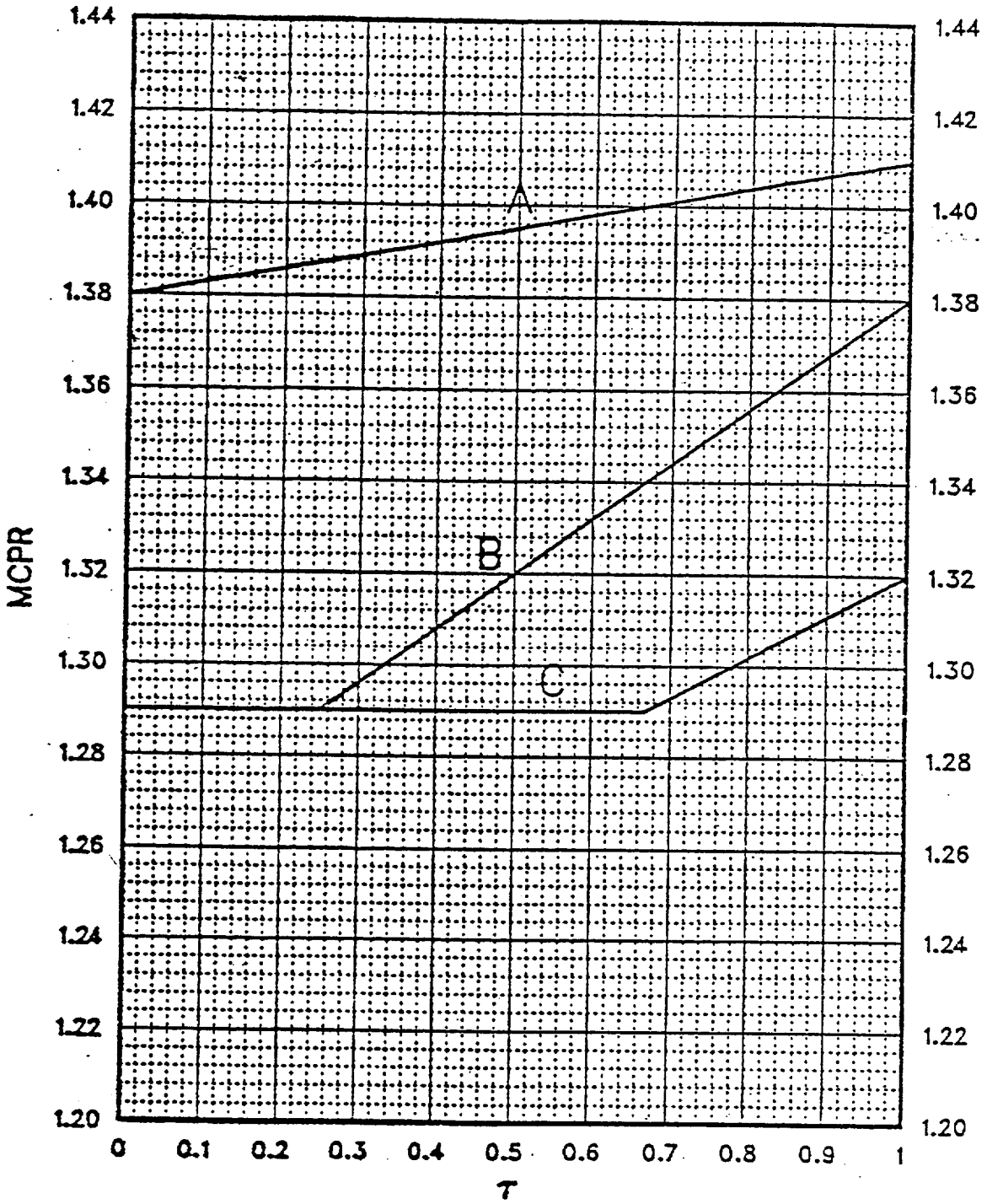


Curve A: Main Turbine Bypass Inoperable; EOC – RPT Operable
Curve B: EOC – RPT Inoperable; Main Turbine Bypass Operable
Curve C: EOC–RPT and Main Turbine Bypass Operable

* RBM AT 106% PER TABLE 3.3.6–2

FIGURE 3.2.3–1a

MINIMUM CRITICAL POWER RATIO (MCPR) VERSUS τ AT RATED FLOW*



Curve A: Main Turbine Bypass Inoperable; EOC – RPT Operable
Curve B: EOC – RPT Inoperable; Main Turbine Bypass Operable
Curve C: EOC – RPT and Main Turbine Bypass Operable

* RBM AT 108% PER TABLE 3.3.6–2

FIGURE 3.2.3–1b

TABLE 3.3.6-1 (Continued)

CONTROL ROD BLOCK INSTRUMENTATION

ACTION

ACTION 60 - Declare the RBM inoperable and take the ACTION required by Specification 3.1.4.3.

ACTION 61 - With the number of OPERABLE Channels:

a. One less than required by the Minimum OPERABLE Channels per Trip Function requirement, restore the inoperable channel to OPERABLE status within 7 days or place the inoperable channel in the tripped condition within the next hour.

b. Two or more less than required by the Minimum OPERABLE Channels per Trip Function requirement, place at least one inoperable channel in the tripped condition within 1 hour.

ACTION 62 - With the number of OPERABLE channels less than required by the Minimum OPERABLE Channels per Trip Function requirement, place the inoperable channel in the tripped condition within 1 hour.

NOTES

* With THERMAL POWER ≥ 30% of RATED THERMAL POWER.

** With more than one control rod withdrawn. Not applicable to control rods removed per Specification 3.9.10.1 or 3.9.10.2.

a. The RBM shall be automatically bypassed when a peripheral control rod is selected or the reference APRM channel indicates less than 30% of RATED THERMAL POWER.

b. This function shall be automatically bypassed if detector count rate is ≥ 100 cps or the IRM channels are on range 3 or higher.

c. This function is automatically bypassed when the associated IRM channels are on range 8 or higher.

d. This function is automatically bypassed when the IRM channels are on range 3 or higher.

e. This function is automatically bypassed when the IRM channels are on range 1.

TABLE 3.3.6-2

CONTROL ROD BLOCK INSTRUMENTATION SETPOINTS

TRIP FUNCTION	TRIP SETPOINT	ALLOWABLE VALUE
1. ROD BLOCK MONITOR		
a. Upscale	≤ 0.66 W + 40%	≤ 0.66 W + 43%
1) 106%	≤ 0.66 W + 42%	≤ 0.66 W + 45%
2) 108%#		
b. Inoperative	NA	NA
c. Downscale	≥ 5/125 divisions of full scale	≥ 3/125 of divisions full scale
2. APRM		
a. Flow Biased Neutron Flux - Upscale	≤ 0.58 W + 50%*	≤ 0.58 W + 53%*
b. Inoperative	NA	NA
c. Downscale	≥ 5% of RATED THERMAL POWER	≥ 3% of RATED THERMAL POWER
d. Neutron Flux - Upscale Startup	≤ 12% of RATED THERMAL POWER	≤ 14% of RATED THERMAL POWER
3. SOURCE RANGE MONITORS		
a. Detector not full in	NA	NA
b. Upscale	≤ 2×10^5 cps	≤ 4×10^5 cps
c. Inoperative	NA	NA
d. Downscale	≥ 0.7 cps**	≥ 0.5 cps**
4. INTERMEDIATE RANGE MONITORS		
a. Detector not full in	NA	NA
b. Upscale	≤ 108/125 divisions of full scale	≤ 110/125 divisions of full scale
c. Inoperative	NA	NA
d. Downscale	≥ 5/125 divisions of full scale	≥ 3/125 divisions of full scale
5. SCRAM DISCHARGE VOLUME		
a. Water Level - High	≤ 44 gallons	≤ 44 gallons
6. REACTOR COOLANT SYSTEM RECIRCULATION FLOW		
a. Upscale	≤ 108/125 divisions of full scale	≤ 111/125 divisions of full scale
b. Inoperative	NA	NA
c. Comparator	≤ 10% flow deviation	≤ 11% flow deviation

*The Average Power Range Monitor rod block function is varied as a function of recirculation loop flow (W). The trip setting of this function must be maintained in accordance with Specification 3.2.2.

**Provided signal-to-noise ratio is >2. Otherwise, 3cps as trip setpoint and 2.8cps for allowable value.

#May be used when the associated MCPR requirements in Specification 3.2.3 are satisfied.

Bases Table B 3.2.1-1

SIGNIFICANT INPUT PARAMETERS TO THE LOSS-OF-COOLANT ACCIDENT ANALYSIS

Plant Parameters;

Core THERMAL POWER ..... 3439 Mwt* which corresponds to 105% of rated steam flow

Vessel Steam Output ..... 14.15×10^6 lbm/hr which corresponds to 105% of rated steam flow

Vessel Steam Dome Pressure..... 1055 psia

Design Basis Recirculation Line
- Break Area for:
  a. Large Breaks 4.153 ft^2
  b. Small Breaks 1.0 ft^2 to 0.02 ft^2

Fuel Parameters:

FUEL TYPE	FUEL BUNDLE GEOMETRY	PEAK TECHNICAL SPECIFICATION LINEAR HEAT GENERATION RATE (kw/ft)	DESIGN AXIAL PEAKING FACTOR	INITIAL MINIMUM CRITICAL POWER RATIO
Initial Core	8 x 8	13.4	1.4	1.18

A more detailed listing of input of each model and its source is presented in Section II of Reference 1 and Section 6.3 of the FSAR.

*This power level meets the Appendix requirement of 102%. The core heatup calculation assumes a bundle power consistent with operation of the highest powered rod at 102% of its Technical Specification LINEAR HEAT GENERATION RATE limit.

3/4.2.3 MINIMUM CRITICAL POWER RATIO

The required operating limit MCPRs at steady state operating conditions as specified in Specification 3.2.3 are derived from the established fuel cladding integrity Safety Limit MCPR of 1.06, and an analysis of abnormal operational transients. For any abnormal operating transient analysis evaluation with the initial condition of the reactor being at the steady state operating limit, it is required that the resulting MCPR does not decrease below the Safety Limit MCPR at any time during the transient assuming instrument trip setting given in Specification 2.2.

To assure that the fuel cladding integrity Safety Limit is not exceeded during any anticipated abnormal operational transient, the most limiting transients have been analyzed to determine which result in the largest reduction in CRITICAL POWER RATIO (CPR). The type of transients evaluated were loss of flow, increase in pressure and power, positive reactivity insertion, and coolant temperature decrease. The limiting transient yields the largest delta MCPR. When added to the Safety Limit MCPR of 1.06, the required minimum operating limit MCPR of Specification 3.2.3 is obtained and presented in Figure 3.2.3-1a and 3.2.3-1b.

When the less operationally limiting Rod Block Monitoring trip setpoint (.66W + 42% from Table 3.3.6-2) is used, the more limiting MCPR curve Figure 3.2.3-1b is applicable due to a larger delta MCPR from the limiting Rod Withdrawal Error (RWE) transient. Figure 3.2.3-1a is applicable when the Rod Block Monitor trip setpoint (.66W + 40% from TAble 3.3.6-2) is used.

The evaluation of a given transient begins with the system initial parameters shown in FSAR Table 15.0-2 that are input to a GE-core dynamic behavior transient computer program. The code used to evaluate pressurization events is described in NEDO-24154[3] and the program used in nonpressurization events is described in NEDO-10802[2]. The outputs of this program along with the initial MCPR form the input for further analyses of the thermally limiting bundle with the single channel transient thermal hydraulic TASC code described in NEDE-25149[4]. The principal result of this evaluation is the reduction in MCPR caused by the transient.

The purpose of the K_f factor of Figure 3.2.3-2 is to define operating limits at other than rated core flow conditions. At less than 100% of rated flow the required MCPR is the product of the MCPR and the K_f factor. The K_f factors assure that the Safety Limit MCPR will not be violated during a flow increase transient resulting from a motor-generator speed control failure. The K_f factors may be applied to both manual and automatic flow control modes.

The K_f factor values shown in Figure 3.2.3-2 were developed generically and are applicable to all BWR/2, BWR/3 and BWR/4 reactors. The K_f factors were derived using the flow control line corresponding to RATED THERMAL POWER at rated core flow.

For the manual flow control mode, the K_f factors were calculated such that for the maximum flow rate, as limited by the pump scoop tube set point and the corresponding THERMAL POWER along the rated flow control line, the limiting

MINIMUM CRITICAL POWER-RATIO (Continued)

bundle's relative power was adjusted until the MCPR changes with different core flows. The ratio of the MCPR calculated at a given point of core flow, divided by the operating limit MCPR, determines the K_f.

For operation in the automatic flow control mode, the same procedure was employed except the initial power distribution was established such that the MCPR was equal to the operating limit MCPR at RATED THERMAL POWER and rated flow.

The K_f factors shown in Figure 3.2.3-2 are conservative for the General Electric Plant operation because the operating limit MCPRs of Specification 3.2.3 are greater than the original 1.20 operating limit MCPR used for the generic derivation of K_f.

At THERMAL POWER levels less than or equal to 25% of RATED THERMAL POWER, the reactor will be operating at minimum recirculation pump speed and the moderator void content will be very small. For all designated control rod patterns which may be employed at this point, operating plant experience indicates that the resulting MCPR value is in excess of requirements by a considerable margin. During initial start-up testing of the plant, a MCPR evaluation will be made at 25% of RATED THERMAL POWER level with minimum recirculation pump speed. The MCPR margin will thus be demonstrated such that future MCPR evaluation below this power level will be shown to be unnecessary. The daily requirement for calculating MCPR when THERMAL POWER is greater than or equal to 25% of RATED THERMAL POWER is sufficient since power distribution shifts are very slow when there have not been significant power or control rod changes. The requirement for calculating MCPR when a limiting control rod pattern is approached ensures that MCPR will be known following a change in THERMAL POWER or power shape, regardless of magnitude, that could place operation at a thermal limit.

3/4.2.4 LINEAR HEAT GENERATION RATE

This specification assures that the Linear Heat Generation Rate (LHGR) in any rod is less than the design linear heat generation even if fuel pellet densification is postulated.

References:

1. General Electric Company Analytical Model for Loss-of-Coolant Analysis in Accordance with 10 CFR 50, Appendix K, NEDE-20566, November 1975.
2. R. B. Linford, Analytical Methods of Plant Transient Evaluations for the GE BWR, February 1973 (NEDO-10802).
3. Qualification of the One Dimensional Core Transient Model For Boiling Water Reactor, NEDO-24154, October 1978.
4. TASC 01-A Computer Program For the Transient Analysis of a Single Channel, Technical Description, NEDE-25149, January 1980.

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

PENNSYLVANIA POWER & LIGHT COMPANY
ALLEGHENY ELECTRIC COOPERATIVE, INC.
DOCKET NO. 50-388
SUSQUEHANNA STEAM ELECTRIC STATION, UNIT 2
AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 10
License No. NPF-22

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

   A. The application for the amendment filed by the Pennsylvania Power and Light Company, dated September 6, 1984, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's 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 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 the Facility Operating License No. NPF-22 hereby amended to read as follows:

   (2) Technical Specifications and Environmental Protection Plan

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 10 , and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This amendment is effective as of thirty (30) days from the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

A. Schwencer

A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing

Enclosure:
Changes to the Technical
Specifications

Date of Issuance: APR 23 1985

ENCLOSURE TO LICENSE AMENDMENT NO. 10
FACILITY OPERATING LICENSE NO. NPF-22
DOCKET NO. 50-388

Replace the following pages of the Appendix "A" Technical Specifications with the enclosed pages. The revised pages are identified by Amendment number and contain a vertical line indicating the area of change.

REMOVE	INSERT
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3/4 2-8	3/4 2-8
	3/4 2-8.a
3/4 3-53	3/4 3-53
3/4 3-54	3/4 3-54
B 3/4 2-3	B 3/4 2-3
B 3/4 2-4	B 3/4 2-4
B 3/4 2-5	B 3/4 2-5

3/4.2.2 APRM SETPOINTS

LIMITING CONDITION FOR OPERATION

3.2.2 The APRM flow biased simulated thermal power-upscale scram trip setpoint (S) and flow biased neutron flux-upscale control rod block trip setpoint (S_{RB}) shall be established according to the following relationships:

Trip Setpoint	Allowable Value
$S \leq (0.58W + 59\%)T$	$S \leq (0.58W + 62\%)T$
$S_{RB} \leq (0.58W + 50\%)T$	$S_{RB} \leq (0.58W + 53\%)T$

where: S and S_{RB} are in percent of RATED THERMAL POWER,
W = Loop recirculation flow as a percentage of the loop recirculation flow which produces a rated core flow of 100 million lbs/hr,
T = Lowest value of the ratio of FRACTION OF RATED THERMAL POWER divided by the MAXIMUM FRACTION OF LIMITING POWER DENSITY. T is always less than or equal to 1.0.

APPLICABILITY: OPERATIONAL CONDITION 1, when THERMAL POWER is greater than or equal to 25% of RATED THERMAL POWER.

ACTION:

With the APRM flow biased simulated thermal power-upscale scram trip setpoint and/or the flow biased neutron flux-upscale control rod block trip setpoint less conservative than the value shown in the Allowable Value column for S or S_{RB}, as above determined, initiate corrective action within 15 minutes and adjust S and/or S_{RB} to be consistent with the Trip Setpoint value* within 2 hours or reduce THERMAL POWER to less than 25% of RATED THERMAL POWER within the next 4 hours.

SURVEILLANCE REQUIREMENTS

4.2.2 The FRTP and the MFLPD shall be determined, the value of T calculated, and the most recent actual APRM flow biased simulated thermal power-upscale scram and flow biased neutron flux-upscale control rod block trip setpoints verified to be within the above limits or adjusted, as required:

a. At least once per 24 hours,

b. Within 12 hours after completion of a THERMAL POWER increase of at least 15% of RATED THERMAL POWER, and

c. Initially and at least once per 12 hours when the reactor is operating with MFLPD greater than or equal to FRTP.

d. The provisions of Specification 4.0.4 are not applicable.

---

*With MFLPD greater than the FRTP during power ascension up to 90% of RATED THERMAL POWER, rather than adjusting the APRM setpoints, the APRM gain may be adjusted such that APRM readings are greater than or equal to 100% times MFLPD, provided that the adjusted APRM reading does not exceed 100% of RATED THERMAL POWER, the required gain adjustment increment does not exceed 10% of RATED THERMAL POWER, and a notice of the adjustment is posted on the reactor control panel.

3/4.2.3 MINIMUM CRITICAL POWER RATIO

LIMITING CONDITION FOR OPERATION

3.2.3 The MINIMUM CRITICAL POWER RATIO (MCPR) shall be equal to or greater than the MCPR limit determined from Figure 3.2.3-1a or Figure 3.2.3-1b, as applicable, times the K_f shown in Figure 3.2.3-2, provided that the end-of-cycle recirculation pump trip (EOC-RPT) system is OPERABLE per Specification 3.3.4.2 and the turbine bypass system is OPERABLE per Specification 3.7.8, with:

$$\tau = \frac{(\tau_{ave} - \tau_B)}{\tau_A - \tau_B}$$

τ_A = 0.86 seconds, control rod average scram insertion time limit to notch 39 per Specification 3.1.3.3,

$$\tau_B = 0.688 + 1.65 \left[\frac{N_1}{\sum_{i=1}^{n} N_i}\right]^{\frac{1}{2}}(0.052),$$

$$\tau_{ave} = \frac{\sum_{i=1}^{n} N_i \tau_i}{\sum_{i=1}^{n} N_i},$$

where:

n = number of surveillance tests performed to date in cycle,

N_i = number of active control rods measured in the ith surveillance tests,

τ_i = average scram time to notch 39 of all rods measured in the ith surveillance test, and

N_1 = total number of active rods measured in Specification 4.1.3.2.a.

APPLICABILITY:

OPERATIONAL CONDITION 1, when THERMAL POWER is greater than or equal to 25% of RATED THERMAL POWER.

LIMITING CONDITION FOR OPERATION (Continued)

ACTION:

a. With the end-of-cycle recirculation pump trip system inoperable per Specification 3.3.4.2, operation may continue and the provisions of Specification 3.0.4 are not applicable provided that, within 1 hour, MCPR is determined to be greater than or equal to the MCPR limit as a function of average scram time as shown in Figure 3.2.3-1a or Figure 3.2.3-1b, as applicable, EOC-RPT inoperable curve, times the K_f shown in Figure 3.2.3-2.

b. With the turbine bypass system inoperable per Specification 3.7.8, operation may continue and the provisions of Specification 3.0.4 are not applicable provided that within 1 hour, MCPR is determined to be greater than or equal to the MCPR limit as a function of average scram time as shown in Figure 3.2.3-1a or Figure 3.2.3-1b, as applicable, turbine bypass inoperable curve, times the K_f shown in Figure 3.2.3-2.

c. With MCPR less than the applicable MCPR limit determined from Figure 3.2.3-1a or Figure 3.2.3-1b, as applicable, and Figure 3.2.3-2, initiate corrective action within 15 minutes and restore MCPR to within the required limit within 2 hours or reduce THERMAL POWER to less than 25% of RATED THERMAL POWER within the next 4 hours.

SURVEILLANCE REQUIREMENTS

4.2.3 MCPR, with

a. $\tau = 1.0$ prior to performance of the initial scram time measurements for the cycle in accordance with Specification 4.1.3.2, or

b. τ as defined in Specification 3.2.3 used to determine the limit within 72 hours of the conclusion of each scram time surveillance test required by Specification 4.1.3.2,

c. The provisions of Specification 4.0.4 are not applicable.

shall be determined to be equal to or greater than the applicable MCPR limit determined from Figure 3.2.3-1a or Figure 3.2.3-1b, as applicable, and Figure 3.2.3-2:

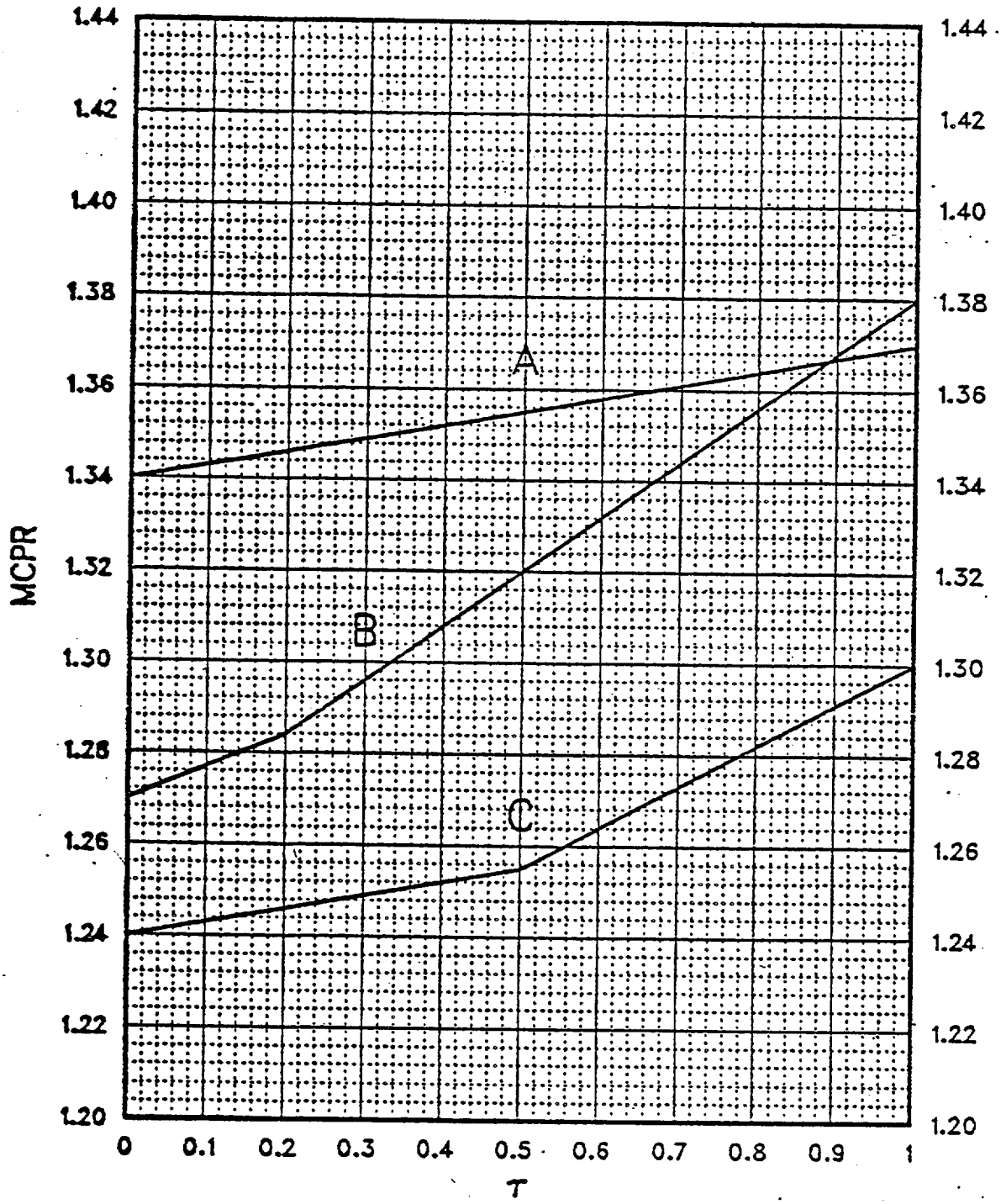
a. At least once per 24 hours,

b. Within 12 hours after completion of a THERMAL POWER increase of at least 15% of RATED THERMAL POWER, and

c. Initially and at least once per 12 hours when the reactor is operating with a LIMITING CONTROL ROD PATTERN FOR MCPR.

d. The provisions of Specification 4.0.4 are not applicable.

MINIMUM CRITICAL POWER RATIO (MCPR) VERSUS τ AT RATED FLOW*

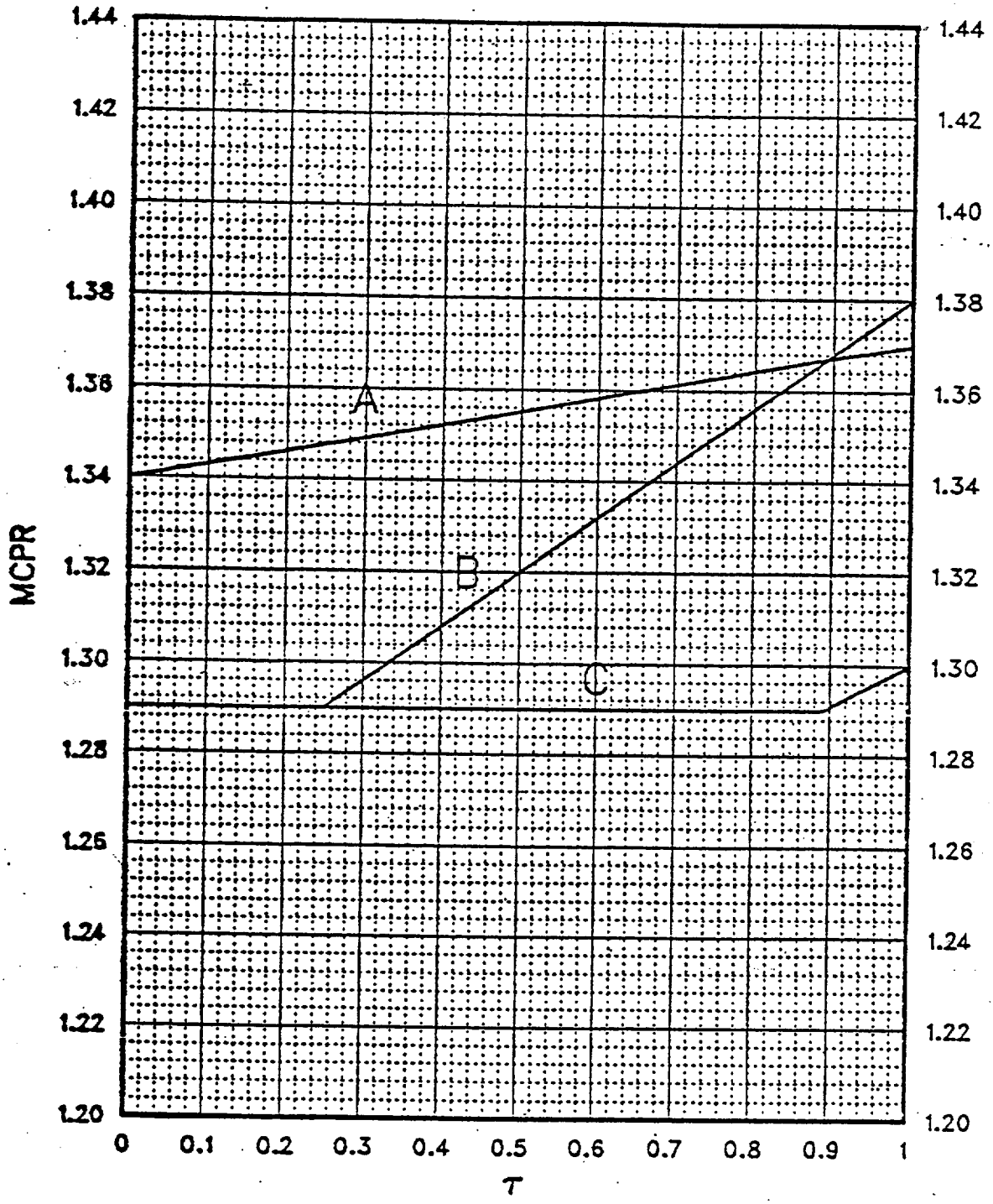


Curve A: Main Turbine Bypass Inoperable; EOC – RPT Operable
Curve B: EOC – RPT Inoperable; Main Turbine Bypass Operable
Curve C: EOC – RPT And Main Turbine Bypass Operable

* RBM AT 106% PER TABLE 3.3.6–2

FIGURE 3.2.3–1a

MINIMUM CRITICAL POWER RATIO (MCPR) VERSUS τ AT RATED FLOW*



Curve A: Main Turbine Bypass Inoperable; EOC – RPT Operable
Curve B: EOC – RPT Inoperable; Main Turbine Bypass Operable
Curve C: EOC – RPT And Main Turbine Bypass Operable

* RBM AT 108% PER TABLE 3.3.6–2

FIGURE 3.2.3–1b

TABLE 3.3.6-1 (Continued)

CONTROL ROD BLOCK INSTRUMENTATION

ACTION

ACTION 60 - Declare the RBM inoperable and take the ACTION required by Specification 3.1.4.3.

ACTION 61 - With the number of OPERABLE Channels:

a. One less than required by the Minimum OPERABLE Channels per Trip Function requirement, restore the inoperable channel to OPERABLE status within 7 days or place the inoperable channel in the tripped condition within the next hour.

b. Two or more less than required by the Minimum OPERABLE Channels per Trip Function requirement, place at least one inoperable channel in the tripped condition within 1 hour.

ACTION 62 - With the number of OPERABLE channels less than required by the Minimum OPERABLE Channels per Trip Function requirement, place the inoperable channel in the tripped condition within 1 hour.

NOTES

* With THERMAL POWER ≥ 30% of RATED THERMAL POWER.

** With more than one control rod withdrawn. Not applicable to control rods removed per Specification 3.9.10.1 or 3.9.10.2.

(a) The RBM shall be automatically bypassed when a peripheral control rod is selected or the reference APRM channel indicates less than 30% of RATED THERMAL POWER.

(b) This function shall be automatically bypassed if detector count rate is ≥ 100 cps or the IRM channels are on range 3 or higher.

(c) This function is automatically bypassed when the associated IRM channels are on range 8 or higher.

(d) This function is automatically bypassed when the IRM channels are on range 3 or higher.

(e) This function is automatically bypassed when the IRM channels are on range 1.

TABLE 3.3.6-2

CONTROL ROD BLOCK INSTRUMENTATION SETPOINTS

TRIP FUNCTION	TRIP SETPOINT	ALLOWABLE VALUE
1. ROD BLOCK MONITOR		
a. Upscale	≤ 0.66 W + 40%	≤ 0.66 W + 43%
1) 106%	≤ 0.66 W + 42%	≤ 0.66 W + 45%
2) 108%#		
b. Inoperative	NA	NA
c. Downscale	≥ 5/125 divisions of full scale	≥ 3/125 of divisions full scale
2. APRM		
a. Flow Biased Neutron Flux - Upscale	≤ 0.58 W + 50%*	≤ 0.58 W + 53%*
b. Inoperative	NA	NA
c. Downscale	≥ 5% of RATED THERMAL POWER	≥ 3% of RATED THERMAL POWER
d. Neutron Flux - Upscale Startup	≤ 12% of RATED THERMAL POWER	≤ 14% of RATED THERMAL POWER
3. SOURCE RANGE MONITORS		
a. Detector not full in	NA	NA
b. Upscale	≤ 2×10^5 cps	≤ 4×10^5 cps
c. Inoperative	NA	NA
d. Downscale	≥ 0.7 cps**	≥ 0.5 cps**
4. INTERMEDIATE RANGE MONITORS		
a. Detector not full in	NA	NA
b. Upscale	≤ 108/125 divisions of full scale	≤ 110/125 divisions of full scale
c. Inoperative	NA	NA
d. Downscale	≥ 5/125 divisions of full scale	≥ 3/125 divisions of full scale
5. SCRAM DISCHARGE VOLUME		
a. Water Level - High	≤ 44 gallons	≤ 44 gallons
6. REACTOR COOLANT SYSTEM RECIRCULATION FLOW		
a. Upscale	≤ 108/125 divisions of full scale	≤ 111/125 divisions of full scale
b. Inoperative	NA	NA
c. Comparator	≤ 10% flow deviation	≤ 11% flow deviation

*The Average Power Range Monitor rod block function is varied as a function of recirculation loop flow (W). The trip setting of this function must be maintained in accordance with Specification 3.2.2.
**Provided signal-to-noise ratio is ≥ 2. Otherwise, 3 cps as trip setpoint and 2.8 cps for allowable value.
#May be used when the associated MCPR requirements in Specification 3.2.3 are satisfied.

Bases Table B 3.2.1-1

SIGNIFICANT INPUT PARAMETERS TO THE LOSS-OF-COOLANT ACCIDENT ANALYSIS

Plant Parameters;

Core THERMAL POWER ..... 3439 Mwt* which corresponds to 105% of rated steam flow

Vessel Steam Output ..... 14.15×10^6 lbm/hr which corresponds to 105% of rated steam flow

Vessel Steam Dome Pressure..... 1055 psia

Design Basis Recirculation Line Break Area for:

a. Large Breaks 4.153 ft^2

b. Small Breaks 1.0 ft^2 to 0.02 ft^2

Fuel Parameters:

FUEL TYPE	FUEL BUNDLE GEOMETRY	PEAK TECHNICAL SPECIFICATION LINEAR HEAT GENERATION RATE (kw/ft)	DESIGN AXIAL PEAKING FACTOR	INITIAL MINIMUM CRITICAL POWER RATIO
Initial Core	8 x 8	13.4	1.4	1.18

A more detailed listing of input of each model and its source is presented in Section II of Reference 1 and Section 6.3 of the FSAR.

*This power level meets the Appendix requirement of 102%. The core heatup calculation assumes a bundle power consistent with operation of the highest powered rod at 102% of its Technical Specification LINEAR HEAT GENERATION RATE limit.

3/4.2.3 MINIMUM CRITICAL POWER RATIO

The required operating limit MCPRs at steady state operating conditions as specified in Specification 3.2.3 are derived from the established fuel cladding integrity Safety Limit MCPR of 1.06, and an analysis of abnormal operational transients. For any abnormal operating transient analysis evaluation with the initial condition of the reactor being at the steady state operating limit, it is required that the resulting MCPR does not decrease below the Safety Limit MCPR at any time during the transient assuming instrument trip setting given in Specification 2.2.

To assure that the fuel cladding integrity Safety Limit is not exceeded during any anticipated abnormal operational transient, the most limiting transients have been analyzed to determine which result in the largest reduction in CRITICAL POWER RATIO (CPR). The type of transients evaluated were loss of flow, increase in pressure and power, positive reactivity insertion, and coolant temperature decrease. The limiting transient yields the largest delta MCPR. When added to the Safety Limit MCPR of 1.06, the required minimum operating limit MCPR of Specification 3.2.3 is obtained and presented in Figure 3.2.3-1a and 3.2.3-1b.

When the less operationally limiting Rod Block Monitoring trip setpoint (.66W + 42% from Table 3.3.6-2) is used, the more limiting MCPR curve Figure 3.2.3-1b is applicable due to a larger delta MCPR from the limiting Rod Withdrawal Error (RWE) transient. Figure 3.2.3-1a is applicable when the Rod Block Monitor trip setpoint (.66W + 40% from Table 3.3.6-2) is used.

The evaluation of a given transient begins with the system initial parameters shown in FSAR Table 15.0-2 that are input to a GE-core dynamic behavior transient computer program. The code used to evaluate pressurization events is described in NEDO-24154[3] and the program used in nonpressurization events is described in NEDO-10802[2]. The outputs of this program along with the initial MCPR form the input for further analyses of the thermally limiting bundle with the single channel transient thermal hydraulic TASC code described in NEDE-25149[4]. The principal result of this evaluation is the reduction in MCPR caused by the transient.

The purpose of the K_f factor of Figure 3.2.3-2 is to define operating limits at other than rated core flow conditions. At less than 100% of rated flow the required MCPR is the product of the MCPR and the K_f factor. The K_f factors assure that the Safety Limit MCPR will not be violated during a flow increase transient resulting from a motor-generator speed control failure. The K_f factors may be applied to both manual and automatic flow control modes.

The K_f factor values shown in Figure 3.2.3-2 were developed generically and are applicable to all BWR/2, BWR/3 and BWR/4 reactors. The K_f factors were derived using the flow control line corresponding to RATED THERMAL POWER at rated core flow.

MINIMUM CRITICAL POWER RATIO (Continued)

For the manual flow control mode, the K_f factors were calculated such that for the maximum flow rate, as limited by the pump scoop tube set point and the corresponding THERMAL POWER along the rated flow control line, the limiting bundle's relative power was adjusted until the MCPR changes with different core flows. The ratio of the MCPR calculated at a given point of core flow, divided by the operating limit MCPR, determines the K_f.

For operation in the automatic flow control mode, the same procedure was employed except the initial power distribution was established such that the MCPR was equal to the operating limit MCPR at RATED THERMAL POWER and rated flow.

The K_f factors shown in Figure 3.2.3-2 are conservative for the General Electric Plant operation because the operating limit MCPRs of Specification 3.2.3 are greater than the original 1.20 operating limit MCPR used for the generic derivation of K_f.

At THERMAL POWER levels less than or equal to 25% of RATED THERMAL POWER, the reactor will be operating at minimum recirculation pump speed and the moderator void content will be very small. For all designated control rod patterns which may be employed at this point, operating plant experience indicates that the resulting MCPR value is in excess of requirements by a considerable margin. During initial start-up testing of the plant, a MCPR evaluation will be made at 25% of RATED THERMAL POWER level with minimum recirculation pump speed. The MCPR margin will thus be demonstrated such that future MCPR evaluation below this power level will be shown to be unnecessary. The daily requirement for calculating MCPR when THERMAL POWER is greater than or equal to 25% of RATED THERMAL POWER is sufficient since power distribution shifts are very slow when there have not been significant power or control rod changes. The requirement for calculating MCPR when a limiting control rod pattern is approached ensures that MCPR will be known following a change in THERMAL POWER or power shape, regardless of magnitude, that could place operation at a thermal limit.

3/4.2.4 LINEAR HEAT GENERATION RATE

This specification assures that the Linear Heat Generation Rate (LHGR) in any rod is less than the design linear heat generation even if fuel pellet densification is postulated.

References:

1. General Electric Company Analytical Model for Loss-of-Coolant Analysis in Accordance with 10 CFR 50, Appendix K, NEDE-20566, November 1975.

2. R. B. Linford, Analytical Methods of Plant Transient Evaluations for the GE BWR, February 1973 (NEDO-10802).

3. Qualification of the One Dimensional Core Transient Model For Boiling Water Reactor, NEDO-24154, October 1978.

4. TASC 01-A Computer Program For the Transient Analysis of a Single Channel, Technical Description, NEDE-25149, January 1980.

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

SAFETY EVALUATION

AMENDMENT NO. 39 TO NPF-14 AND

AMENDMENT NO. 10 TO NPF-22

SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2

DOCKET NOS. 50-387 AND 50-388

Introduction (Unit 1)

By letter dated September 6, 1984, Pennsylvania Power and Light Company (the licensee) made application to amend the Technical Specifications of the Susquehanna Steam Electric Station, Unit 1. The proposed changes would:

(1) Revise the trip setpoint on the Rod Block Monitor to provide dual settings with corresponding operating limit Minimum Critical Power Ratio (MCPR) values;

(2) Reanalyze those transients taking credit for the Reactor Pump Trip to account for the measured flow coastdown characteristics and revise the MCPR operating limits accordingly; and

(3) Revise the labels on Figures 3.2.3-1a and 3.2.3-1b to increase their clarity.

Evaluation (Unit 1)

1. Rod Block Monitor Trip Setpoints

The analysis of the rod withdrawal error at power produces a table of changes in Critical Power Ratio (Delta CPR) as a function of the trip setpoint of the Rod Block Monitor. The licensee has proposed to employ two different settings - 108 percent full power and 106 percent full power. The higher values would be used at low powers and the lower value when operating at or near full power. Alternatively the higher value might be used in portions of the cycle when normal operating margins are high and the smaller value when they are low. The higher value of trip setpoint requires larger operating MCPR values than does the lower value. Accordingly the curve of MCPR as a function of the scram speed parameter (τ), Figure 3.2.3-1, has been replaced by two Figures - 3.2.3-1a for the 106 percent trip setpoint and 3.2.3-1b for 108 percent. The Technical Specification 3/4.2.3 has been revised to reflect this change.

Since the increased setpoint of the Rod Block Monitor is accompanied by a requirement for an increased operating MCPR in order to maintain margins to safety limits we conclude that this change is acceptable.

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2. Recirculation Pump Coastdown Events

During startup testing of Unit 1 it was discovered that the coastdown flow during the first second following a recirculation pump trip was larger than had been assumed in safety analyses. Operation was continued by invoking the operating limit MCPR values appropriate to the case in which the pump trip was inoperable. The vendor, General Electric, has since reanalyzed the events which might be affected by the altered coastdown curve and prepared revised operating limit MCPR values.

The analysis was performed with the same codes and procedures as was employed for the FSAR analyses and the operating limit MCPR values have been increased to provide the same margin to safety limits as before. We find this to be acceptable.

3. Revised Labels for OLMCPR Curves

The curves' Operating Limit MCPR (OLMCPR) as a function of the scram time parameter, τ, has been relabeled in order to more clearly identify the conditions under which each of the curves is applicable. Since this change reduces the likelihood of confusion as to which of the curves in Figures 3.2.3-1a and 3.2.3-1b are to be used for the OLMCPR we find the proposed change acceptable.

Introduction (Unit 2)

By the same letter dated September 6, 1984, Pennsylvania Power and Light Company (the licensee) made application to amend the Technical Specification of the Susquehanna Steam Station, Unit 2. The proposed changes would:

(1) Revise the trip setpoint on the Rod Block Monitor to provide dual settings with corresponding operating limit MCPR values;

(2) Revise the labels on Figures 3.2.3-1a and 3.2.3-1b to increase their clarity.

Evaluation (Unit 2)

1. Rod Block Monitor Trip Setpoints

The analysis of the rod withdrawal error at power produces a table of changes in Critical Power Ratio (Delta CPR) as a function of the trip setpoint of the Rod Block Monitor. The licensee has proposed to employe two different settings - 108 percent full power and 106 percent full power. This higher value would be used at low power and the lower value when operating at or near full power. Atlernatively the higher value might be used in portions of the cycle when normal operating margins are high and the smaller value when they are low. The higher value of trip setpoint requires larger operating

MCPR values than does the lower value. Accordingly the curve of MCPR as a function of the scram speed parameter (τ), Figure 3.2.3-1, has been replaced by two figures - 3.2.3-1a for the 106 percent trip setpoint and 3.2.3-1b for the 108 percent. The Technical Specification 3/4.2.3 has been revised to reflect this change.

Since the increased setpoint of the Rod Block Monitor is accompanied by a requirement for an increased operating MCPR in order to maintain margins to safety limits we conclude that this change is acceptable.

2. Revised Labels for OLMCPR Curves

The curves of Operating Limit MCPR (OLMCPR) as a function of the scram time parameter, τ, has been relabeled in order to more clearly identify the conditions under which each of the curves is applicable. Since this change reduces the likelihood of confusion as to which of the curves in Figures 3.2.3-1a and 3.2.3-1b are to be used for the OLMCPR we find the proposed change acceptable.

Conclusion (Units 1 and 2)

The proposed changes to the Susquehanna Unit 1 and Unit 2 Technical Specifications are found to be acceptable to the NRC staff. These modifications do not involve any significant safety considerations. We, therefore, recommend approval of the changes to the Unit 1 and Unit 2 Technical Specifications as proposed by the licensee.

Environmental Consideration

These amendments involve changes in the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The 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 these amendments involve no significant hazards consideration and there has been no public comment on such finding. Accordingly, these amendments meet the eligibility criteria for categorical exclusion set forth in 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 these amendments.

Conclusion

We have 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, and (2) such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public.

Dated: APR 23 1985

APR 23 1985

Docket Nos.: 50-387
and 50-388

Mr. Norman W. Curtis
Vice President
Engineering and Construction - Nuclear
Pennsylvania Power and Light Company
2 North Ninth Street
Allentwon, Pennsylvania 18101

Dear Mr. Curtis:

SUBJECT: AMENDMENT NOS. 39 AND 10 TO FACILITY OPERATING LICENSE NO. NPF-14 AND NPF-22, SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2 RESPECTIVELY

The Nuclear Regulatory Commission has issued the enclosed Amendment Nos. 39 and 10 to Facility Operating License Nos. NPF-14 and NPF-22 for the Susquehanna Steam Electric Station, Units 1 and 2 respectively. The amendment is in response to your letter dated September 6, 1984. This amendment revises the Susquehanna Unit 1 and Unit 2 Technical Specifications to 1) add an additional rod block monitor (RBM) setpoint of 108%, creating a dual RBM setpoint to allow additional operating flexibility within the power flow map, 2) change the labels associated with Figures 3.2.2-1 and redesignate as Figure 3.2.3-1a and 3) add Figure 3.2.3-1b. In addition, this amendment revises Susquehanna Unit 1 Technical Specifications to update Figure 3.2.3-1 as a result of actual startup test data relating to recirculation pump coastdown.

A copy of the related safety evaluation supporting Amendment Nos. 39 and 10 is enclosed.

Sincerely,

Original signed by:

A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing

Enclosures:
1. Amendment No. 39 to NPF-14
2. Amendment No. 10 to NPF-22
3. Safety Evaluation

cc w/enclosures:
See next page

*Previous concurrence concurred on by:

DL:LB#2	DL:LB#2	OELD	DL:LB#2	AD/L:DL
*EHylton	*MCampagnone:pob	*JGray	*ASchwencer	*TNovak
1/24/85	1/23/85	2/11/85	2/08/85 & 4/12/85	4/12/85

4/23/85

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