Mr. Robert G. Byram
Senior Vice President-Generation
and Chief Nuclear Officer
PP&L, Inc.
2 North Ninth Street
Allentown, PA 18101

July 30, 1999

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2 (TAC NOS. MA2271 and MA2445)

Dear Mr. Byram:

The Commission has issued the enclosed Amendment No. 184 to Facility Operating License No. NPF-14 and Amendment No. 158 to Facility Operating License No. NPF-22 for the Susquehanna Steam Electric Station (SSES), Units 1 and 2. This amendment consists of changes to the Technical Specifications (TSs) in response to your applications dated June 19, 1998, (Unit 1) and August 5, 1998, (Unit 2) as supplemented by letters dated November 23, 1998 (Units 1 and 2), and June 23, 1999.

These amendments incorporate long-term power stability solution instrumentation into the SSES Unit 1 and Unit 2 TS. The changes reflect the addition of a new TS Section 3.3.1.3, "Oscillation Power Range Monitoring Instrumentation," and revisions to TS Section 3.4.1, "Recirculation Loops Operating," to remove specifications related to the current power stability specifications that are no longer required.

A copy of our safety evaluation is also enclosed. Notice of Issuance will be included in the Commission's Biweekly Federal Register Notice.

Sincerely,

Original signed by:

Victor Nerses, Sr. Project Manager, Section 1
Project Directorate I
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-387/50-388

Enclosures:
1. Amendment No. 184 to License No. NPF-14
2. Amendment No. 158 to License No. NPF-22
3. Safety Evaluation

cc w/encls: See next page

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

July 30, 1999

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Mr. Robert G. Byram
PP&L, Inc.

Susquehanna Steam Electric Station,
Units 1 & 2

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

PP&L, INC.

ALLEGHENY ELECTRIC COOPERATIVE, INC.

DOCKET NO. 50-387

SUSQUEHANNA STEAM ELECTRIC STATION, UNIT 1

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 184
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 PP&L, Inc., dated June 19, 1998, and supplemented by letters dated November 23, 1998, and June 23, 1999, 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. 184 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. PP&L shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of its date of issuance and is to be implemented within 30 days following startup from the Unit 1, eleventh Refueling Inspection Outage, currently scheduled for spring 2000.

FOR THE NUCLEAR REGULATORY COMMISSION

S. Singh Bajwa, Director
Project Directorate I-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: July 30, 1999

ATTACHMENT TO LICENSE AMENDMENT NO. 184

FACILITY OPERATING LICENSE NO. NPF-14

DOCKET NO. 50-387

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

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3.3 INSTRUMENTATION

3.3.1.3 Oscillation Power Range Monitor (OPRM) Instrumentation

LCO 3.3.1.3 Four channels of the OPRM instrumentation shall be OPERABLE. Each OPRM channel Period Based Algorithm (Sp) Allowable Value shall be less than or equal to 1.09 at a confirmation count permissive (Np) of 10.

APPLICABILITY: Thermal Power ≥ 25% RTP.

ACTIONS:

------------------------------NOTE------------------------------

Separate Condition entry is allowed for each channel.

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One or more required channels inoperable.	A.1 Place channel in trip.	30 days
	<u>OR</u>	
	A.2 Place associated RPS trip system in trip.	30 days
	<u>OR</u>	
	A.3 Initiate alternate method to detect and suppress thermal hydraulic instability oscillations.	30 days
B. OPRM trip capability not maintained.	B.1 Initiate alternate method to detect and suppress thermal hydraullic instability oscillations.	12 hours
	<u>AND</u>	
	B.2 Restore OPRM trip capability	120 days
C. Required Action and associated Completion Time not met.	C.1 Reduce THERMAL POWER < 25% RTP.	4 hours

SURVEILLANCE REQUIREMENTS

-----NOTE-----
When a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours provided the OPRM System maintains trip capability.

SURVEILLANCE		FREQUENCY
SR 3.3.1.3.1	Perform CHANNEL FUNCTIONAL TEST.	184 days
SR 3.3.1.3.2	Calibrate the local power range monitors.	1000 MWD/MT average core exposure
SR 3.3.1.3.3	-----NOTE----- Neutron detectors are excluded. ----- Perform CHANNEL CALIBRATION.	24 months
SR 3.3.1.3.4	Perform LOGIC SYSTEM FUNCTIONAL TEST	24 months
SR 3.3.1.3.5	Verify OPRM is not bypassed when THERMAL POWER is $\geq$ 30% RTP and core flow $\leq$ 60 MLb/Hr.	24 months
SR 3.3.1.3.6	-----NOTE----- Neutron detectors are excluded. ----- Verify the RPS RESPONSE TIME is within limits.	24 months on a STAGGERED TEST BASIS

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.1 Recirculation Loops Operating

LCO 3.4.1 Two recirculation loops with matched flows shall be in operation.

<u>OR</u>

One recirculation loop may be in operation provided the following limits are applied when the associated LCO is applicable:

a. LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)," single loop operation limits specified in the COLR;

b. LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)," single loop operation limits specified in the COLR;

c. LCO 3.2.3, "LINEAR HEAT GENERATION RATE (LHGR)," single loop operation limits specified in the COLR, and

d. LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation," Function 2.b (Average Power Range Monitors Flow Biased Simulated Thermal Power—High), Allowable Value of Table 3.3.1.1-1 is reset for single loop operation.

e. Recirculation pump speed is ≤ 80%.

-------------------------------------Note-------------------------------------

Required limit and setpoint resets for single recirculation loop operation may be delayed for up to 12 hours after transition from two recirculation loop operation to single recirculation loop operation.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. No recirculation loops operating while in MODE 1	A.1 Place reactor mode switch in the shutdown position.	Immediately
B. Recirculation loop flow mismatch not within limits.	B.1 Declare the recirculation loop with lower flow to be "not in operation."	2 hours
C. No recirculation loops in operation while in MODE 2 <u>OR</u> Single Recirculation Loop required limits and setpoints not established within required time.	C.1 Be in MODE 3.	12 hours

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SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.1.1	-------------------NOTE------------------- Not required to be performed until 24 hours after both recirculation loops are in operation. -- Verify recirculation loop jet pump flow mismatch with both recirculation loops in operation is: a. ≤ 10 million lbm/hr when operating at < 75 million lbm/hr total core flow; and b. ≤ 5 million lbm/hr when operating at ≥ 75 million lbm/hr total core flow.	24 hours
SR 3.4.1.2	-------------------NOTE------------------- Only required to be met during single loop operations. -- Verify recirculation pump speed is within the limit specified in the LCO.	24 hours

(Figure 3.4.1-1)

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B 3.3 INSTRUMENTATION

B 3.3.1.3 Oscillation Power Range Monitor (OPRM)

BASES

BACKGROUND

General Design Criterion 10 (GDC 10) requires the reactor core and associated coolant, control, and protection system to be designed with appropriate margin to assure that acceptable fuel design limits are not exceeded during any condition of normal operation including the effects of anticipated operational occurrences. Additionally, GDC 12 requires the reactor core and associated coolant control and protection systems to be designed to assure that power oscillations which can result in conditions exceeding acceptable fuel design limits are either not possible or can be reliably and readily detected and suppressed. The OPRM System provides compliance with GDC 10 and GDC 12, thereby providing protection from exceeding the fuel MCPR safety limit.

References 1, 2, and 3 describe three separate algorithms for detecting stability related oscillations: the period based detection algorithm, the amplitude based algorithm, and the growth rate algorithm. The OPRM System hardware implements these algorithms in microprocessor based modules. These modules execute the algorithms based on LPRM inputs and generate alarms and trips based on these calculations. These trips result in tripping the Reactor Protection System (RPS) when the appropriate RPS trip logic is satisfied, as described in the Bases for LCO 3.3.1.1, "RPS Instrumentation." Only the period based detection algorithm is used in the safety analysis (Ref. 1, 2, 6 & 7). The remaining algorithms provide defense-in-depth and additional protection against unanticipated oscillations.

The period based detection algorithm detects a stability-related oscillation based on the occurrence of a fixed number of consecutive LPRM signal period confirmations followed by the LPRM signal amplitude exceeding a specified setpoint. Upon detection of a stability related oscillation, a trip is generated for that OPRM channel.

The OPRM System consists of four OPRM trip channels, each channel consisting of two OPRM modules. Each OPRM module receives input from LPRMs. Each OPRM module also receives

(continued)

BASES

BACKGROUND (continued)

input from the Neutron Monitoring System (NMS) average power range monitor (APRM) power and flow signals to automatically enable the trip function of the OPRM module.

Each OPRM module is continuously tested by a self-test function. On detection of any OPRM module failure, either a trouble alarm or INOP alarm is activated. The OPRM module provides an INOP alarm when the self-test feature indicates that the OPRM module may not be capable of meeting its functional requirements.

APPLICABLE SAFETY ANALYSES

It has been shown that BWR cores may exhibit thermal-hydraulic reactor instabilities in high power and low flow portions of the core power to flow operating domain. GDC 10 requires the reactor core and associated coolant control and protection systems to be designed with appropriate margin to assure that acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences. GDC 12 requires assurance that power oscillations which can result in conditions exceeding acceptable fuel design limits are either not possible or can be reliably and readily detected and suppressed. The OPRM System provides compliance with GDC 10 and GDC 12 by detecting the onset of oscillations and suppressing them by initiating a reactor scram. This assures that the MCPR safety limit will not be violated for anticipated oscillations.

The OPRM Instrumentation satisfies Criterion 3 of the NRC Policy Statement.

LCO

Four channels of the OPRM System are required to be OPERABLE to ensure that stability related oscillations are detected and suppressed prior to exceeding the MCPR safety limit. Only one of the two OPRM modules' period based detection algorithm is required for OPRM channel OPERABILITY. The minimum number of LPRMs required OPERABLE to maintain an OPRM channel OPERABLE is consistent with the minimum number of LPRMs required to maintain the APRM system OPERABLE per LCO 3.3.1.1.

(continued)

BASES

LCO (continued)

The Allowable Value for the OPRM Period Based Algorithm setpoint (Sp) is derived from the Analytic Limit corrected for instrument and calibration errors (Ref. 9 & 10).

APPLICABILITY

The OPRM instrumentation is required to be OPERABLE in order to detect and suppress neutron flux oscillations in the event of thermal-hydraulic instability. As described in References 1, 2, and 3, the power/core flow region protected against anticipated oscillations is defined by THERMAL POWER ≥ 30% RTP and core flow ≤ 60 Mlb/Hr. The OPRM trip is required to be enabled in this region, and the OPRM must be capable of enabling the trip function as a result of anticipated transients that place the core in that power/flow condition. Therefore, the OPRM is required to be OPERABLE with THERMAL POWER ≥ 25% RTP and at all core flows while above that THERMAL POWER. It is not necessary for the OPRM to be operable with THERMAL POWER < 25% RTP because transients from below this THERMAL POWER are not anticipated to result in power that exceeds 30% RTP.

ACTIONS

A Note has been provided to modify the ACTIONS related to the OPRM instrumentation channels. Section 1.3, Completion Times, specifies that once a Condition has been entered subsequent divisions, subsystems, components, or variables expressed in the Condition discovered to be inoperable or not within limits will not result in separate entry into the Condition. Section 1.3 also specifies that Required Actions of the Condition continue to apply for each additional failure with Completion Times based on initial entry into the Condition. However, the Required Actions for inoperable OPRM instrumentation channels provide appropriate compensatory measures for separate inoperable channels. As such, a Note has been provided that allows separate Condition entry for each inoperable OPRM instrumentation channel.

A1, A2 and A3

Because of the reliability and on-line self-testing of the OPRM instrumentation and the redundancy of the RPS design, an allowable out of service time of 30 days has been shown

BASES

ACTIONS

A1, A2 and A3 (continued)

to be acceptable (Ref. 7) to permit restoration of any inoperable channel to OPERABLE status. However, this out of service time is only acceptable provided the OPRM instrumentation still maintains OPRM trip capability (refer to Required Actions B.1 and B.2). The remaining OPERABLE OPRM channels continue to provide trip capability (see Condition B) and provide operator information relative to stability activity. The remaining OPRM modules have high reliability. With this high reliability, there is a low probability of a subsequent channel failure within the allowable out of service time. In addition, the OPRM modules continue to perform on-line self-testing and alert the operator if any further system degradation occurs.

If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the OPRM channel or associated RPS trip system must be placed in the tripped condition per Required Actions A.1 and A.2. Placing the inoperable OPRM channel in trip (or the associated RPS trip system in trip) would conservatively compensate for the inoperability, provide the capability to accommodate a single failure and allow operation to continue. Alternately, if it is not desired to place the OPRM channel (or RPS trip system) in trip (e.g., as in the case where placing the inoperable channel in trip would result in a full scram), the alternate method of detecting and suppression thermal hydraulic instability oscillations is required (Required Action A.3). This alternate method is described in Reference 5. It consists of increased operator awareness and monitoring for neutron flux oscillations when operating in the region where oscillations are possible. If indications of oscillation, as described in Reference 5 are observed by the operator, the operator will take the actions described by procedures which include initiating a manual scram of the reactor.

B.1 and B.2

Required action B.1 is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped OPRM channels within the same RPS trip system result in not maintaining OPRM trip capability. OPRM trip capability is

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

considered to be maintained when sufficient OPRM channels are OPERABLE or in trip (or the associated RPS trip system is in trip), such that a valid OPRM signal will generate a trip signal in both RPS trip systems (this would require both RPS trip systems to have at least one OPRM channel OPERABLE or the associated RPS trip system in trip).

Because of the low probability of the occurrence of an instability, 12 hours is an acceptable time to initiate the alternate method of detecting and suppression thermal hydraulic instability oscillations described in Action A.3 above. The alternate method of detecting and suppressing thermal hydraulic instability oscillations would adequately address detection and mitigation in the event of instability oscillations. Based on industry operating experience with actual instability oscillations, the operator would be able to recognize instabilities during this time and take action to suppress them through a manual scram. In addition, the OPRM System may still be available to provide alarms to the operator if the onset of oscillations were to occur. Since plant operation is minimized in areas where oscillations may occur, operation for 120 days without OPRM trip capability is considered acceptable with implementation of the alternate method of detecting and suppression thermal hydraulic instability oscillations.

C.1

With any Required Action and associated Completion Time not met, THERMAL POWER must be reduced to < 25% RTP within 4 hours. Reducing THERMAL POWER to < 25% RTP places the plant in a condition where instabilities are not likely to occur. The 4 hours is reasonable, based on operating experience, to reduce THERMAL POWER < 25% RTP from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.3.1.3.1

A CHANNEL FUNCTIONAL TEST is performed to ensure that the entire channel will perform the intended function. A Frequency of 184 days provides an acceptable level of system

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.3.1

average availability over the Frequency and is based on the reliability of the channel. (Ref. 7)

SR 3.3.1.3.2

LPRM gain settings are determined from the local flux profiles measured by the Traversing Incore Probe (TIP) System. This establishes the relative local flux profile for appropriate representative input to the OPRM System. The 1000 MWD/MT Frequency is based on operating experience with LPRM sensitivity changes.

SR 3.3.1.3.3

A CHANNEL CALIBRATION verifies that the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations. Calibration of the channel provides a check of the internal reference voltage and the internal processor clock frequency. It also compares the desired trip setpoints with those in processor memory. Since the OPRM is a digital system, the internal reference voltage and processor clock frequency are, in turn, used to automatically calibrate the internal analog to digital convertors. As noted, neutron detectors are excluded from CHANNEL CALIBRATION because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Changes in neutron detector sensitivity are compensated for by performing the 1000 MWD/MT LPRM calibration using the TIPs (SR 3.3.1.3.2).

The Frequency of 24 months is based upon the assumption of the magnitude of equipment drift provided by the equipment supplier. (Ref. 7)

SR 3.3.1.3.4

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required trip logic for a specific channel. The functional testing of control rods, in LCO

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.3.4 (continued)

3.1.3, "Control Rod OPERABILITY", and scram discharge volume (SDV) vent and drain valves, in LCO 3.1.8, "Scram Discharge Volume (SDV) Vent and Drain Valves", overlaps this Surveillance to provide complete testing of the assumed safety function. The OPRM self-test function may be utilized to perform this testing for those components that it is designed to monitor.

The 24 month Frequency is based on engineering judgement, reliability of the components and operating experience.

SR 3.3.1.3.5

This SR ensure that trips initiated from the OPRM System will not be inadvertently bypassed when THERMAL POWER is ≥ 30% RTP and core flow is ≤ 60 MLb/Hr. This normally involves calibration of the bypass channels. Adequate margins for the instrument setpoint methodology are incorporated into the actual setpoints (Reference 7).

If any bypass channel setpoint is nonconservative (i.e., the OPRM module is bypassed at ≥ 30% RTP and core flow is ≤ 60 MLB/Hr), then the affected OPRM module is considered inoperable. Alternatively, the bypassed channel can be manually placed in the conservative position (Manual Enable). If placed in the manual enable condition, this SR is met and the module is considered OPERABLE.

The 24 month Frequency is based on engineering judgment and reliability of the components.

SR 3.3.1.3.6

This SR ensure that the individual channel response times are less than or equal to the maximum values assumed in the safety analysis (Ref. 6) The OPRM self-test function may be utilized to perform this testing for those components it is designed to monitor. The LPRM amplifier cards inputting to the OPRM are excluded from the OPRM response time testing. The RPS RESPONSE TIME acceptance criteria are included in Reference 8.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.3.6 (continued)

As noted, neutron detectors are excluded from RPS RESPONSE TIME testing because the principles of detector operation virtually ensure an instantaneous response time. RPS RESPONSE TIME tests are conducted on an 24 month STAGGERED TEST BASIS. This Frequency is based upon operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequency occurrences.

REFERENCES

1. NEDO-31960-A, "BWR Owners Group Long-Term Stability Solutions Licensing Methodology", November 1995.

2. NEDO 31960-A, Supplement 1, "BWR Owners Group Long-Term Stability Solutions Licensing Methodology", November 1995.

3. NRC Letter, A. Thadani to L. A. England, "Acceptance for Referencing of Topical Reports NEDO-31960, Supplement 1, 'BWR Owners Group Long-Term Stability Solutions Licensing Methodology', July 12, 1994.

4. Generic Letter 94-02, "Long-Term Solutions and Upgrade of Interim Operating Recommendations for Thermal-Hydraulic Instabilities in Boiling Water Reactors", July 11, 1994.

5. BWROG Letter BWROG-9479, "Guidelines for Stability Interim Corrective Action", June 6, 1994.

6. NEDO-32465-A, "BWR Owners Group Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology and Reload Applications", August 1996.

7. CENPD-400-P-A, Rev. 01, "Generic Topical Report for the ABB Option III Oscillation Power Range Monitor (OPRM)", May 1995.

8. FSAR, Table 7.3-28.

(continued)

BASES

REFERENCES (continued)

9. NFE-1-11-003, "Unit 1 Cycle 11 Stability Option III Analyses"

10. EC-078-1010, "Oscillation Power Range Monitor (OPRM) Period Based Algorithm (Sp) Technical Specification Limit Value".

(continued)

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.1 Recirculation Loops Operating

BASES

BACKGROUND

The Reactor Coolant Recirculation System is designed to provide a forced coolant flow through the core to remove heat from the fuel. The forced coolant flow removes more heat from the fuel than would be possible with just natural circulation. The forced flow, therefore, allows operation at significantly higher power than would otherwise be possible. The recirculation system also controls reactivity over a wide span of reactor power by varying the recirculation flow rate to control the void content of the moderator. The Reactor Coolant Recirculation System consists of two recirculation pump loops external to the reactor vessel. These loops provide the piping path for the driving flow of water to the reactor vessel jet pumps. Each external loop contains one variable speed motor driven recirculation pump, a motor generator (MG) set to control pump speed and associated piping, jet pumps, valves, and instrumentation. The recirculation pump, piping, and valves are part of the reactor coolant pressure boundary and are located inside the drywell structure. The jet pumps are reactor vessel internals.

The recirculated coolant consists of saturated water from the steam separators and dryers that has been subcooled by incoming feedwater. This water passes down the annulus between the reactor vessel wall and the core shroud. A portion of the coolant flows from the vessel, through the two external recirculation loops, and becomes the driving flow for the jet pumps. Each of the two external recirculation loops discharges high pressure flow into an external manifold, from which individual recirculation inlet lines are routed to the jet pump risers within the reactor vessel. The remaining portion of the coolant mixture in the annulus becomes the suction flow for the jet pumps. This flow enters the jet pump at suction inlets and is accelerated by the driving flow. The drive flow and suction flow are mixed in the jet pump throat section. The total flow then passes through the jet pump diffuser section into the area below the core (lower plenum), gaining sufficient head in the process to drive the required flow upward through the core. The subcooled water enters the bottom of the fuel channels and contacts the fuel cladding, where heat

(continued)

BASES

BACKGROUND (continued)

is transferred to the coolant. As it rises, the coolant begins to boil, creating steam voids within the fuel channel that continue until the coolant exits the core. Because of reduced moderation, the steam voiding introduces negative reactivity that must be compensated for to maintain or to increase reactor power. The recirculation flow control allows operators to increase recirculation flow and sweep some of the voids from the fuel channel, overcoming the negative reactivity void effect. Thus, the reason for having variable recirculation flow is to compensate for reactivity effects of boiling over a wide range of power generation without having to move control rods and disturb desirable flux patterns.

Each recirculation loop is manually started from the control room. The MG set provides regulation of individual recirculation loop drive flows. The flow in each loop is manually controlled.

APPLICABLE SAFETY ANALYSES

The operation of the Reactor Coolant Recirculation System is an initial condition assumed in the design basis loss of coolant accident (LOCA) (Ref. 1). During a LOCA caused by a recirculation loop pipe break, the intact loop is assumed to provide coolant flow during the first few seconds of the accident. The initial core flow decrease is rapid because the recirculation pump in the broken loop ceases to pump reactor coolant to the vessel almost immediately. The pump in the intact loop coasts down relatively slowly. This pump coastdown governs the core flow response for the next several seconds until the jet pump suction is uncovered (Ref. 1). The analyses assume that both loops are operating at the same flow prior to the accident. However, the LOCA analysis was reviewed for the case with a flow mismatch between the two loops, with the pipe break assumed to be in the loop with the higher flow. While the flow coastdown and core response are potentially more severe in this assumed case (since the intact loop starts at a lower flow rate and the core response is the same as if both loops were operating at a lower flow rate), a small mismatch has been determined to be acceptable based on engineering judgement. The recirculation system is also assumed to have sufficient flow coastdown characteristics to maintain fuel thermal margins during abnormal operational transients (Ref. 2), which are analyzed in Chapter 15 of the FSAR.

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

Plant specific LOCA analyses have been performed assuming only one operating recirculation loop. These analyses have demonstrated that, in the event of a LOCA caused by a pipe break in the operating recirculation loop, the Emergency Core Cooling System response will provide adequate core cooling, provided that the LHGR limit for SPC 9x9-2 fuel and GE lead use assemblies and the APLHGR limit for SPC ATRIUM™-10 fuel is modified.

The transient analyses of Chapter 15 of the FSAR have also been performed for single recirculation loop operation and demonstrate sufficient flow coastdown characteristics to maintain fuel thermal margins during the abnormal operational transients analyzed provided the MCPR requirements are modified. During single recirculation loop operation, modification to the Reactor Protection System (RPS) average power range monitor (APRM) instrument setpoints is also required to account for the different relationships between recirculation drive flow and reactor core flow. The APLHGR, LHGR, and MCPR setpoints for single loop operation are specified in the COLR. The APRM flow biased simulated THERMAL POWER setpoint is in LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation." In addition, a restriction on recirculation pump speed is incorporated to address reactor vessel internals vibration concerns and assumptions in the event analysis.

Recirculation loops operating satisfies Criterion 2 of the NRC Policy Statement (Ref. 5).

LCO

Two recirculation loops are required to be in operation with their flows matched within the limits specified in SR 3.4.1.1 to ensure that during a LOCA caused by a break of the piping of one recirculation loop the assumptions of the LOCA analysis are satisfied. With the limits specified in SR 3.4.1.1 not met, the recirculation loop with the lower flow must be considered not in operation. With only one recirculation loop in operation, modifications to the required APLGHR limits (LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE"), LHGR limits (LCO 3.2.3, "LINEAR HEAT GENERATION RATE (LHGR)"), MCPR limits (LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)"), and APRM Flow Biased Simulated Thermal Power – High setpoint (LCO 3.3.1.1) may be applied to allow continued operation consistent with the

(continued)

BASES

LCO (continued)

safety analysis assumptions. Furthermore, restrictions are placed on recirculation pump speed to ensure the initial assumption of the event analysis are maintained.

The LCO is modified by a Note that allows up to 12 hours to establish the required limits and setpoints after a change from two recirculation loops operation to single recirculation loop operation. If the limits and setpoints are not in compliance with the applicable requirements at the end of the this period, the ACTIONS required by the applicable specifications must be implemented. This time is provided to stabilize operation with one recirculation loop by: limiting flow in the operating loop, limiting total THERMAL POWER; and, fully implementing and confirming the required limit and setpoint modifications.

APPLICABILITY

In MODES 1 and 2, requirements for operation of the Reactor Coolant Recirculation System are necessary since there is considerable energy in the reactor core and the limiting design basis transients and accidents are assumed to occur.

In MODES 3, 4, and 5, the consequences of an accident are reduced and the coastdown characteristics of the recirculation loops are not important.

ACTIONS

A.1

When operating with no recirculation loops operating in MODE 1, the potential for thermal-hydraulic oscillations is greatly increased. Although this transient is protected for expected modes of oscillation by the OPRM system, when operable per LCO 3.3.1.3 (References 3 and 4), the prudent response to the natural circulation condition is to preclude potential thermal-hydraulic oscillations by immediately placing the mode switch in the shutdown position.

B-1

Recirculation loop flow must match within required limits when both recirculation loops are in operation. If flow mismatch is not within required limits, matched flow must be restored within 2 hours. If matched flows are not restored,

(continued)

BASES

ACTIONS

B-1 (continued)

the recirculation loop with lower flow must be declared "not in operation." Should a LOCA occur with recirculation loop flow not matched, the core flow coastdown and resultant core response may not be bounded by the LOCA analyses. Therefore, only a limited time is allowed prior to imposing restrictions associated with single loop operation. Operation with only one recirculation loop satisfies the requirements of the LCO and the initial conditions of the accident sequence.

The 2 hour Completion Time is based on the low probability of an accident occurring during this time period, providing a reasonable time to complete the Required Action, and considering that frequent core monitoring by operators allows abrupt changes in core flow conditions to be quickly detected.

These Required Actions do not require tripping the recirculation pump in the lowest flow loop when the mismatch between total jet pump flows of the two loops is greater than the required limits. However, in cases where large flow mismatches occur, low flow or reverse flow can occur in the low flow loop jet pumps, causing vibration of the jet pumps. If zero or reverse flow is detected, the condition should be alleviated by changing recirculation pump speed to re-establish forward flow or by tripping the pump.

C.1

With no recirculation loops in operation while in MODE 2 or if after going to single loop operations the required limits and setpoints cannot be established, the plant must be brought to MODE 3, where the LCO does not apply within 12 hours. In this condition, the recirculation loops are not required to be operating because of the reduced severity of DBAs and minimal dependence on the recirculation loop coastdown characteristics. The allowed Completion Time of 12 hours is reasonable to reach MODE 3 from full power conditions in an orderly manner without challenging plant systems.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.4.1.1

This SR ensures the recirculation loops are within the allowable limits for mismatch. At low core flow (i.e., < 75 million lbm/hr), the MCPR requirements provide larger margins to the fuel cladding integrity Safety Limit such that the potential adverse effect of early boiling transition during a LOCA is reduced. A larger flow mismatch can therefore be allowed when core flow is < 75 million lbm/hr. The recirculation loop jet pump flow, as used in this Surveillance, is the summation of the flows from all of the jet pumps associated with a single recirculation loop.

The mismatch is measured in terms of core flow. If the flow mismatch exceeds the specified limits, the loop with the lower flow is considered inoperable. The SR is not required when both loops are not in operation since the mismatch limits are meaningless during single loop or natural circulation operation. The Surveillance must be performed within 24 hours after both loops are in operation. The 24 hour Frequency is consistent with the Surveillance Frequency for jet pump OPERABILITY verification and has been shown by operating experience to be adequate to detect off normal jet pump loop flows in a timely manner.

SR 3.4.1.2

As noted, this SR is only applicable when in single loop operation. This SR ensures the recirculation pump limit is maintained. The 24 hour Frequency is based on operating experience and the operators inherent knowledge of the current reactor status.

(continued)

BASES

REFERENCES

1. FSAR, Section 6.3.3.7.
2. FSAR, Section 5.4.1.4.
3. NEDO-31960-A "BWROG Long Term Stability Solutions Licensing Methodology," November, 1995.
4. NEDO-31960-A "BWROG Long Term Stability Solutsions Licensing Methodology, Supplement 1," November 1995.
5. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 39132).

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PP&L, INC.

ALLEGHENY ELECTRIC COOPERATIVE, INC.

DOCKET NO. 50-388

SUSQUEHANNA STEAM ELECTRIC STATION, UNIT 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 158
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 PP&L, Inc., dated August 5, 1998, and supplemented by letters dated November 23, 1998, and June 23, 1999, 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 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.158 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. PP&L shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of its date of issuance and is to be implemented within 30 days following startup from the Unit 1, eleventh Refueling Inspection Outage, currently scheduled for spring 2000.

FOR THE NUCLEAR REGULATORY COMMISSION

S. Singh Bajwa, Director
Project Directorate I-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical Specifications

Date of Issuance: July 30, 1999

ATTACHMENT TO LICENSE AMENDMENT NO. 158

FACILITY OPERATING LICENSE NO. NPF-22

DOCKET NO. 50-388

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

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3.3 INSTRUMENTATION

3.3.1.3 Oscillation Power Range Monitor (OPRM) Instrumentation

LCO 3.3.1.3 Four channels of the OPRM instrumentation shall be OPERABLE. Each OPRM channel Period Based Algorithm (Sp) Allowable Value shall be less than or equal to 1.10 at a confirmation count permissive (Np) of 10.

APPLICABILITY: Thermal Power ≥ 25% RTP.

ACTIONS:

------------------------------NOTE------------------------------

Separate Condition entry is allowed for each channel.

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. One or more required channels inoperable.	A.1	Place channel in trip.	30 days
	<u>OR</u>		
	A.2	Place associated RPS trip system in trip.	30 days
	<u>OR</u>		
	A.3	Initiate alternate method to detect and suppress thermal hydraulic instability oscillations.	30 days
B. OPRM trip capability not maintained.	B.1	Initiate alternate method to detect and suppress thermal hydraullic instability oscillations.	12 hours
	<u>AND</u>		
	B.2	Restore OPRM trip capability	120 days
C. Required Action and associated Completion Time not met.	C.1	Reduce THERMAL POWER < 25% RTP.	4 hours

SURVEILLANCE REQUIREMENTS

-----------------------------------NOTE-----------------------------------
When a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated Conditions and Required Actions may be delayed for up to 6 hours provided the OPRM System maintains trip capability.

SURVEILLANCE		FREQUENCY
SR 3.3.1.3.1	Perform CHANNEL FUNCTIONAL TEST.	184 days
SR 3.3.1.3.2	Calibrate the local power range monitors.	1000 MWD/MT average core exposure
SR 3.3.1.3.3	------------------NOTE------------------ Neutron detectors are excluded. -- Perform CHANNEL CALIBRATION.	24 months
SR 3.3.1.3.4	Perform LOGIC SYSTEM FUNCTIONAL TEST	24 months
SR 3.3.1.3.5	Verify OPRM is not bypassed when THERMAL POWER is ≥ 30% RTP and core flow ≤ 60 MLb/Hr.	24 months
SR 3.3.1.3.6	------------------NOTE------------------ Neutron detectors are excluded. -- Verify the RPS RESPONSE TIME is within limits.	24 months on a STAGGERED TEST BASIS

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.1 Recirculation Loops Operating

LCO 3.4.1 Two recirculation loops with matched flows shall be in operation.

<u>OR</u>

One recirculation loop may be in operation provided the following limits are applied when the associated LCO is applicable:

a. LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)," single loop operation limits specified in the COLR;

b. LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)," single loop operation limits specified in the COLR;

c. LCO 3.2.3, "LINEAR HEAT GENERATION RATE (LHGR)," single loop operation limits specified in the COLR, and

d. LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation," Function 2.b (Average Power Range Monitors Flow Biased Simulated Thermal Power—High), Allowable Value of Table 3.3.1.1-1 is reset for single loop operation.

e. Recirculation pump speed is ≤ 80%

--------------------------------------Note--------------------------------------

Required limit and setpoint resets for single recirculation loop operation may be delayed for up to 12 hours after transition from two recirculation loop operation to single recirculation loop operation.

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. No recirculation loops operating while in MODE 1	A.1 Place reactor mode switch in the shutdown position.	Immediately
B. Recirculation loop flow mismatch not within limits.	B.1 Declare the recirculation loop with lower flow to be "not in operation."	2 hours
C. No recirculation loops in operation while in MODE 2 <u>OR</u> Single Recirculation Loop required limits and setpoints not established within required time.	C.1 Be in MODE 3.	12 hours

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SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.1.1	-------------------NOTE------------------- Not required to be performed until 24 hours after both recirculation loops are in operation. -- Verify recirculation loop jet pump flow mismatch with both recirculation loops in operation is: a. ≤ 10 million lbm/hr when operating at < 75 million lbm/hr total core flow; and b. ≤ 5 million lbm/hr when operating at ≥ 75 million lbm/hr total core flow.	24 hours
SR 3.4.1.2	-------------------NOTE------------------- Only required to be met during single loop operations. -- Verify recirculation pump speed is within the limits specified in the LCO.	24 hours

(Figure 3.4.1-1)

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B 3.3 INSTRUMENTATION

B 3.3.1.3 Oscillation Power Range Monitor (OPRM)

BASES

BACKGROUND

General Design Criterion 10 (GDC 10) requires the reactor core and associated coolant, control, and protection system to be designed with appropriate margin to assure that acceptable fuel design limits are not exceeded during any condition of normal operation including the effects of anticipated operational occurrences. Additionally, GDC 12 requires the reactor core and associated coolant control and protection systems to be designed to assure that power oscillations which can result in conditions exceeding acceptable fuel design limits are either not possible or can be reliably and readily detected and suppressed. The OPRM System provides compliance with GDC 10 and GDC 12, thereby providing protection from exceeding the fuel MCPR safety limit.

References 1, 2, and 3 describe three separate algorithms for detecting stability related oscillations: the period based detection algorithm, the amplitude based algorithm, and the growth rate algorithm. The OPRM System hardware implements these algorithms in microprocessor based modules. These modules execute the algorithms based on LPRM inputs and generate alarms and trips based on these calculations. These trips result in tripping the Reactor Protection System (RPS) when the appropriate RPS trip logic is satisfied, as described in the Bases for LCO 3.3.1.1, "RPS Instrumentation." Only the period based detection algorithm is used in the safety analysis (Ref. 1, 2, 6 & 7). The remaining algorithms provide defense-in-depth and additional protection against unanticipated oscillations.

The period based detection algorithm detects a stability-related oscillation based on the occurrence of a fixed number of consecutive LPRM signal period confirmations followed by the LPRM signal amplitude exceeding a specified setpoint. Upon detection of a stability related oscillation, a trip is generated for that OPRM channel.

The OPRM System consists of four OPRM trip channels, each channel consisting of two OPRM modules. Each OPRM module receives input from LPRMs. Each OPRM module also receives

(continued)

BASES

BACKGROUND (continued)	input from the Neutron Monitoring System (NMS) average power range monitor (APRM) power and flow signals to automatically enable the trip function of the OPRM module. Each OPRM module is continuously tested by a self-test function. On detection of any OPRM module failure, either a trouble alarm or INOP alarm is activated. The OPRM module provides an INOP alarm when the self-test feature indicates that the OPRM module may not be capable of meeting its functional requirements.
APPLICABLE SAFETY ANALYSES	It has been shown that BWR cores may exhibit thermal-hydraulic reactor instabilities in high power and low flow portions of the core power to flow operating domain. GDC 10 requires the reactor core and associated coolant control and protection systems to be designed with appropriate margin to assure that acceptable fuel design limits are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences. GDC 12 requires assurance that power oscillations which can result in conditions exceeding acceptable fuel design limits are either not possible or can be reliably and readily detected and suppressed. The OPRM System provides compliance with GDC 10 and GDC 12 by detecting the onset of oscillations and suppressing them by initiating a reactor scram. This assures that the MCPR safety limit will not be violated for anticipated oscillations. The OPRM Instrumentation satisfies Criterion 3 of the NRC Policy Statement.
LCO	Four channels of the OPRM System are required to be OPERABLE to ensure that stability related oscillations are detected and suppressed prior to exceeding the MCPR safety limit. Only one of the two OPRM modules' period based detection algorithm is required for OPRM channel OPERABILITY. The minimum number of LPRMs required OPERABLE to maintain an OPRM channel OPERABLE is consistent with the minimum number of LPRMs required to maintain the APRM system OPERABLE per LCO 3.3.1.1.

(continued)

BASES

LCO (continued)

The Allowable Value for the OPRM Period Based Algorithm setpoint (Sp) is derived from the Analytic Limit corrected for instrument and calibration errors.

APPLICABILITY

The OPRM instrumentation is required to be OPERABLE in order to detect and suppress neutron flux oscillations in the event of thermal-hydraulic instability. As described in References 1, 2, and 3, the power/core flow region protected against anticipated oscillations is defined by THERMAL POWER ≥ 30% RTP and core flow ≤ 60 Mlb/Hr. The OPRM trip is required to be enabled in this region, and the OPRM must be capable of enabling the trip function as a result of anticipated transients that place the core in that power/flow condition. Therefore, the OPRM is required to be OPERABLE with THERMAL POWER ≥ 25% RTP and at all core flows while above that THERMAL POWER. It is not necessary for the OPRM to be operable with THERMAL POWER < 25% RTP because transients from below this THERMAL POWER are not anticipated to result in power that exceeds 30% RTP.

ACTIONS

A Note has been provided to modify the ACTIONS related to the OPRM instrumentation channels. Section 1.3, Completion Times, specifies that once a Condition has been entered subsequent divisions, subsystems, components, or variables expressed in the Condition discovered to be inoperable or not within limits will not result in separate entry into the Condition. Section 1.3 also specifies that Required Actions of the Condition continue to apply for each additional failure with Completion Times based on initial entry into the Condition. However, the Required Actions for inoperable OPRM instrumentation channels provide appropriate compensatory measures for separate inoperable channels. As such, a Note has been provided that allows separate Condition entry for each inoperable OPRM instrumentation channel.

A1, A2 and A3

Because of the reliability and on-line self-testing of the OPRM instrumentation and the redundancy of the RPS design, an allowable out of service time of 30 days has been shown

(continued)

BASES

ACTIONS

A1, A2 and A3 (continued)

to be acceptable (Ref. 7) to permit restoration of any inoperable channel to OPERABLE status. However, this out of service time is only acceptable provided the OPRM instrumentation still maintains OPRM trip capability (refer to Required Actions B.1 and B.2). The remaining OPERABLE OPRM channels continue to provide trip capability (see Condition B) and provide operator information relative to stability activity. The remaining OPRM modules have high reliability. With this high reliability, there is a low probability of a subsequent channel failure within the allowable out of service time. In addition, the OPRM modules continue to perform on-line self-testing and alert the operator if any further system degradation occurs.

If the inoperable channel cannot be restored to OPERABLE status within the allowable out of service time, the OPRM channel or associated RPS trip system must be placed in the tripped condition per Required Actions A.1 and A.2. Placing the inoperable OPRM channel in trip (or the associated RPS trip system in trip) would conservatively compensate for the inoperability, provide the capability to accommodate a single failure and allow operation to continue. Alternately, if it is not desired to place the OPRM channel (or RPS trip system) in trip (e.g., as in the case where placing the inoperable channel in trip would result in a full scram), the alternate method of detecting and suppression thermal hydraulic instability oscillations is required (Required Action A.3). This alternate method is described in Reference 5. It consists of increased operator awareness and monitoring for neutron flux oscillations when operating in the region where oscillations are possible. If indications of oscillation, as described in Reference 5 are observed by the operator, the operator will take the actions described by procedures which include initiating a manual scram of the reactor.

B.1 and B.2

Required action B.1 is intended to ensure that appropriate actions are taken if multiple, inoperable, untripped OPRM channels within the same RPS trip system result in not maintaining OPRM trip capability. OPRM trip capability is

(continued)

BASES

ACTIONS

B.1 and B.2 (continued)

considered to be maintained when sufficient OPRM channels are OPERABLE or in trip (or the associated RPS trip system is in trip), such that a valid OPRM signal will generate a trip signal in both RPS trip systems (this would require both RPS trip systems to have at least one OPRM channel OPERABLE or the associated RPS trip system in trip).

Because of the low probability of the occurrence of an instability, 12 hours is an acceptable time to initiate the alternate method of detecting and suppression thermal hydraulic instability oscillations described in Action A.3 above. The alternate method of detecting and suppressing thermal hydraulic instability oscillations would adequately address detection and mitigation in the event of instability oscillations. Based on industry operating experience with actual instability oscillations, the operator would be able to recognize instabilities during this time and take action to suppress them through a manual scram. In addition, the OPRM System may still be available to provide alarms to the operator if the onset of oscillations were to occur. Since plant operation is minimized in areas where oscillations may occur, operation for 120 days without OPRM trip capability is considered acceptable with implementation of the alternate method of detecting and suppression thermal hydraulic instability oscillations.

C.1

With any Required Action and associated Completion Time not met, THERMAL POWER must be reduced to < 25% RTP within 4 hours. Reducing THERMAL POWER to < 25% RTP places the plant in a condition where instabilities are not likely to occur. The 4 hours is reasonable, based on operating experience, to reduce THERMAL POWER < 25% RTP from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.3.1.3.1

A CHANNEL FUNCTIONAL TEST is performed to ensure that the entire channel will perform the intended function. A Frequency of 184 days provides an acceptable level of system

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.3.1.3.1

average availability over the Frequency and is based on the reliability of the channel. (Ref. 7)

SR 3.3.1.3.2

LPRM gain settings are determined from the local flux profiles measured by the Traversing Incore Probe (TIP) System. This establishes the relative local flux profile for appropriate representative input to the OPRM System. The 1000 MWD/MT Frequency is based on operating experience with LPRM sensitivity changes.

SR 3.3.1.3.3

A CHANNEL CALIBRATION verifies that the channel responds to the measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drifts between successive calibrations. Calibration of the channel provides a check of the internal reference voltage and the internal processor clock frequency. It also compares the desired trip setpoints with those in processor memory. Since the OPRM is a digital system, the internal reference voltage and processor clock frequency are, in turn, used to automatically calibrate the internal analog to digital convertors. As noted, neutron detectors are excluded from CHANNEL CALIBRATION because they are passive devices, with minimal drift, and because of the difficulty of simulating a meaningful signal. Changes in neutron detector sensitivity are compensated for by performing the 1000 MWD/MT LPRM calibration using the TIPs (SR 3.3.1.3.2).

The Frequency of 24 months is based upon the assumption of the magnitude of equipment drift provided by the equipment supplier. (Ref. 7)

SR 3.3.1.3.4

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required trip logic for a specific channel. The functional testing of control rods, in LCO

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.3.4 (continued)

3.1.3, "Control Rod OPERABILITY", and scram discharge volume (SDV) vent and drain valves, in LCO 3.1.8, "Scram Discharge Volume (SDV) Vent and Drain Valves", overlaps this Surveillance to provide complete testing of the assumed safety function. The OPRM self-test function may be utilized to perform this testing for those components that it is designed to monitor.

The 24 month Frequency is based on engineering judgement, reliability of the components and operating experience.

SR 3.3.1.3.5

This SR ensure that trips initiated from the OPRM System will not be inadvertently bypassed when THERMAL POWER is ≥ 30% RTP and core flow is ≤ 60 MLb/Hr. This normally involves calibration of the bypass channels. Adequate margins for the instrument setpoint methodology are incorporated into the actual setpoints (Reference 7).

If any bypass channel setpoint is nonconservative (i.e., the OPRM module is bypassed at ≥ 30% RTP and core flow is ≤ 60 MLB/Hr), then the affected OPRM module is considered inoperable. Alternatively, the bypassed channel can be manually placed in the conservative position (Manual Enable). If placed in the manual enable condition, this SR is met and the module is considered OPERABLE.

The 24 month Frequency is based on engineering judgment and reliability of the components.

SR 3.3.1.3.6

This SR ensure that the individual channel response times are less than or equal to the maximum values assumed in the safety analysis (Ref. 6) The OPRM self-test function may be utilized to perform this testing for those components it is designed to monitor. The LPRM amplifier cards inputting to the OPRM are excluded from the OPRM response time testing. The RPS RESPONSE TIME acceptance criteria are included in Reference 8.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.3.6 (continued)

As noted, neutron detectors are excluded from RPS RESPONSE TIME testing because the principles of detector operation virtually ensure an instantaneous response time. RPS RESPONSE TIME tests are conducted on an 24 month STAGGERED TEST BASIS. This Frequency is based upon operating experience, which shows that random failures of instrumentation components causing serious response time degradation, but not channel failure, are infrequency occurrences.

REFERENCES

1. NEDO-31960-A, "BWR Owners Group Long-Term Stability Solutions Licensing Methodology", November 1995.

2. NEDO 31960-A, Supplement 1, "BWR Owners Group Long-Term Stability Solutions Licensing Methodology", November 1995.

3. NRC Letter, A. Thadani to L. A. England, "Acceptance for Referencing of Topical Reports NEDO-31960, Supplement 1, 'BWR Owners Group Long-Term Stability Solutions Licensing Methodology', July 12, 1994.

4. Generic Letter 94-02, "Long-Term Solutions and Upgrade of Interim Operating Recommendations for Thermal-Hydraulic Instabilities in Boiling Water Reactors", July 11, 1994.

5. BWROG Letter BWROG-9479, "Guidelines for Stability Interim Corrective Action", June 6, 1994.

6. NEDO-32465-A, "BWR Owners Group Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology and Reload Applications", August 1996.

7. CENPD-400-P-A, Rev. 01, "Generic Topical Report for the ABB Option III Oscillation Power Range Monitor (OPRM)", May 1995.

8. FSAR, Table 7.3-28.

(continued)

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.1 Recirculation Loops Operating

BASES

BACKGROUND

The Reactor Coolant Recirculation System is designed to provide a forced coolant flow through the core to remove heat from the fuel. The forced coolant flow removes more heat from the fuel than would be possible with just natural circulation. The forced flow, therefore, allows operation at significantly higher power than would otherwise be possible. The recirculation system also controls reactivity over a wide span of reactor power by varying the recirculation flow rate to control the void content of the moderator. The Reactor Coolant Recirculation System consists of two recirculation pump loops external to the reactor vessel. These loops provide the piping path for the driving flow of water to the reactor vessel jet pumps. Each external loop contains one variable speed motor driven recirculation pump, a motor generator (MG) set to control pump speed and associated piping, jet pumps, valves, and instrumentation. The recirculation pump, piping, and valves are part of the reactor coolant pressure boundary and are located inside the drywell structure. The jet pumps are reactor vessel internals.

The recirculated coolant consists of saturated water from the steam separators and dryers that has been subcooled by incoming feedwater. This water passes down the annulus between the reactor vessel wall and the core shroud. A portion of the coolant flows from the vessel, through the two external recirculation loops, and becomes the driving flow for the jet pumps. Each of the two external recirculation loops discharges high pressure flow into an external manifold, from which individual recirculation inlet lines are routed to the jet pump risers within the reactor vessel. The remaining portion of the coolant mixture in the annulus becomes the suction flow for the jet pumps. This flow enters the jet pump at suction inlets and is accelerated by the driving flow. The drive flow and suction flow are mixed in the jet pump throat section. The total flow then passes through the jet pump diffuser section into the area below the core (lower plenum), gaining sufficient head in the process to drive the required flow upward through the core. The subcooled water enters the bottom of the fuel channels and contacts the fuel cladding, where heat

(continued)

BASES

BACKGROUND (continued)	is transferred to the coolant. As it rises, the coolant begins to boil, creating steam voids within the fuel channel that continue until the coolant exits the core. Because of reduced moderation, the steam voiding introduces negative reactivity that must be compensated for to maintain or to increase reactor power. The recirculation flow control allows operators to increase recirculation flow and sweep some of the voids from the fuel channel, overcoming the negative reactivity void effect. Thus, the reason for having variable recirculation flow is to compensate for reactivity effects of boiling over a wide range of power generation without having to move control rods and disturb desirable flux patterns. Each recirculation loop is manually started from the control room. The MG set provides regulation of individual recirculation loop drive flows. The flow in each loop is manually controlled.
APPLICABLE SAFETY ANALYSES	The operation of the Reactor Coolant Recirculation System is an initial condition assumed in the design basis loss of coolant accident (LOCA) (Ref. 1). During a LOCA caused by a recirculation loop pipe break, the intact loop is assumed to provide coolant flow during the first few seconds of the accident. The initial core flow decrease is rapid because the recirculation pump in the broken loop ceases to pump reactor coolant to the vessel almost immediately. The pump in the intact loop coasts down relatively slowly. This pump coastdown governs the core flow response for the next several seconds until the jet pump suction is uncovered (Ref. 1). The analyses assume that both loops are operating at the same flow prior to the accident. However, the LOCA analysis was reviewed for the case with a flow mismatch between the two loops, with the pipe break assumed to be in the loop with the higher flow. While the flow coastdown and core response are potentially more severe in this assumed case (since the intact loop starts at a lower flow rate and the core response is the same as if both loops were operating at a lower flow rate), a small mismatch has been determined to be acceptable based on engineering judgement. The recirculation system is also assumed to have sufficient flow coastdown characteristics to maintain fuel thermal margins during abnormal operational transients (Ref. 2), which are analyzed in Chapter 15 of the FSAR.

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

Plant specific LOCA analyses have been performed assuming only one operating recirculation loop. These analyses have demonstrated that, in the event of a LOCA caused by a pipe break in the operating recirculation loop, the Emergency Core Cooling System response will provide adequate core cooling, provided that the LHGR limit for SPC 9x9-2 fuel and GE lead use assemblies and the APLHGR limit for SPC ATRIUM™-10 fuel is modified.

The transient analyses of Chapter 15 of the FSAR have also been performed for single recirculation loop operation and demonstrate sufficient flow coastdown characteristics to maintain fuel thermal margins during the abnormal operational transients analyzed provided the MCPR requirements are modified. During single recirculation loop operation, modification to the Reactor Protection System (RPS) average power range monitor (APRM) instrument setpoints is also required to account for the different relationships between recirculation drive flow and reactor core flow. The APLHGR, LHGR and MCPR setpoints for single loop operation are specified in the COLR. The APRM flow biased simulated THERMAL POWER setpoint is in LCO 3.3.1.1, "Reactor Protection System (RPS) Instrumentation." In addition, a restriction on recirculation pump speed is incorporated to address Reactor Vessel Internals vibration concerns and assumptions in the event analysis.

Recirculation loops operating satisfies Criterion 2 of the NRC Policy Statement (Ref. 5).

LCO

Two recirculation loops are required to be in operation with their flows matched within the limits specified in SR 3.4.1.1 to ensure that during a LOCA caused by a break of the piping of one recirculation loop the assumptions of the LOCA analysis are satisfied. With the limits specified in SR 3.4.1.1 not met, the recirculation loop with the lower flow must be considered not in operation. With only one recirculation loop in operation, modifications to the required APLHGR limits (LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE"), LHGR limits (LCO 3.2.3, "LINEAR HEAT GENERATION RATE (LHGR)"), MCPR limits (LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)"), and APRM Flow Biased Simulated Thermal Power—High setpoint (LCO 3.3.1.1) may be applied to allow continued operation consistent with the safety analysis assumptions. Furthermore, restrictions are

(continued)

BASES

LCO (continued)

placed on recirculation pump speed to assure the initial assumptions of the event analysis are maintained.

The LCO is modified by a Note that allows up to 12 hours to establish the required limits and setpoints after a change from two recirculation loops operation to single recirculation loop operation. If the limits and setpoints are not in compliance with the applicable requirements at the end of this period, the ACTIONS required by the applicable specifications must be implemented. This time is provided to stabilize operation with one recirculation loop by: limiting flow in the operating loop, limiting total THERMAL POWER; and, fully implementing and confirming the required limit and setpoint modifications.

APPLICABILITY

In MODES 1 and 2, requirements for operation of the Reactor Coolant Recirculation System are necessary since there is considerable energy in the reactor core and the limiting design basis transients and accidents are assumed to occur.

In MODES 3, 4, and 5, the consequences of an accident are reduced and the coastdown characteristics of the recirculation loops are not important.

ACTIONS

A.1

When operating with no recirculation loops operating in MODE 1, the potential for thermal-hydraulic oscillations is greatly increased. Although this transient is protected for expected modes of oscillation by the OPRM system, when operable per LCO 3.3.1.3 (References 3 and 4), the prudent response to the natural circulation condition is to preclude potential thermal-hydraulic oscillations by immediately placing the mode switch in the shutdown position.

ACTIONS (continued)

B.1

Recirculation loop flow must match within required limits when both recirculation loops are in operation. If flow mismatch is not within required limits, matched flow must be restored within 2 hours. If matched flows are not restored, the recirculation loop with lower flow must be declared "not

(continued)

BASES

in operation." Should a LOCA occur with recirculation loop flow not matched, the core flow coastdown and resultant core response may not be bounded by the LOCA analyses. Therefore, only a limited time is allowed prior to imposing restrictions associated with single loop operation. Operation with only one recirculation loop satisfies the requirements of the LCO and the initial conditions of the accident sequence.

The 2 hour Completion Time is based on the low probability of an accident occurring during this time period, providing a reasonable time to complete the Required Action, and considering that frequent core monitoring by operators allows abrupt changes in core flow conditions to be quickly detected.

These Required Actions do not require tripping the recirculation pump in the lowest flow loop when the mismatch between total jet pump flows of the two loops is greater than the required limits. However, in cases where large flow mismatches occur, low flow or reverse flow can occur in the low flow loop jet pumps, causing vibration of the jet pumps. If zero or reverse flow is detected, the condition should be alleviated by changing recirculation pump speed to re-establish forward flow or by tripping the pump.

C.1

With no recirculation loops in operation while in MODE 2 or if after going to single loop operations the required limits and setpoints cannot be established, the plant must be brought to MODE 3, where the LCO does not apply within 12 hours. In this condition, the recirculation loops are not required to be operating because of the reduced severity of DBAs and minimal dependence on the recirculation loop coastdown characteristics. The allowed Completion Time of 12 hours is reasonable to reach MODE 3 from full power conditions in an orderly manner without challenging plant systems.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.4.1.1

This SR ensures the recirculation loops are within the allowable limits for mismatch. At low core flow (i.e., < 75 million lbm/hr), the MCPR requirements provide larger margins to the fuel cladding integrity Safety Limit such that the potential adverse effect of early boiling transition during a LOCA is reduced. A larger flow mismatch can therefore be allowed when core flow is < 75 million lbm/hr. The recirculation loop jet pump flow, as used in this Surveillance, is the summation of the flows from all of the jet pumps associated with a single recirculation loop.

The mismatch is measured in terms of core flow. If the flow mismatch exceeds the specified limits, the loop with the lower flow is considered inoperable. The SR is not required when both loops are not in operation since the mismatch limits are meaningless during single loop or natural circulation operation. The Surveillance must be performed within 24 hours after both loops are in operation. The 24 hour Frequency is consistent with the Surveillance Frequency for jet pump OPERABILITY verification and has been shown by operating experience to be adequate to detect off normal jet pump loop flows in a timely manner.

SR 3.4.1.2

As noted, this SR is only applicable when in single loop operation. This SR ensures the recirculation pump limit is maintained. The 24 hour Frequency is based on operating experience and the operators inherent knowledge of the current reactor status.

(continued)

BASES

REFERENCES

1. FSAR, Section 6.3.3.7.

2. FSAR, Section 5.4.1.4.

3. NEDO-31960-A "BWROG Long Term Stability Solutions Licensing Methodology," November, 1995.

4. NEDO-31960-A "BWROG Long Term Stability Solutions Licensing Methodology, Supplement 1," November 1995.

5. Final Policy Statement on Technical Specifications Improvements, July 22, 1993 (58 FR 39132).

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 184 TO FACILITY OPERATING LICENSE NO. NPF-14

AMENDMENT NO. 158 TO FACILITY OPERATING LICENSE NO. NPF-22

PP&L, INC.

ALLEGHENY ELECTRIC COOPERATIVE, INC.

SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2

DOCKET NOS. 50-387 AND 388

1.0 INTRODUCTION

By letters dated June 19, 1998 (Unit 1), August 5, 1998 (Unit 2), November 23, 1998 (Units 1 and 2), and June 23, 1999, PP&L, Inc. (the licensee) proposed license amendments to change the Technical Specifications (TSs) for Susquehanna Steam Electric Station (SSES), Units 1 & 2. The proposed amendments incorporate long-term power stability solution instrumentation into the SSES Units 1 and 2, TSs. The changes reflect the addition of a new TS Section 3.3.1.3, "Oscillation Power Range Monitoring (OPRM) Instrumentation," and revisions to TS Section 3.4.1, "Recirculation Loops Operating," to remove specifications related to the current power stability specifications that will no longer be required. The November 23, 1998, and June 23, 1999, letters provided clarifying information that did not change the initial proposed no significant hazards consideration determination or expand the scope of the amendment request. The revised index pages for the Unit 2 TS issued with this amendment are renumbered to start at i instead of iii.

2.0 SYSTEM DESCRIPTION

The digital-based OPRM described in ABB Combustion Engineering (ABB CE) topical report CENPD-400-P, "Generic Topical Report for the ABB Option III Oscillation Power Range Monitor (OPRM)," detects and suppresses reactor core power instabilities using the Option III approach described in NEDO-31960, "BWR Owners' Group Long-Term Stability Solutions Licensing Methodology," dated June 1991, and NEDO-31960, Supplement 1, dated March 1992, which were approved by the staff in safety evaluations dated July 12, 1993. Using existing local power range monitors (LPRMs) and reactor core recirculation flow instrumentation, the OPRM provides independent oscillation detection algorithm (ODA) trip function outputs to the original reactor protection system (RPS) interface relays.

The OPRM consists of four independent channels, one per RPS channel. Each OPRM channel consists of two modules, either of which can generate a channel trip signal. This configuration provides redundancy between OPRM channels and within each OPRM channel.

Each OPRM module receives signals from dedicated LPRMs, and provides LPRM signals to the other module in its channel through a fiber optic data link. The OPRM module combines the locally wired LPRM signals with the shared LPRM signals to create LPRM cells that represent the neutron flux distribution in the reactor core. A microprocessor in each module uses these cells of LPRM signals to calculate the trip function values with the ODAs described in NEDO-31960 and NEDO-31960, Supplement 1.

One OPRM module is installed in each LPRM page in the existing space in the LPRM amplifier card frame (An LPRM page is a collection of components in the power range monitoring cabinets which contains LPRM amplifier cards, wiring, and supporting electronics on a hinged assembly that allows access to the wiring and components behind the assembly). Except for unassigned LPRM pages, there is one LPRM page per average power range monitor (APRM) set. The OPRM module will be connected to the APRM power and flow signals and the LPRM flux amplifier card outputs in its page.

In the Operate mode, the OPRM module performs the three diverse ODA calculations, runs self-tests, services the interpage data link, broadcasts channel information on the maintenance and plant computer data links, and provides annunciator indications to the main control room panel. The Trip output is automatically armed (Trip Enable) when the programmed high APRM power and low core flow setpoints are reached.

The OPRM monitors the number of available and on-scale LPRMs and flags an LPRM cell as not valid if a sufficient number of LPRMs are not available or are not on-scale. When Trip Enabled is armed, an alert to the operator of a Trouble condition results. If no LPRM cells are valid, an inoperable (INOP) alarm is generated. Trouble and INOP conditions caused by an insufficient number of LPRMs will not cause a reactor trip when at power. This design feature is acceptable because technical specification APRM limiting conditions for operation are intended to ensure that an APRM trip will occur if a sufficient number of LPRMs are not available. Additionally, regional core oscillations do not occur during low power operation when LPRMs are frequently out of range (and the corresponding LPRM cells are not valid). The OPRM Trip module relays and INOP module relays will change state upon loss of power or when an OPRM module is physically removed from the chassis.

The OPRM protection system provides the following control board annunciator outputs to the SSES control room operator:

- Trip Enable (the OPRM is armed)
- Alarm (one or more cells calculating the period based algorithm have reached the pre-trip setpoint),
- Trip (one or more cells have tripped),
- INOP (the OPRM module may not be performing the ODA function),
- TROUBLE (the OPRM module is performing the ODA function but requires operator attention).

A design option is available to the licensee to provide the operator with the above information through the plant process computer via a one-way data link. The above indications are also available at the OPRM module, where they remain latched until manually reset.

A keyswitch on each OPRM module panel provides the operator with administrative control of the OPRM operating modes. The position of the keyswitch determines whether the OPRM module is in the Test or Operate mode. The keyswitch in the Test position and entry of an OPRM access password are required to make configuration changes or perform surveillance tests.

While in the Operate mode, the OPRM module unidirectionally transmits LPRM and ODA status information to the maintenance terminal and plant computer fiber optic data links. This transmission occurs even when the maintenance terminal and plant computer are not connected or installed to the OPRM module panel. A 20-minute event recall buffer in each OPRM module saves trip-related data for further analysis. The event recall buffer data may be downloaded to the maintenance terminal or plant computer when the OPRM module is in the Test mode.

The OPRM module consists of a metal enclosure (which provides shielding against electromagnetic interference) with a removable circuit card assembly. The metal enclosure is permanently mounted in the card file of the APRM or LPRM page. Digital isolators and relays mounted remote from the OPRM provide isolation and fault protection for the OPRM digital inputs and outputs. OPRM module repair is limited to module replacement.

The OPRM chassis connects to the LPRMs, the APRM power signal, the total flow signal, digital input signals, relays, power, and ground through a prefabricated pigtail connector. OPRM modules are connected in pairs via fiber optic data links to ensure isolation between APRM/LPRM groups.

3.0 EVALUATION

As stated in the staff's safety evaluation report (SER) that approved ABB CE topical report CENPD-400-P, "Generic Topical Report for the ABB Option III Oscillation Power Range Monitor (OPRM)," licensees referencing the topical report for implementation of the OPRM should provide the following information in their license amendment submittals:

1) Confirm the applicability of CENPD-400-P, including clarifications and reconciled differences between the specific plant design and the topical report design descriptions.
2) Confirm the applicability of Boiling Water Reactor Owners Group topical reports that address the OPRM and associated instability functions, set points and margins.
3) Provide a plant-specific Technical Specification (TS) for the OPRM functions consistent with CENPD-400-P, Appendix A.
4) Confirm that the plant-specific environmental (temperature, humidity, radiation, electromagnetic and seismic) conditions are enveloped by the OPRM equipment environmental qualification values.
5) Confirm that administrative controls are provided for manually bypassing OPRM channels or protective functions, and for controlling access to the OPRM functions.
6) Confirm that any changes to the plant operator's main control room panel have received human factors reviews per plant-specific procedures.

3.1 Applicability of the ABB Option III OPRM Design to the Plant Design

The staff compared the applicable SSES design features with the corresponding design features in CENPD-400-P, Appendix A (CENPD-400-P-A). The SSES units are General Electric/Boiling Water Reactor, GE BWR/4s; a BWR design addressed in CENPD-400-P-A. The OPRMs are installed consistent with the system description provided in Section 2, above. The only SSES deviation from the system description provided in Section 2 above, is that indications of Trouble conditions (the OPRM module is performing the ODA function but requires operator attention), are provided to the operators via the plant integrated computer system (PICSY), and are also indicated locally at the OPRM installed location. This optional display output was found acceptable in the SER approving CENPD-400-P-A. The staff, therefore, finds that the OPRM design is applicable to SSES.

3.2 Power Instability Functions, Set Points, and Margins

The licensee tested the OPRM, including the adequacy of the setpoint values and margins during the first fuel cycle of OPRM operation. At the end of the testing period, the licensee developed setpoints and margins that will be incorporated into the limiting conditions for operation portion of the SSES TSs. These setpoints will be consistent with the guidelines in NEDO-31960 and NEDO-31960, Supplement 1.

3.3 Plant-Specific Revised TSs

The following section describes the licensee's proposed TS amendments and the NRC staff's evaluation of each proposed change.

3.3.1 Addition of TS 3.3.1.3, Oscillation Power Range Monitor (OPRM) Instrumentation, Limiting Condition for Operation (LCO) 3.3.1.3, Conditions, Required Actions, and Completion Times

The licensee added the Period Based Algorithm setpoint and confirmation count permissive values to LCO 3.3.1.3. The Conditions, Required Actions, and Completion Times of LCO 3.3.1.3 are consistent with CENPD-400-P-A.

3.3.2 Addition of TS 3.3.1.3, Oscillation Power Range Monitor (OPRM) Instrumentation, LCO 3.3.1.3, Surveillance Requirements (SRs)

In SR 3.3.1.3.5, the licensee revised the minimum core flow requirement from 60% of rated recirculation drive flow to 60 MLb/Hr. The value used by the licensee is consistent with the existing TS limits, as defined in Figure 3.4.1-1, which have been used by the licensee in the existing interim corrective actions. The staff, therefore, finds this deviation from CENPD-400-P-A to be acceptable. The remainder of TS 3.3.1.3 SRs are consistent with CENPD-400-P-A.

3.3.3 Proposed Changes to TS Bases Section B.3.3.1.3, Oscillation Power Range Monitor (OPRM)

The TS 3.3.1.3 Bases are consistent with CENPD-400-P-A.

3.3.4 Changes made to Section 3.4

The changes made to Section 3.4 of the TSs are intended to reflect the fact that the Long Term Stability Option III allows operation without the need for restricted regions defined on the power-to-flow map. The restricted regions were intended to ensure that the plant did not have instability by avoiding operation in regions where instabilities were credible. The OPRM in Option III provides an automatic stability detection and suppression capability which provides better protection than the restricted regions. Figure 3.4.1.1-1 defines the restricted regions currently in use at SSES. Figure 3.4.4-1 and any references to it are, therefore, being deleted. The remainder of the TS is unchanged including the requirement to immediately shutdown the plant if no recirculation pumps are operating.

Figure 3.4.1-1 is deleted. This figure defined regions which were to be avoided to ensure that the plant did not exhibit unstable behavior. These regions are no longer needed because the OPRM system automatically detects instabilities and will provide at least the same level of protection as that provided by the Regions defined in Figure 3.4.1-1.

Reference to Figure 3.4.1-1 is removed from two locations in the statement of the LCO of TS 3.4.1. This change is acceptable because these references are no longer needed.

Reference to Region I on Figure 3.4.1–1 is removed from Action A of TS 3.4.1. This reference required immediate reactor shutdown if the combined core thermal power/core flow fall within the area designated as "Region 1" on Figure 3.4.1-1. This action is no longer required since the OPRM provides automatic protection against Region I instabilities.

Action B of TS 3.4.1 is deleted. Action B was used to ensure that an oscillation could be properly detected and that, once detected, appropriate action was taken. These functions are now being performed by the automatic OPRM system included in Option III. Therefore, this action is no longer needed.

Action C of TS 3.4.1 is deleted. Action C ensured that the plant was not operated in Region II of Figure 3.4.1-1. This action is no longer needed because the figure is being deleted.

SR 3.4.1.2 is deleted. This SR ensured that the plant was operated outside of Regions I and II on Figure 3.4.1-1. This SR is no longer needed.

3.4 Plant-Specific Environmental Conditions

The licensee states that the OPRM components, including modules, digital isolator blocks, external relay boards, analog signal isolators, replacement power supplies and voltage regulators, and additional mounting hardware and separation barriers are accounted for in approved Seismic Qualification data file records. The licensee reviewed the effect of the additional OPRM equipment on the seismic qualification of the Power Range Neutron Monitoring System Panel and approved the qualification in accordance with the requirements of the licensee's design control program. These actions for seismic qualification are acceptable to the staff.

In Table 1 below, the SSES plant-specific environmental conditions at the OPRM installation location for temperature, humidity, pressure, and radiation are compared to the OPRM environmental qualification values. As shown in Table 1, the generic OPRM qualification values envelope the SSES temperature and radiation environmental conditions and, therefore, are acceptable.

The generic OPRM qualification values for humidity do not envelope the SSES environmental conditions (low humidity limit). The licensee states that operation at humidity levels lower than 40% are justified because all OPRM circuit cards are coated with CONAP or an acrylic urethane, which isolates the electronic equipment from direct contact with a low humidity environment and thereby addresses the primary concern of damage from electrostatic discharges, which can occur in low humidity conditions. The staff finds this justification for the lower humidity limit to be consistent with guidance for protection against electrostatic discharge and, therefore, acceptable.

-Table 1. Comparison of SSES Environmental Conditions with OPRM Environmental Qualification Values

	SSES	OPRM
Temperature	15.6°C to 32.2°C (60°F to 90°F)	4.4°C to 48.9°C (40°F to 120°F)
Humidity	10% to 60% RH	40% to 95% RH
Radiation	1.8 Gy TID	100 Gy (Co-60 γ) TID

CENPD-400-P-A states that the addition of the new OPRM equipment and plant modifications for its installation should not produce unacceptable levels of noise emissions (electromagnetic interference) that could adversely affect adjacent equipment, or the licensee is to take action to prevent these emissions from reaching potentially sensitive equipment in the area of the OPRM installation. These measures apply for both noise susceptibility and emissions. The staff finds that the licensee's evaluation of the electromagnetic interference (EMI) environment and the measures taken to shield surrounding equipment in order to reduce adverse EMI affects in the OPRM installation meets the staff guidance in Standard Review Plan Chapter 7 on EMI qualification, and therefore, they are acceptable.

3.5 Administrative controls

In the SER for CENPD-400-P-A, the staff found the OPRM design features that control access to setpoint adjustments, calibrations, and test points to be acceptable. The licensee states that administrative procedures will provide controls for manually bypassing OPRM channels or protective functions when making setpoint adjustments and calibrations and will control access to the bypass controls. These activities are acceptable to the staff.

3.6 Confirmation of Human Factors Review

The licensee stated that the addition of the OPRM system annunciation windows to the indication panel did not require changes to this panel beyond the activation of existing annunciation windows and etching of the activated windows with the specific OPRM alarmed condition (e.g., 'Bypass/INOP,' 'Trip Enable,' 'Alarm'). The licensee further stated that the changes were in accordance with the SSES human factors manual. The staff finds this acceptable.

4.0 SUMMARY

Based on the above review and justifications for TS changes, the staff concludes that the licensee's OPRM implementation and associated proposed TS changes are consistent with the staff SER approving CENDP-400-P and appropriate guidance for design of digital instrumentation and control system modifications, and therefore, are acceptable.

5.0 STATE CONSULTATION

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

6.0 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 the 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 (63 FR 43210 and 63 FR 45528). Accordingly, the amendments meet 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.

7.0 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.

Principal Contributor: M. Waterman

Date: July 30, 1999