November 22, 1983

Docket No. 50-293

Mr. William D. Harrington
Senior Vice President, Nuclear
Boston Edison Company
800 Boylston Street
Boston, Massachusetts 02199

Dear Mr. Harrington:

The Commission has issued the enclosed Amendment No. 72 to Facility Operating License No. DPR-35 for the Pilgrim Nuclear Power Station. This amendment consists of changes to the Technical Specifications in response to your application dated May 31, 1983.

These changes to the Technical Specifications expand the operating region of Pilgrim's power/flow map, and provide associated changes in the Average Power Range Monitor (APRM) flux scram and APRM rod block trip settings.

A copy of the related Safety Evaluation is also enclosed.

Sincerely,

Original signed by/

Paul H. Leech, Project Manager
Operating Reactors Branch #2
Division of Licensing

Enclosures:
1. Amendment No. 72 to License No. DPR-35
2. Safety Evaluation

cc w/enclosures:
See next page

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Mr. William D. Harrington
Boston Edison Company
Pilgrim Nuclear Power Station

cc:

Mr. Charles J. Mathis, Station Mgr.
Boston Edison Company
RFD #1, Rocky Hill Road
Plymouth, Massachusetts 02360

Resident Inspector's Office
U. S. Nuclear Regulatory Commission
Post Office Box 867
Plymouth, Massachusetts 02360

Henry Herrmann, Esquire
Massachusetts Wildlife Federation
151 Tremont Street
Boston, Massachusetts 02111

Water Quality and
Environmental Commissioner
Department of Environmental Quality
Engineering
100 Cambridge Street
Boston, Massachusetts 02202

Mr. David F. Tarantino
Chairman, Board of Selectman
11 Lincoln Street
Plymouth, Massachusetts 02360

Office of the Attorney General
1 Ashburton Place
19th Floor
Boston, Massachusetts 02108

U. S. Environmental Protection
Agency
Region I Office
Regional Radiation Representative
JFK Federal Building
Boston, Massachusetts 02203

Thomas A. Murley
Regional Administrator
Region I Office
U. S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, Pennsylvania 19406

Mr. A. Victor Morisi
Boston Edison Company
25 Braintree Hill Park
Rockdale Street
Braintree, Massachusetts 02184

Mr. Robert M. Hallisey, Director
Radiation Control Program
Massachusetts Department of Public Health
600 Washington Street, Room 770
Boston, Massachusetts 02111

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

BOSTON EDISON COMPANY

DOCKET NO. 50-293

PILGRIM NUCLEAR POWER STATION

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 72
License No. DPR-35

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

   A. The application for amendment by Boston Edison Company (the licensee) dated May 31, 1983 complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 3.B of Facility Operating License No. DPR-35 is hereby amended to read as follows:

   B. Technical Specifications

   The Technical Specifications contained in Appendix A, as revised through Amendment No. 72, 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 the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Domenic B. Vassallo, Chief
Operating Reactors Branch #2
Division of Licensing

Attachment:
Changes to the Technical
Specifications

Date of Issuance: November 22, 1983

ATTACHMENT TO LICENSE AMENDMENT NO. 72

FACILITY OPERATING LICENSE NO. DPR-35

DOCKET NO. 50-293

Replace the following pages of the 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
6	6
7	7
8	8
9	9
15	15
21	21
54	54
205H	205H

1.1 SAFETY LIMIT

1.1 FUEL CLADDING INTEGRITY

Applicability:

Applies to the interrelated variables associated with fuel thermal behavior.

Objective:

To establish limits below which the integrity of the fuel cladding is preserved.

Specification:

A. Reactor Pressure >800 psia and Core Flow >10% of Rated

The existence of a minimum critical power ratio (MCPR) less than 1.07 shall constitute violation of the fuel cladding integrity safety limit. A MCPR of 1.07 is hereinafter referred to as the Safety Limit MCPR.

B. Core Thermal Power Limit (Reactor Pressure ≤ 800 psia and/or Core Flow ≤ 10%)

When the reactor pressure is ≤ 800 psia or core flow is less than or equal to 10% of rated, the steady state core thermal power shall not exceed 25% of design thermal power.

C. Power Transient

The safety limit shall be assumed to be exceeded when scram is known to have been accomplished by a means other than the expected scram signal unless analyses demonstrate that the fuel cladding integrity safety limits defined in Specifications 1.1A and 1.1B were not exceeded during the actual transient.

2.1 LIMITING SAFETY SYSTEM SETTING

2.1 FUEL CLADDING INTEGRITY

Applicability:

Applies to trip settings of the instruments and devices which are provided to prevent the reactor system safety limits from being exceeded.

Objective:

To define the level of the process variables at which automatic protective action is initiated to prevent the fuel cladding integrity safety limits from being exceeded.

Specification:

A. Neutron Flux Scram

The limiting safety system trip settings shall be as specified below:

1. Neutron Flux Trip Settings

   a. APRM Flux Scram Trip Setting (Run Mode)

   When the Mode Switch is in the RUN position, the APRM flux scram trip setting shall be:

   $S \leq .58W + 62\%$ 2 loop

   Where:

   S = Setting in percent of rated thermal power (1998 MWt)

   W = Percent of drive flow to produce a rated core flow of 69 M lb/hr.

1.1 SAFETY LIMIT

D. Whenever the reactor is in the cold shutdown condition with irradiated fuel in the reactor vessel, the water level shall not be less than 12 in. above the top of the normal active fuel zone.

2.1 LIMITING SAFETY SYSTEM SETTING

In the event of operation with a maximum fraction of limiting power density (MFLPD) greater than the fraction of rated power (FRP), the setting shall be modified as follows:

$$S \leq (0.58W + 62\%) \left[\frac{FRP}{MFLPD}\right] \quad \underline{2\ Loop}$$

Where,

FRP = fraction of rated thermal power (1998 MWt)

MFLPD = maximum fraction of limiting power density where the limiting power density is 13.4 KW/ft for 8x8 and P8x8R fuel.

The ratio of FRP to MFLPD shall be set equal to 1.0 unless the actual operating value is less than the design value of 1.0, in which case the actual operating value will be used.

For no combination of loop recirculation flow rate and core thermal power shall the APRM flux scram trip setting be allowed to exceed 120% of rated thermal power.

b. APRM Flux Scram Trip Setting (Refuel or Start and Hot Standby Mode)

When the reactor mode switch is in the REFUEL or STARTUP position, the APRM scram shall be set at less than or equal to 15% of rated power.

c. IRM

The IRM flux scram setting shall be ≤ 120/125 of scale.

B. APRM Rod Block Trip Setting

The APRM rod block trip setting shall be:

$$S_{RB} \leq 0.58W + 50\% \quad \underline{2\ Loop}$$

1.1 SAFETY LIMIT

2.1 LIMITING SAFETY SYSTEM SETTING

Where,

S_{RB} = Rod block setting in percent of rated thermal power (1998 MWt)

W = Percent of drive flow required to produce a rated core flow of 69M lb/hr.

In the event of operating with a maximum fraction limiting power density (MFLPD) greater than the fraction of rated power (FRP), the setting shall be modified as follows:

$$S_{RB} \leq (0.58W + 50\%)\left[\frac{FRP}{MFLPD}\right] \quad \underline{2\ Loop}$$

Where,

FRP = fraction of rated thermal power

MFLPD = maximum fraction of limiting power density where the limiting power density is 13.4 KW/ft for 8x8 and P8x8R fuel.

The ratio of FRP to MFLPD shall be set equal to 1.0 unless the actual operating value is less than the design value of 1.0, in which case the actual operating value will be used.

C. Reactor low water level scram setting shall be ≥ 9 in. on level instruments.

D. Turbine stop valve closure scram settings shall be ≤ 10 percent valve closure.

E. Turbine control valve fast closure setting shall be ≥ 150 psig control oil pressure at acceleration relay.

F. Condenser low vacuum scram setting shall be ≥ 23 in. Hg. vacuum.

G. Main steam isolation scram setting shall be ≤ 10 percent valve closure.

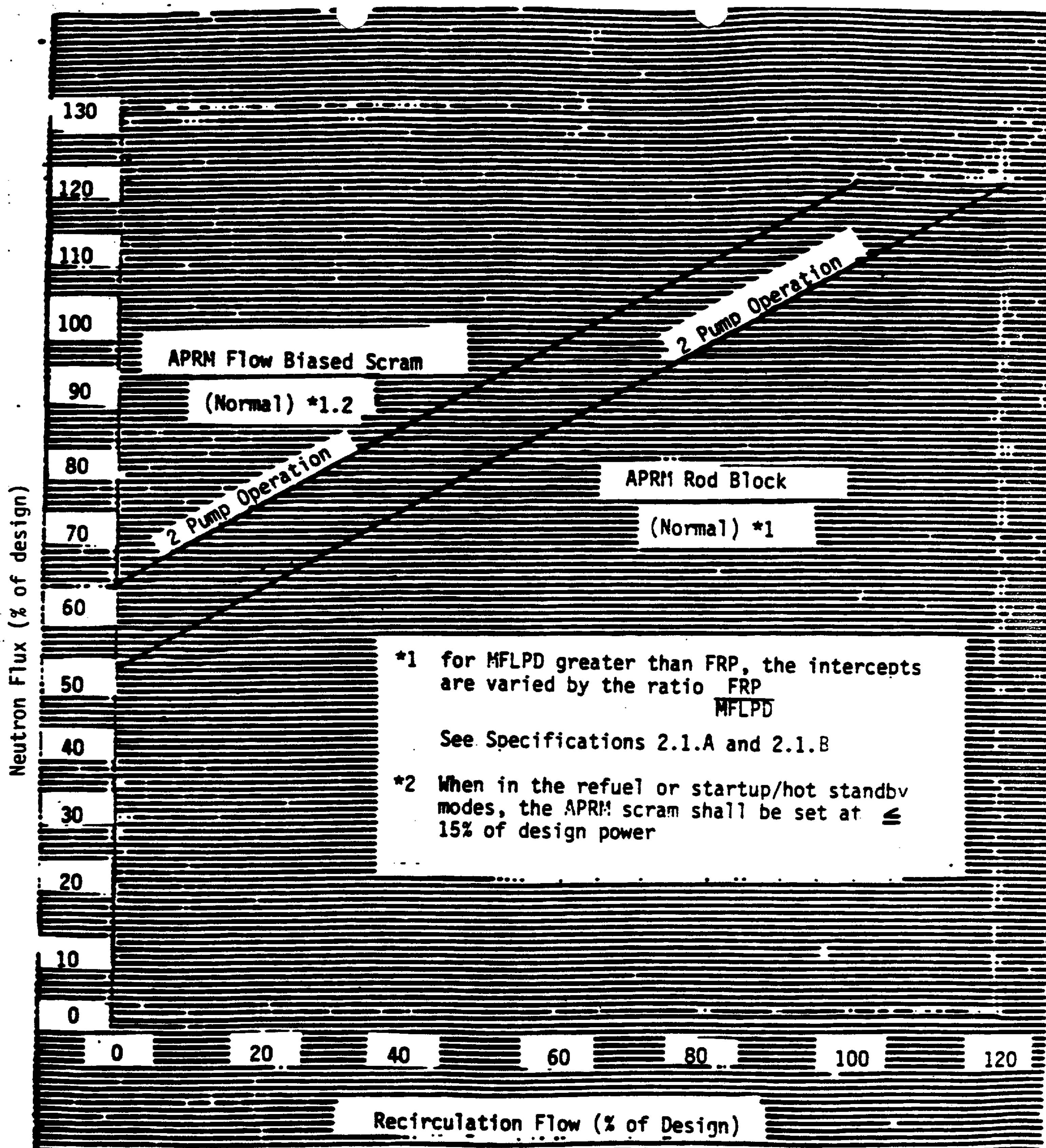


Figure 2.1.1

APRM Scram and Rod Block Trip Limiting Safety System Settings

2.1 **BASES:**

In summary:

i. The abnormal operational transients were analyzed to a power level of 1998 MWt.

ii. The licensed maximum power level is 1998 MWt.

iii. Analyses of transients employ adequately conservative values of the controlling reactor parameters.

iv. The analytical procedures now used result in a more logical answer than the alternative method of assuming a higher starting power in conjunction with the expected values for the parameters.

The bases for individual set points are discussed below:

A. Neutron Flux Scram Trip Settings

APRM

The average power range monitoring (APRM) system, which is calibrated using heat balance data taken during steady-state conditions, reads in percent of design power (1998 MWt). Because fission chambers provide the basic input signals, the APRM system responds directly to average neutron flux. During transients, the instantaneous rate of heat transfer from the fuel (reactor thermal power) is less than the instantaneous neutron flux due to the time constant of the fuel. Therefore, during abnormal operational transients, the thermal power of the fuel will be less than that indicated by the neutron flux at the scram setting. Analyses demonstrated that with a 120 percent scram trip setting, none of the abnormal operational transients analyzed violate the fuel safety limit and there is a substantial margin from fuel damage. Therefore, the use of flow referenced scram trip provides even additional margin.

The flow biased scram plotted on Figure 2.1.1 is based on recirculation loop flow.

An increase in the APRM scram setting would decrease the margin present before the fuel cladding integrity safety limit is reached. The APRM scram setting was determined by an analysis of margins required to provide a reasonable range for maneuvering during operation. Reducing this operating margin would increase the frequency of spurious scrams, which have an adverse effect on reactor safety because of the resulting thermal stresses. Thus, the APRM setting was selected because it provides adquate margin for the fuel cladding integrity safety limit yet allows operating margin that reduces the possibility of unnecessary scrams.

(DELETED)

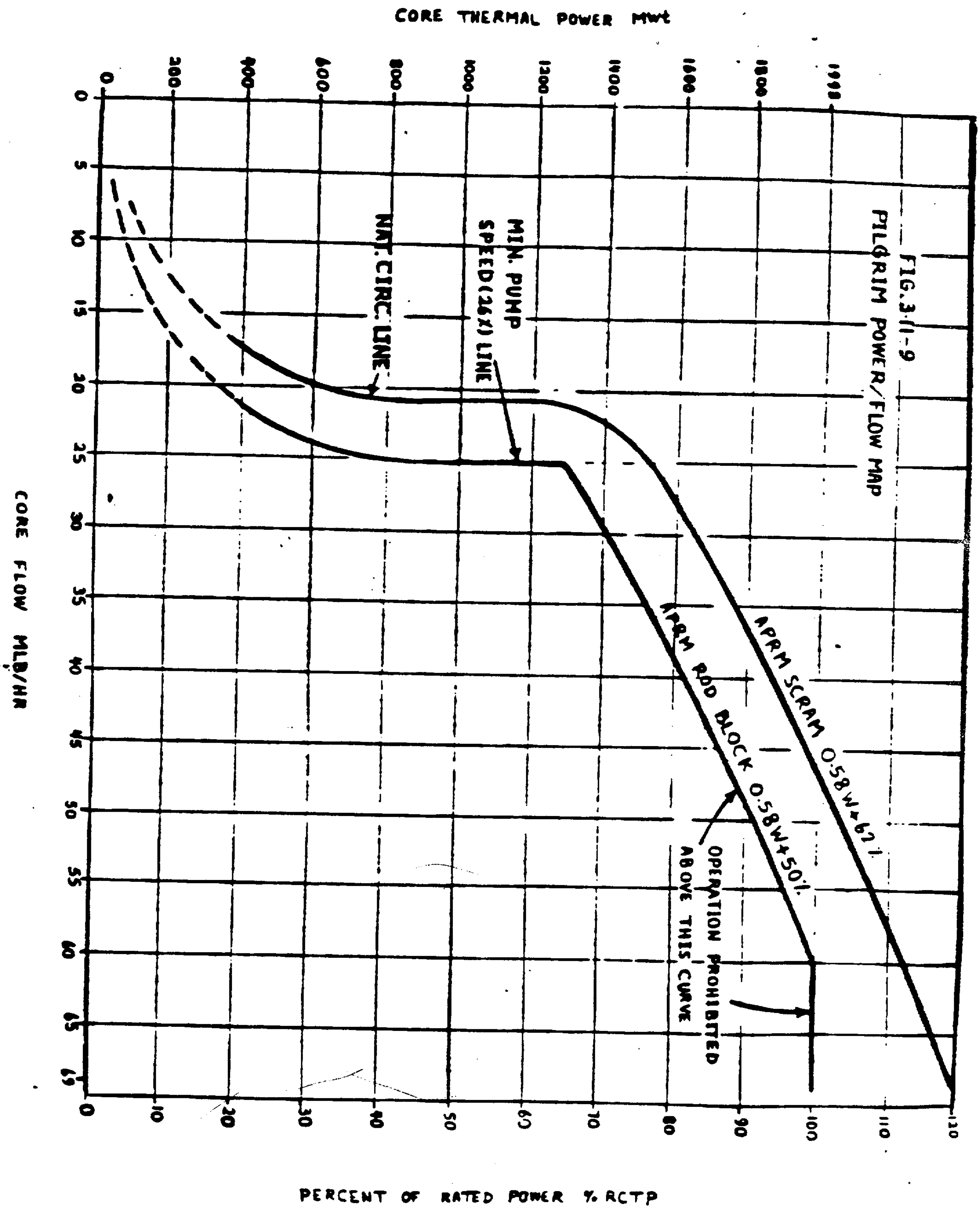
Amendment No. ~~65~~, 72

PNPS

TABLE 3.2.C

INSTRUMENTATION THAT INITIATES ROD BLOCKS

Minimum # of Operable Instrument Channels Per Trip Systems (1)	Instrument	Trip Level Setting
2	APRM Upscale (Flow Biased)	$(0.58W + 50\%)\left[\frac{FRP}{MFLPD}\right]$(2)
2	APRM Downscale	2.5 indicated on scale
1 (7)	Rod Block Monitor (Flow Biased)	$(0.65W + 42\%)\left[\frac{FRP}{MFLPD}\right]$(2)
1 (7)	Rod Block Monitor Downscale	5/125 of full scale
3	IRM Downscale (3)	5/125 of full scale
3	IRM Detector not in Startup Position	(8)
3	IRM Upscale	$\leq$108/125 of full scale
2 (5)	SRM Detector not in Startup Position	(4)
2 (5) (6)	SRM Upscale	$\leq 10^5$ counts/sec.
1.(9)	Scram Discharge Volume Water Level-High	$\leq$18 gallons


CORE THERMAL POWER Mwt
FIG.3.11-9
PILGRIM POWER/FLOW MAP
MIN. PUMP SPEED(26%) LINE
NAT. CIRC. LINE
APRM SCRAM 0.58W+67%
APRM ROD BLOCK 0.58W+50%
OPERATION PROHIBITED ABOVE THIS CURVE
CORE FLOW MLB/HR
PERCENT OF RATED POWER % RCTP

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

SUPPORTING AMENDMENT NO. 72 TO FACILITY OPERATING LICENSE NO. DPR-35

BOSTON EDISON COMPANY

PILGRIM NUCLEAR POWER STATION

DOCKET NO. 50-293

1.0 Introduction

By reference 1, Boston Edison Company (licensee) proposed the Technical Specification changes for Pilgrim Nuclear Power Station, during the Cycle 6 operation. The submittal proposes a revision to the Technical Specifications to allow rated power operation at any core flow rate between 87 percent and 100 percent of the rated flow as a result of extension of the load line limits. The purpose of the Technical Specification changes is to improve operating flexibility during power ascension.

2.0 Evaluation

The objective of the review is to confirm that the thermal-hydraulic design of the core has been accomplished using acceptable methods, and provides an acceptable margin of safety from conditions which could lead to fuel damage during normal and anticipated operational transients, and is not susceptible to thermal-hydraulic instability.

The review includes the following areas: (1) safety limit minimum critical power ratio, (2) operating limit MCPR, (3) thermal hydraulic stability, and (4) changes to Table 3.2.C, Sections 2.1.B, and Figures 2.1.1 and 3.11-9 of the Technical Specifications.

The safety limit MCPR has been imposed to assure that 99.9 percent of the fuel rods in the core are not expected to experience boiling transition during normal operation and anticipated operational transients. As stated in reference 3, the safety limit MCPR is 1.07 for the reload fuel. A safety limit of 1.07 is used for the Pilgrim Cycle 6 operation.

The maximum value of operating limit MCPR, as indicated in the Technical Specifications, is 1.30. This is calculated by using the ODYN methods for the most limiting transient, generator load rejection without bypass event, a 100 percent power and 100 percent flow condition (licensing basis for BWR/3's).

The licensee has submitted revised power/flow map as shown in Figure 1-1 of reference 2. The proposed extension of the power/flow map is to allow ascension along the 108 percent APRM rod block line to 100 percent power at 87 percent flow and allow rated power operation at any core flow rate between 87 percent and 100 percent.

The ODYN results in reference 2 indicate that calculated ΔCPRs for the most limiting transient, generator load rejection without bypass event, are 0.33 and 0.30 for 8x8 fuel, and 0.36 and 0.33 for P8x8R fuel for the power/flow map at 100/100 and 100/87 points respectively. Therefore, reference 2 concludes that (1) the ODYN results for power/flow at the 100/87 point are bounded by the licensing basis results which are based on the power/flow map at the 100/100 point, and (2) the OLMCPR's specified in the Technical Specifications are applicable to the rated power operation at any core flow rate between 87 percent and 100 percent. We have reviewed the extended load line limit analysis (Ref. 2) discussed above and we find that the ODYN methods were used and results have shown an acceptable margin of safety from conditions which could lead to fuel damage during any anticipated operational transient.

The results of the thermal-hydraulic analysis (Ref. 2) show that the core has the smallest stability margin for the power/flow map at the point where the extrapolated rod block line intercepts the natural circulation line and the corresponding maximum decay ratio is 0.65 as compared to 0.59 for the Cycle 5.

The large difference of the maximum decay ratio is due to the higher power/flow ratio for the extended load operation. Since the calculated maximum core stability ratio is less than that of some of the operating plants (for example, Peach Bottom Units 2 and 3 have decay ratio of 0.98), we conclude that the thermal-hydraulic stability results are acceptable for extension of the load line limits of Cycle 6 operation.

Table 3.2.C, Sections 2.1.A and 2.1.B and Figures 2.1.1 and 3.11-9 of the proposed Technical Specifications have been modified to include the extended operating power/flow map given in Figure 1.1 of reference 2. The modifications include the changes of the APRM rod block and trip set points from 0.65 W + 42% to 0.58 W + 50%, and 0.65 W + 55% to 0.58 W and 62% respectively, where W is the loop recirculation flow as a percentage of the loop recirculation flow which produced a rated core flow of 69 million lbs/hr.

We find that approved methods have been used, and that the results of the extended load line limit analysis support the proposed MCPR limits, which avoid violation of the safety limit MCPR for design transients.

We conclude that this core design will not adversely affect the capability to operate the Pilgrim Station safely during the remaining Cycle 6 operation and that proposed changes to Tables 3.2.C, Sections 2.1.A and 2.1.B Figures 2.1.1 and 3.11-9 of the Technical Specifications discussed above are acceptable.

3.0 Environmental Consideration

We have determined that the amendment does not authorize a change in effluent types or total amounts nor an increase in power level and will not result in any significant environmental impact. Having made this determination, we have further concluded that the amendment involves an action which is insignificant from the standpoint of environmental impact and, pursuant to 10 CFR §51.5(d)(4), that an environmental impact statement, or negative declaration and environmental impact appraisal need not be prepared in connection with the issuance of this amendment.

4.0 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.

5.0 References

1. Letter from W. Harrington (BE) to D. Vassallo (NRC) dated May 31, 1983.

2. NEDO-22198, General Electric Boiling Water Reactor Extended Load Line Limit Analysis for Pilgrim Nuclear Power Station Unit 1, Cycle 6 May 1982.

3. NEDO-24011-A-4, General Electric Boiling Water Reactor Generic Reload Fuel Applications dated January 1982.

Principal Contributor: S. Sun

Dated: November 22, 1983