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PSEG
Nuclear LLC

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United States Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Gentlemen:

REQUEST FOR CHANGE TO TECHNICAL SPECIFICATIONS
OSCILLATION POWER RANGE MONITOR (OPRM)
HOPE CREEK GENERATING STATION
FACILITY OPERATING LICENSE NPF-57
DOCKET NO. 50-354

In accordance with 10CFR50.90, PSEG Nuclear LLC Company hereby requests a revision to the Technical Specifications (TS) for the Hope Creek Generating Station (HC). In accordance with 10CFR50.91(b)(1), a copy of this submittal has been sent to the State of New Jersey.

The proposed changes revise the Technical Specifications to include the Oscillation Power Range Monitor (OPRM) system. Similar submittals have been made by Pennsylvania Power and Light for Susquehanna (November 3, 1998) and the Tennessee Valley Authority for Browns Ferry Unit 2 (September 8, 1998). The OPRM, which was installed at Hope Creek during the seventh refueling outage, is being operated in the "indicate only" mode to evaluate the system's performance. PSEG Nuclear plans to fully enable the OPRM trip function during Hope Creek's tenth refueling outage (RF10), which is currently scheduled for the Fall of 2001. Hence in preparation for this action, we are providing proposed TS for the operation of the OPRM system. Hope Creek will continue to operate with the interim corrective actions (ICAs) described in our response to Generic Letter 94-02 until the OPRM trip function is enabled and revised Technical Specifications are implemented. With the activation of the OPRM, PSEG Nuclear considers that commitments in response to Generic Letter 94-02 are fulfilled for Hope Creek.

The proposed changes have been evaluated in accordance with 10CFR50.91(a)(1), using the criteria in 10CFR50.92(c), and a determination has been made that this request involves no significant hazards considerations. The basis for the requested

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change is provided in Attachment 1 to this letter. A 10CFR50.92 evaluation, with a determination of no significant hazards consideration, and a statement of environmental considerations is provided in Attachment 2. The marked up and new Technical Specification pages affected by the proposed changes are provided in Attachment 3. Attachment 4 describes the degree to which the Hope Creek design and implementation conforms to the applicable NRC accepted generic topical reports and associated NRC safety evaluation reports.

Upon NRC approval of this proposed change, PSEG Nuclear requests that the amendment be made effective immediately and be implemented prior to exceeding 25% rated thermal power during return to power from the tenth refueling outage (RF10). Based on the current date for RF10 and in order to provide sufficient time for associated administrative activities we would like to receive the amendment by October 15, 2001.

Should you have any questions regarding this request, please contact Mr. Paul Duke at 856-339-1466.

Sincerely,

Mark B. Bezilla
Vice President – Technical Support

Affidavit
Attachments (4)

C Mr. H. Miller, Administrator - Region I
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REF: LRN-00-0429
LCR H00-07

STATE OF NEW JERSEY)
) SS.
COUNTY OF SALEM)

Mark B. Bezilla, being duly sworn according to law deposes and says:

I am Vice President – Technical Support of PSEG Nuclear LLC, and as such, I find the matters set forth in the above referenced letter, concerning Hope Creek Generating Station, Unit 1, are true to the best of my knowledge, information and belief.

Subscribed and Sworn to before me
this 29 day of Nov, 2000

Notary Public of New Jersey

My Commission expires on

SHERI L. HUSTON
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires 12/08/2003

HOPE CREEK GENERATING STATION
FACILITY OPERATING LICENSE NPF-57
DOCKET NO. 50-354
REVISIONS TO THE TECHNICAL SPECIFICATIONS (TS)

BASIS FOR REQUESTED CHANGE

PSEG Nuclear LLC, under Facility Operating License No. NPF-57 for the Hope Creek Generating Station, requests that the Technical Specifications (TS) contained in Appendix A to the Operating License be amended as proposed herein: to add TS 3.3.10, Oscillation Power Range Monitor Instrumentation; to revise TS 3.4.1, Recirculation System to remove requirements restricting operation consistent with the application of the OPRM Option III as the long term solution to the thermal-hydraulic (T-H) instability issue; and to revise TS 6.9.1.9, Core Operating Limits Report (COLR) to include the analytical methods used to determine OPRM operating limits. TS 3.3.10 delineates the Oscillation Power Range Monitor (OPRM) system Limiting Conditions for Operation, Applicability, Actions and Surveillance Requirements.

REQUESTED CHANGE, PURPOSE AND BACKGROUND:

Hope Creek is operating under the interim corrective actions (ICAs) described in PSEG Nuclear's response to NRC Generic Letter 94-02. The ICAs include restrictions on plant operation and procedural requirements for operator action in response to instability events. The ICAs supplement existing Technical Specifications requirements applicable when operating with one or more recirculation loops, for monitoring and mitigating the magnitude of APRM and LPRM noise levels within one defined region of the power to flow map and to quickly exit a second defined region.

The requirements of the ICAs and existing Technical Specifications limit the probability of an instability event by restricting the duration of any entry into the regions of the power to flow map most susceptible to instability under anticipated entry conditions. Actions are also required by the ICAs when conditions consistent with the onset of T-H oscillations are observed. These actions result in the suppression of conditions required for an instability event and thereby prevent any potential challenge to the minimum critical power ratio (MCPR) safety limit.

The proposed change alleviates the reliance upon the operator by implementing the Oscillating Power Range Monitor (OPRM) system. The OPRM does not require operator action or involvement to suppress conditions which have the potential to develop into anticipated T-H instability events. The OPRM ensures automatic protection of the MCPR safety limit.

Consistent with the implementation of the OPRM, TS 3.4.1 (which sets limiting conditions for operation for recirculation loops) and TS 6.9.1.9 (which identifies the analytical methods for determination of limits reported in the COLR) are revised by the proposed change. The revisions to TS 3.4.1 delete Figure 3.4.1.1-1 and eliminate requirements for monitoring local neutron flux noise and limiting the duration of entry into regions of the power to flow map associated with the detection, suppression or prevention of thermal hydraulic instability. The revisions to TS 6.9.1.9 require the documentation of operating limits for TS 3/4.3.10 in the COLR. The revision also identifies the applicable NRC reviewed and approved analytical methods. The revisions of TS 3.4.1 and 6.9.1.9 are consistent with the application of the OPRM as an Option III long-term solution to the T-H instability issue, as noted in Attachment 4 of this submittal.

JUSTIFICATION OF REQUESTED CHANGES:

The OPRM is designed to initiate a reactor scram via existing reactor protection system (RPS) trip logic upon detection of conditions consistent with the onset of local oscillations in core power and the approach to conditions required for sustained oscillations and a thermal-hydraulic instability event. This capability will assure protection of the MCPR safety limit under all anticipated core-wide and regional T-H instability events.

The design and effectiveness of the OPRM system in meeting the regulatory requirement to detect and suppress conditions necessary to initiate T-H instability is documented in the following NRC accepted topical reports:

NEDO-32645-A, August 1996	BWROG Reactor Core Stability Detect and Suppress Solutions Licensing Basis Methodology and Reload Applications
NEDO-31960-A, November 1995	BWROG Long-Term Stability Solutions Licensing Methodology
NEDO-31960-A, Supplement 1, November 1995	BWROG Long-Term Stability Solutions Licensing Methodology
CENPD-400-P-A, Rev. 1, May 1995	Generic Topical Report for the ABB Option III Oscillation Power Range Monitor (OPRM)

The OPRM system is comprised of four OPRM channels that provide inputs to an associated RPS channel via eight OPRM modules. The OPRM modules are installed in available locations in the associated LPRM pages in the power range neutron monitoring system (PRNMS) panels. Each OPRM channel takes amplified LPRM signals from one APRM group and either another APRM group or one unassigned LPRM group. The LPRM signals are grouped together such that the resulting OPRM response provides adequate coverage of anticipated oscillation modes. Each OPRM channel consists of two OPRM modules and contains more than 30 OPRM cells, where a cell represents a combination of four LPRMs in adjacent areas of the core. The use of instantaneous flux and smaller grouping of LPRMs in cells provides better resolution for the detection of local oscillations than the APRM system alone. With many cells, each consisting of multiple LPRMs in close proximity, the sensitivity of the OPRM is not adversely impacted by single LPRM failures.

The design and implementation of the OPRM does not cause any degradation in the existing APRM, LPRM and RPS systems. The OPRM system conforms to the existing 1 out of 2 taken twice trip input to the Reactor Protection System. The OPRM System does not adversely impact the design basis and operation of the interfacing equipment (i.e., the APRM, RPS, Recirculation Flow Unit and LPRM Systems). Isolator accuracy, response time and performance requirements are included in the design. The OPRM module locations have been assigned consistent with RPS and Neutron Monitoring system separation requirements. Additional considerations to maintain redundancy diversity, separation, and electrical isolation requirements are as follows:

The APRM power signal in 6 out of 8 cases is derived from within the page; thus, no separation/isolation requirements apply. For the two signals required for the LPRM A and B pages, the signal is derived from APRM E and F consistent with existing APRM subsystem logic. In these cases, analog isolators are provided at the signal originating page to maintain the integrity of the RPS / OPRM interface. Cable separation is provided as required by the use of Siltemp fire wrap. The flow signal is derived with the respective APRM and LPRM page. As in APRM power, the flow signal to LPRM A and B pages is derived from APRM E and F providing the same logic and separation.

Each OPRM module applies the three separate algorithms for detecting local oscillations described in NEDO-31960-A and NEDO-31960-A, Supplement 1: the period based algorithm (PBA), the amplitude based algorithm (ABA) and the growth rate algorithm (GRA). Each OPRM module executes the algorithms on the LPRM signals and cell configurations for that channel and generates alarms and trips based on the results. Either module in a channel can trip the OPRM channel. The OPRM trips actuate the RPS when the appropriate RPS trip logic is satisfied. The OPRM trip function is enabled when APRM power is greater than or equal to 30% of rated thermal power (RTP) and the recirculation drive flow is less than or equal to the value corresponding to approximately 60% of rated core flow.

The OPRM provides annunciation to alert the operator when the system is enabled and also provides a pre-trip alarm upon detection of the imminent onset of local core power oscillations. The alarm is available to alert the operator to the plant condition in time for compensatory actions to be taken for those conditions for which instability may be anticipated.

The RPS trip provided by the PBA is actuated when oscillation as detected by one or more OPRM cells in each OPRM channel meet certain criteria for period and amplitude. The PBA is the only algorithm that is credited in the analysis of the capability of the OPRM to protect the MCPR safety limit. The remaining algorithms (ABA and GRA) provide defense-in-depth and additional protection for T-H instability events initiated from unanticipated conditions.

Upon implementation of the OPRM and its associated RPS trip function, operation in regions of the power/flow map potentially susceptible to T-H instability is acceptable since the OPRM system provides reliable detection and suppression of conditions necessary for the initiation of T-H instability events. Therefore, Technical Specifications requirements which currently limit operation in specified regions of the power to flow map are deleted.

The OPRM assures maintenance of the margin of safety associated with the MCPR safety limit for instability events initiated from anticipated conditions without relying on operator action. This capability was demonstrated by Hope Creek specific analyses based on the methodology described in NEDO-32465-A and for future operating cycles will be verified as part of the cycle-specific core reload analysis.

The OPRM provides improved protection by automating the detection and suppression function.

Conclusion

The OPRM assures maintenance of the margin of safety associated with the MCPR safety limit for instability events initiated from anticipated conditions without relying on operator action. The system is designed and installed in a manner that does not degrade existing APRM, LPRM and RPS systems. With the elimination of the ICA's, operator burden is reduced.

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10CFR50.92 EVALUATION AND ENVIRONMENTAL ANALYSIS

PSEG Nuclear LLC has concluded that the proposed changes to the Hope Creek Generating Station (HC) Technical Specifications do not involve a significant hazards consideration. In support of this determination, an evaluation of each of the three standards set forth in 10CFR50.92 is provided below.

REQUESTED CHANGE

The proposed change: adds TS 3.3.10, Oscillation Power Range Monitor Instrumentation; revises TS 3.4.1, Recirculation System to eliminate restrictions upon operating in those regions of the power to flow map most susceptible to thermal hydraulic (T-H) instability; and revises TS 6.9.1.9, Core Operating Limits Report (COLR) to include the analytical methods used to determine the OPRM amplitude setpoint operating limits specified in the COLR.

BASIS

1. *The proposed changes do not involve a significant increase in the probability or consequences of an accident previously evaluated.*

The proposed change specifies limiting conditions for operations, required actions and surveillance requirements of the OPRM system and allows operation in regions of the power to flow map currently restricted by the requirements of Interim Corrective Actions (ICAs) and certain limiting conditions of operation of Technical Specifications (TS) 3.4.1. The OPRM system can automatically detect and suppress conditions necessary for thermal-hydraulic (T-H) instability. A T-H instability event has the potential to challenge the Minimum Critical Power Ratio (MCPR) safety limit. The restrictions of the ICAs and TS 3.4.1 were imposed to ensure adequate capability to detect and suppress conditions consistent with the onset of T-H oscillations that may develop into a T-H instability event. With the installation of the OPRM System, these restrictions are no longer required.

The probability of a T-H instability event is most significantly impacted by power to flow conditions such that only during operation inside specific regions of the power to flow map, in combination with power shape and inlet enthalpy conditions, can the occurrence of an instability event be postulated to occur. Operation in these regions may increase the probability that operation with conditions necessary for a T-H instability can occur.

However, when the OPRM is operable with operating limits as specified in the COLR, the OPRM can automatically detect the imminent onset of local power oscillations and generate a trip signal. Actuation of an RPS trip will suppress conditions necessary for T-H instability and decrease the probability of a T-H instability event. In the event the trip capability of the OPRM is not maintained, the proposed change includes actions which limit the period of time before the effected OPRM channel (or RPS system) must be placed in the trip condition. If these actions would result in a trip function, an alternate method to detect and suppress thermal hydraulic oscillations is required. In either case the duration of this period of time is limited such that the increase in the probability of a T-H instability event is not significant. Therefore the proposed change does not result in a significant increase in the probability of an accident previously evaluated.

An unmitigated T-H instability event is postulated to cause a violation of the MCPR safety limit. The proposed change ensures mitigation of T-H instability events prior to challenging the MCPR safety limit if initiated from anticipated conditions by detection of the onset of oscillations and actuation of an RPS trip signal. The OPRM also provides the capability of an RPS trip being generated for T-H instability events initiated from unanticipated but postulated conditions. These mitigating capabilities of the OPRM system would become available as a result of the proposed change and have the potential to reduce the consequences of anticipated and postulated T-H instability events. Therefore, the proposed change does not significantly increase the consequences of an accident previously evaluated.

2. *The proposed change does not create the possibility of a new or different kind of accident from any accident previously evaluated.*

The proposed change specifies limiting conditions for operations, required actions and surveillance requirements of the OPRM system and allows operation in regions of the power to flow map currently restricted by the requirements of ICAs and TS 3.4.1. The OPRM system uses input signals shared with APRM and rod block functions to monitor core conditions and generate an RPS trip when required. Quality requirements for software design, testing, implementation and module self-testing of the OPRM system provide assurance that no new equipment malfunctions due to software errors are created. The design of the OPRM system also ensures that neither operation nor malfunction of the OPRM system will adversely impact the operation of other systems and no accident or equipment malfunction of these other systems could cause the OPRM system to malfunction or cause a different kind of accident. Therefore, operation with the OPRM system does not create the possibility of a new or different kind of accident from any accident previously evaluated.

Operation in regions currently restricted by the requirements of ICAs and TS 3.4.1 is within the nominal operating domain and ranges of plant systems and components for which postulated equipment and accidents have been evaluated. Therefore operation within these regions does not create the possibility of a new or different kind of accident from any accident previously evaluated.

The proposed change which specifies limiting conditions for operations, required actions and surveillance requirements of the OPRM system and allows operation in certain regions of the power to flow map does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. *The proposed change does not involve a significant reduction in a margin of safety.*

The proposed change specifies limiting conditions for operations, required actions and surveillance requirements of the OPRM system and allows operation in regions of the power to flow map currently restricted by the requirements of ICAs and TS 3.4.1.

The OPRM system monitors small groups of LPRM signals for indication of local variations of core power consistent with T-H oscillations and generates an RPS trip when conditions consistent with the onset of oscillations are detected. An unmitigated T-H instability event has the potential to result in a challenge to the MCPR safety limit. The OPRM system provides the capability to automatically detect and suppress conditions which might result in a T-H instability event and thereby maintains the margin of safety by providing automatic protection for the MCPR safety limit while significantly reducing the burden on the control room operators. In the event the trip capability of the OPRM is not maintained, the proposed change includes actions which limit the period of time before the effected OPRM channel (or RPS system) must be placed in the trip condition. If these actions would result in a trip function, an alternate method to detect and suppress thermal hydraulic oscillations is required. Since, in either case, the duration of this period of time is limited so that the increase in the probability of a T-H instability event is not significant. Operation with the OPRM system does not involve a significant reduction in a margin of safety.

Operation in regions currently restricted by the requirements of ICAs and TS 3.4.1 is within the nominal operating domain assumed for identifying the range of initial conditions considered in the analysis of anticipated operational occurrences and postulated accidents. Therefore, operation in these regions does not involve a significant reduction in the margin of safety.

The proposed change, which specifies limiting conditions for operations, required actions and surveillance requirements of the OPRM system and allows operation in certain regions of the power to flow map, does not involve a significant reduction in a margin of safety.

CONCLUSION

Based on the above, PSEG Nuclear has determined that the proposed changes do not involve a significant hazards consideration.

ENVIRONMENTAL CONSIDERATION

This proposed revision to the Technical Specifications changes a requirement with respect to a facility component located within the restricted area as defined in 10 CFR Part 20. It has been determined that the proposed changes involve no significant hazards consideration. The proposed changes do not involve a significant change in the types or a significant increase in the amounts of any effluents that may be released offsite; and there is no significant increase in individual or cumulative occupational radiation exposure. Since the proposed changes conform to the criteria for licensing actions eligible for categorical exclusion specified in 10 CFR 51.22(c)(9), no environmental assessment or environmental impact statement is required.

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CONFORMANCE WITH NRC ACCEPTED TOPICAL REPORTS AND ASSOCIATED NRC SAFETY EVALUATION REPORTS

The NRC, in their letter (Bruce A. Boger Director Division of Reactor Controls and Human Factors to Robert A. Pinelli, BWROG, dated August 16, 1995) which transmitted the Safety Evaluation Report accepting the Asea Brown Boveri Combustion Engineering (ABB-CE) Option III OPRM system as a permanent long term solution for the thermal-hydraulic stability issue, required each licensee referencing the OPRM system licensing topical report, CENPD-400-P-A, to address the plant specific issues identified in the SER and to identify and justify any deviations from CENPD-400-P-A and the associated SER.

The plant specific items as stated in Section 5.0 of the SER are restated below along with PSEG Nuclear's response.

1) Confirm the applicability of CENPD-400-P, including clarifications and reconciled differences between the specific plant design and the topical report design descriptions.

The Hope Creek OPRM conforms with the Safety Evaluation Report by the Office of Nuclear Reactor Regulation, CENPD-400-P, Generic Topical Report for the ABB Option III Oscillation Power Range Monitor. The Hope Creek installation and implementation of OPRM is consistent with CENPD-400-P and the associated SER. There are no deviations from Topical Report Sections 2.3 and 3.0.

At Hope Creek, the "plant process computer", as used in the context of the SER is the Control Room Information Display System (CRIDS).

2) Confirm the applicability of BWROG topical reports that address the OPRM and associated instability function, set points and margins.

The Boiling Water Reactor Owners' Group (BWROG) topical reports which address the OPRM and associated instability functions, set points and margins are NEDO-31960 "Long Term Stability Solutions Licensing Methodology" and its supplement and NEDO-

32465 "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications" (References 1, 2 and 5 of CENPD-400).

In the Safety Evaluation Report (SER) accepting NEDO-31960, the NRC specified five conditions required for implementation of Option III in any type of BWR. Each of these five conditions has been reviewed and the following confirmations of the applicability of NEDO-31960 and its supplement to the proposed implementation of the Option III solution at Hope Creek are provided.

i) All three algorithms described in NEDO 31960 and its supplement are used. These algorithms are the amplitude based or high-low detection algorithm; the growth rate or high oscillation amplitude algorithm and the period based algorithm. The OPRM executes these algorithms and generate alarms and RPS trips based on the results.

ii) The validity of the selected scram set points has been confirmed using the initial application and reload review methodology described in NEDO-32465. This methodology uses a combination of generic representative plant and plant specific analyses and includes an uncertainty treatment that accounts for the number of failed sensors.

iii) The selected bypass region outside of which the detect and suppress action is deactivated is defined in the proposed Technical Specifications of Attachment 3.

iv) The automatic protective function of the OPRM when fully implemented will be a full reactor scram.

v) The LPRM assignment grouping proposed to be implemented conforms with LPRM assignments shown in Appendix D of NEDO-32465. The NRC SER concluded that the Initial Application and Reload Review methodologies of NEDO-32465 are acceptable. These methodologies specify that the LPRM assignment is a key assumption. The discussion of the initial application methodology in section 5 of NEDO-32465 specifically identifies the LPRM assignments in Appendix D as examples of the expected LPRM assignments a utility may choose. Therefore, it is concluded that since the LPRM assignment proposed to be implemented at Hope Creek is consistent with an example presented in Appendix D of NEDO-32465, and Appendix D LPRM assignments were cited as possible LPRM assignments in the initial application methodology which the NRC found acceptable, the proposed LPRM assignment for Hope Creek is acceptable. No changes to current requirements for a minimum operable number of LPRM detectors for accurate power distribution monitoring and APRM operability were proposed in NEDO-31960 and found acceptable by the NRC in the associated SER. The proposed implementation at Hope Creek is consistent with this accepted NRC position.

In the Safety Evaluation Report (SER) accepting the Boiling Water Reactor Owners' Group (BWROG) "Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications" (NEDO-32465), the NRC concluded that the proposed methodology should produce set point values that will result in a very low likelihood of exceeding CPR safety limits during instability events. The description of the confirmation set points of the period based algorithm in Section 3.4 of NEDO-32465 identifies that a range of values for the period tolerance and corner frequency was established to allow the OPRM system to be tuned for the unique LPRM noise characteristics of each plant. A specific range of values of the period tolerance and corner frequency demonstrated against available plant data was listed in Table 3-1 of NEDO-32465.

The range of period tolerance set point values listed in Table 3-1 of NEDO-32465 does not include the value of the set point proposed for implementation of Option III at Hope Creek. Based on testing performed during cycle 8 it has been determined that a period tolerance of 50 milliseconds is needed to avoid spurious trips and alarms of the OPRM system for the Hope Creek plant. The proposed value of 50 milliseconds is consistent with the range identified for the period tolerance set point in section 6.2 of Supplement 1 to NEDO-31960.

In an October 21, 1997 letter to the NRC from Southern Nuclear Company (SNC), additional information was provided that demonstrated that the Option III firmware successfully recognized, processed and generated output trips over a range of values for the period tolerance and the corner frequency for instability event data from the Swiss Plant KKL (SNC letter HL-5501). Included in the range of values of the period tolerance set point considered was the value of 50 milliseconds. The capability of the Option III firmware as prescribed in NEDO-31960 and its supplement to reliably perform its intended function to provide continuous confirmations upon transition from stable reactor operation to a growing reactor instability has been verified and the proposed deviation from the range of values for the period tolerance listed in Table 3-1 of NEDO-32465 is justified.

3) Provide a plant-specific Technical Specification (TS) for the OPRM functions consistent with CENPD-400-P, Appendix A.

Plant specific TS are presented in Attachment 3. The proposed TS are consistent with CENPD-400-P, Appendix A with the following exception. In Appendix A of CENPD-400-P, Generic TS were presented for the OPRM system, which specified two required actions in the event OPRM trip capability is not maintained. The first required action is to initiate an alternate method to detect and suppress thermal hydraulic instability oscillations with a completion time of 12 hours and the second required action is to restore the OPRM trip capability with a completion time of 120 days. The proposed TS presented in Attachment 3 includes only the required action to initiate an alternate method to detect and suppress thermal hydraulic instability oscillations in the event OPRM trip capability is not maintained.

The OPRM system is safety related and the requirements of Section XVI of 10 CFR 50 Appendix B for timely corrective action to ensure operability are applicable. Explicit specification of a required action to restore OPRM trip capability is appropriate if such action within a specific completion time is required to ensure detection and suppression of a thermal hydraulic instability event.

In the discussion in Appendix A of CENPD-400-P of the bases for the required actions in the event OPRM trip capability is not maintained, it is stated that an alternate method of detecting and suppressing oscillations would adequately address detection and mitigation in the event of oscillations. Current methods for detecting and suppressing thermal hydraulic instability oscillations have been in place for more than five years without occurrence of an instability event.

It is concluded that when action is required to initiate an alternate method of detecting and suppressing thermal hydraulic instability oscillations the specification of an additional action to restore OPRM trip capability with a specific completion time is not necessary to ensure adequate detection and suppression of a thermal hydraulic instability oscillation. Therefore, a required action to restore OPRM trip operability within 120 days is not included in the proposed TS presented in Attachment 3.

4) Confirm that the plant-specific environmental (temperature, humidity, radiation, electromagnetic and seismic) conditions are enveloped by the OPRM equipment environmental qualification values.

The Hope Creek installation and implementation of OPRM is consistent with the Equipment Qualification described in section 3.3 of the SER. The OPRM components are those subject to the ABB-CE environmental qualification program. The OPRM equipment is installed in the main control room. The OPRM System, along with the Replacement Bulk Power Supply and the Dual Voltage regulator are qualified to perform their Class I E safety function for continuous operation for the following Environmental conditions in the Hope Creek main control room as listed in the HCGS Environmental Design Criteria, D7.5, Table 6

<u>Normal Operating Conditions:</u>

Temperature: Maximum 78 °F; Average 76 °F; Minimum 74 °F

Relative Humidity: Maximum 50% Minimum 40%

Radiation: 2x10E2 RADS TID

Abnormal Conditions

Temperature 78 °F

Relative Humidity: Maximum 50%; Minimum 40%

Pressure .25/-.25 in WC

Temperature and humidity qualification of the OPRM module was performed by test. The OPRM is designed to continuously operate in the following environment, while meeting all performance requirements:

Normal Ambient Temperature: 40 °F to 120 °F

Abnormal Ambient Temperature: 140 °F for 48 hours

Humidity: 30% to 95% RH non-condensing

Voltage: 90 to 140 VAC

Frequency: 47.5 to 63 Hz.

The OPRM system is designed to provide a high degree of immunity from electro-magnetic interference/radio frequency interference (EMI/RFI) and to minimize generated EMI/RFI that may interfere with devices connected to it, devices that share a common AC supply, and devices located in the same enclosure. The OPRM system is designed and tested to meet the Electrostatic Discharges (ESD) requirements of IEC 801-2, Level 4. Fast transient withstand capability is demonstrated for all power input and output and all process input and output circuits, signal common and protective earth connections based on IEC 80104, Level 4 (4 kV on power and ground, 2kV on process signals) as described in IEC 801-4, Sections 7.3.1 and 7.3.2. OPRM circuitry is located inside a metal enclosure. All external power, inputs and outputs, pass through filters which, together with the metal enclosure, provide an EMI boundary. These features, when combined with grounding and cable separation in accordance with PSEG Nuclear standards and restrictions on welding and portable transceiver use in the main control room area, ensure the OPRM system is protected from the effects of electromagnetic interference.

The following two devices were seismically qualified as documented in Document no. R1581, Seismic Simulation Test for the Oscillation Power Range monitor (OPRM), PN11426-1, -2 and the Digital Isolation Block (DIB), PN 11427- 1, Wyle Laboratories Seismic Simulation Test Report No. 44758-1, Revision A. This test used Required Response Spectra (RRS) which envelopes and satisfies the requirements of the base testing reported for other OPRM devices above in Document No. 0000-ICE-37700, Rev. 0. The Safe Shutdown Earthquake (SSE) RRS (5% damping) run from 4.5 g (rigid range) to 10g (resonant response range) with the transition at 35 Hz. The Operating Basis Earthquake) OBE RRS (5% damping) run from 3g (rigid range) to 5g to 5.6g (resonant response range with a transition at 35 Hz). The devices were tested on the same test-mounting frame as used for the first group of devices noted above. The OPRM module is rack mounted and the DIB is DIN rail mounted.

Four TECs are mounted on Unistrut (two per span) located very low (6" above the base) spanning bays 1 and 5. This device is being dynamically qualified in accordance with a Design Basis Earthquake (DBE) Test Response Spectrum peaking at 9 g at 2% damping. The requirements for this device are not as severe as other devices because of the low and rigid mounting configuration. Seismic data for testing of the TEC isolator is based upon the generic RRS indicated in the Qualification Test Report (Non-OPRM Equipment), Document Number 00000-ICE-37700, Rev.0.

Buchanan Terminal blocks are mounted on Unistrut and located very low (6" above the base) spanning bays I and 5. The terminal blocks are generally considered to be seismically insensitive and rugged (See EPRI report TR105849, Generic Seismic Technical Evaluation of Replacement Items for Nuclear Power Plants).

DIN Rail and Unistrut mounting is utilized in panel H 11-P608. The panel is 150" wide by 36" deep by 90" high. Each of the five bays is 30" wide. The total panel weight is approximately 4500 lbs. It is anchored to the floor with a minimum tie down of 20 5/8" diameter bolts (or full plug weld for all twenty holes). With the exception of the OPRM module and switch, all devices are mounted on new Unistrut (N3300) or DIN (35/15) rail (or combinations). The longest Unistrut support beam is less than 30" (the width of a single bay). A simply supported beam, conservatively center loaded with 10 pounds (more than any device combination on any beam) will have a strong axis fundamental frequency of 84 Hz and a weak axis fundamental frequency of 44 Hz. This rigidity assures against local amplification of seismic inputs for such internally mounted devices.

5) Confirm that administrative controls are provided for manually bypassing OPRM channels or protective functions, and for controlling access to the OPRM functions.

The Hope Creek OPRM installation and implementation is consistent with the SER. Hope Creek procedures provide administrative control for placing individual OPRM modules in manual bypass. When the OPRM modules are not in manual bypass, the OPRM protective function is automatically bypassed or automatically activated when the reactor power and recirculation flow are in the appropriate regions of the reactor power/flow map to require automatic bypass or activation respectively. The OPRM as installed and implemented automatically enables its pre- trip and trip alarm outputs upon entry into the high power, low core flow region of the power/flow operating map.

6) Confirm that any changes to the plant operator's main control room panel have received human factor reviews per plant-specific procedures.

The Hope Creek OPRM installation and implementation includes activation of the main control room overhead annunciator if the OPRM has been manually bypassed or deliberately rendered inoperative. Keylock access is necessary to manually bypass an OPRM module. Changes to OPRM software require both keylock access and a password. Procedural requirements control placing an OPRM module in bypass and verifying restoration.

The Hope Creek OPRM installation and implementation includes an operator interface via the CRIDS computer, Control Room annunciators that signal system status and/or problems, and the OPRM front panel LED'S. Alarms which are wired to the Annunciator Logic Cabinet and displayed on the Control Room Overhead Annunciator Panel (window boxes) include the TRIP ENABLE, ALARM, TRIP, AND BYPASS/INOP/TROUBLE. Human Factor Engineering principles consistent with the HCGS Annunciator System Study have been applied in selecting the annunciator location and groupings. In addition, OPRM modules are provided with local indicators. Local LED indicators provide indication for ALARM, TROUBLE, INOP, TRIP, TRIP ENABLED, and READY. ALARM, TRIP, and TROUBLE LEDs are latched until reset locally.

Other than the plant specific items addressed above, there are no deviations from CENPD-400-P-A and the associated SER.

Document Control Desk
Attachment 3

LRN-00-0429
LCR H00-07

HOPE CREEK GENERATING STATION
FACILITY OPERATING LICENSE NPF-57
DOCKET NO. 50-354
REVISIONS TO THE TECHNICAL SPECIFICATIONS (TS)

TECHNICAL SPECIFICATION PAGES WITH PROPOSED CHANGES

The following Technical Specifications for Facility Operating License No. NPF-57 are affected by this change request:

Technical Specification	Page
Existing Specifications	
Index	x, xviii
3.4.1.1	3/4 4-1
3.4.1.1 Action b.	3/4 4-2
3.4.1.1 Action c.	3/4 4-2
3.4.1.1 Action d	3/4 4-2
4.4.1.1.1.c	3/4 4-2a
4.4.1.1.1.d	3/4 4-2a
4.4.1.1.4	3/4 4-2a
Figure 3.4.1.1.1	3/4 4-3
Bases 3/4.4.1	B 3/4 4-1, B3/4 4-2
6.9.1.9	6-20, 6-21, 6-26
New Specifications	
3/4.3.10	3/4 3-109 (New Page)
Bases 3/4.3.10	B3/4.3-9 (New Page)
Bases 3/4.3.10	B3/4.3-10 (New Page)
Bases 3/4.3.10	B3/4.3-11 (New Page)
Bases 3/4.3.10	B3/4.3-12 (New Page)
Bases 3/4.3.10	B3/4.3-13 (New Page)

3/4.3.10 OSCILLATION POWER RANGE MONITOR 3-109

INDEX

LIMITING CONDITIONS FOR OPERATION AND SURVEILLANCE REQUIREMENTS

3/4.4 REACTOR COOLANT SYSTEM

3/4.4.1 RECIRCULATION SYSTEM

RECIRCULATION LOOPS

LIMITING CONDITION FOR OPERATION

3.4.1.1 Two reactor coolant system recirculation loops shall be in operation. ~~with:~~

~~a. Total core flow greater than or equal to 45% of rated core flow, or~~

~~b. THERMAL POWER less than or equal to the limit specified in Figure 3.4.1.1-1.~~

APPLICABILITY: OPERATIONAL CONDITIONS 1* and 2*.

ACTION:

a. With one reactor coolant system recirculation loop not in operation:

1. Within 4 hours:

   a) Place the recirculation flow control system in the Local Manual mode, and

   b) Reduce THERMAL POWER to ≤ 70% of RATED THERMAL POWER, and

   c) Increase the MINIMUM CRITICAL POWER RATIO (MCPR) Safety Limit per Specification 2.1.2, and

   d) Reduce the Maximum Average Planar Linear Heat Generation Rate (MAPLHGR) limit to a value specified in the CORE OPERATING LIMITS REPORT for single loop operation, and

   e) DELETED.

   f) Limit the speed of the operating recirculation pump to less than or equal to 90% of rated pump speed, and

   g) Perform surveillance requirement 4.4.1.1.2 if THERMAL POWER is ≤ 38% of RATED THERMAL POWER or the recirculation loop flow in the operating loop is ≤ 50% of rated loop flow.

2. Within 4 hours, reduce the Average Power Range Monitor (APRM) Scram Trip Setpoints and Allowable Values to those applicable for single recirculation loop operation per Specifications 2.2.1 and 3.2.2; otherwise, with the Trip Setpoints and Allowable Values associated with one trip system not reduced to those applicable for single recirculation loop operation, place the affected trip system in the tripped condition and within the following 6 hours, reduce the Trip Setpoints and Allowable Values of the affected channels to those applicable for single recirculation loop operation per Specifications 2.2.1 and 3.2.2.

3. Within 4 hours, reduce the APRM Control Rod Block Trip Setpoints and Allowable Values to those applicable for single recirculation loop operation per Specifications 3.2.2 and 3.3.6; otherwise, with the Trip Setpoint and Allowable Values associated with one trip function not reduced to those applicable for single recirculation loop operation, place at least one affected channel

* See Special Test Exception 3.10.4.

ACTION (Continued)

in the tripped condition and within the following 6 hours, reduce the Trip Setpoints and Allowable Values of the affected channels to those applicable for single recirculation loop operation per Specifications 3.2.2 and 3.3.6.

4. Within 4 hours, reduce the Rod Block Monitor Trip Setpoints and Allowable Values to those applicable for single recirculation loop operation per Specification 3.3.6; otherwise, with the Trip Setpoints and Allowable Values associated with one trip function not reduced to those applicable for single recirculation loop operation, place at least one affected channel in the tripped condition and within the following 6 hours, reduce the Trip setpoints and Allowable Values of the remaining channels to those applicable for single recirculation loop operation per Specification 3.3.6.

5. The provisions of Specification 3.0.4 are not applicable.

6. Otherwise be in at least HOT SHUTDOWN within the next 12 hours.

b. With no reactor coolant system recirculation loops in operation, ~~immediately initiate action to reduce THERMAL POWER to less than or equal to the limit specified in Figure 3.4.1.1-1 within 2 hours and~~ initiate measures to place the unit in at least STARTUP within 6 hours and in HOT SHUTDOWN within the next 6 hours.

~~c. With one or two reactor coolant system recirculation loops in operation and total core flow less than 45% but greater than 40% of rated core flow and THERMAL POWER greater than the limit specified in Figure 3.4.1.1-1:~~

~~1. Determine the APRM and LPRM* noise levels (Surveillance 4.4.1.1.4):~~

~~a) At least once per 8 hours, and~~
~~b) Within 30 minutes after the completion of a THERMAL POWER increase of at least 5% of RATED THERMAL POWER.~~

~~2. **With the APRM or LPRM* neutron flux noise levels greater than three times their established baseline noise levels, within 15 minutes initiate corrective action to restore the noise levels to within the required limits within 2 hours by increasing core flow to greater than 45% of rated core flow or by reducing THERMAL POWER to less than or equal to the limit specified in Figure 3.4.1.1-1.**~~

~~d. With one or two reactor coolant system recirculation loops in operation and total core flow less than or equal to 40% and THERMAL POWER greater than the limit specified in Figure 3.4.1.1-1, within 15 minutes initiate corrective action to reduce THERMAL POWER to less than or equal to the limit specified in Figure 3.4.1.1-1 or increase core flow to greater than 40% within 4 hours.~~

~~* Detector levels A and C of one LPRM string per core octant plus detectors A and C of one LPRM string in the center of the core should be monitored.~~

SURVEILLANCE REQUIREMENTS

4.4.1.1.1 With one reactor coolant system recirculation loop not in operation at least once per 12 hours verify that:

a. Reactor THERMAL POWER is ≤ 70% of RATED THERMAL POWER, and

b. The recirculation flow control system is in the Local Manual mode, and

c. The speed of the operating recirculation pump is less than or equal to 90% of rated pump speed~~, and~~

~~d. Core flow is greater than 40% when THERMAL POWER is greater than the limit specified in Figure 3.4.1.1-1.~~

4.4.1.1.2 With one reactor coolant system recirculation loop not in operation, within no more than 15 minutes prior to either THERMAL POWER increase or recirculation loop flow increase, verify that the following differential temperature requirements are met if THERMAL POWER is ≤ 38% of RATED THERMAL POWER or the recirculation loop flow in the operating recirculation loop is ≤ 50% of rated loop flow:

a. ≤ 145°F between reactor vessel steam space coolant and bottom head drain line coolant, and

b. ≤ 50°F between the reactor coolant within the loop not in operation and the coolant in the reactor pressure vessel, and

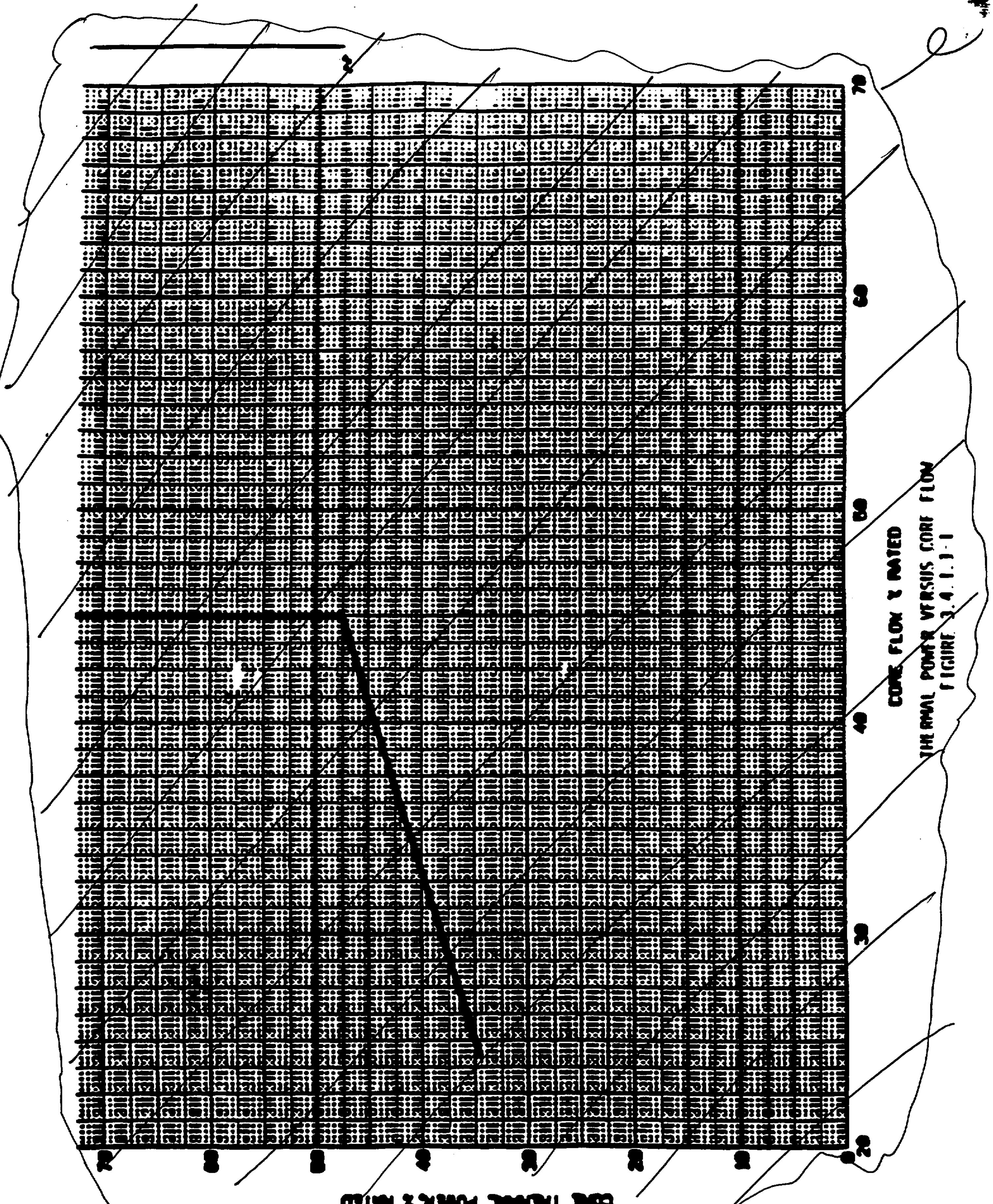
c. ≤ 50°F between the reactor coolant within the loop not in operation and the operating loop.

The differential temperature requirements or Specifications 4.4.1.1.2b and 4.4.1.1.2c do not apply when the loop not in operation is isolated from the reactor pressure vessel.

4.4.1.1.3 Each pump MG set scoop tube mechanical and electrical stop shall be demonstrated OPERABLE with overspeed setpoints less than or equal to 109% and 107%, respectively, of rated core flow, at least once per 18 months.

~~4.4.1.1.4 Establish a baseline APRM and LPRM* neutron flux noise value within the regions for which monitoring is required (Specification 3.4.1.1, ACTION c) within 2 hours of entering the region for which monitoring is required unless baselining has previously been performed in the region since the last refueling outage.~~

~~* Detector levels A and C of one LPRM string per core octant plus detectors A and C of one LPRM string in the center of the core should be monitored.~~



CORE FLOW % RATED
THERMAL POWER VERSUS CORE FLOW
FIGURE 3.4.1.1-1
CORE THERMAL POWER, % RATED

3/4.4.1 RECIRCULATION SYSTEM

The impact of single recirculation loop operation upon plant safety is assessed and shows that single loop operation is permitted if the MCPR fuel cladding Safety Limit is increased as noted by Specification 2.1.2, APRM scram and control rod block setpoints are adjusted as noted in Tables 2.2.1-1 and 3.3.6-2 respectively. MAPLHGR limits are decreased by the factor given in Specification 3.2.1, and MCPR operating limits are adjusted per Specification 3/4.2.3.

Additionally, surveillance on the pump speed of the operating recirculation loop is imposed to exclude the possibility of excessive core internals vibration. The surveillance on differential temperatures below 38% THERMAL POWER or 50% rated recirculation loop flow is to mitigate the undue thermal stress on vessel nozzles, recirculating pump and vessel bottom head during the extended operation of the single recirculation loop mode.

An inoperable jet pump is not in itself a sufficient reason to declare a recirculation loop inoperable, but it does, in case of a design-basis-accident, increase the blowdown area and reduce the capability of reflooding the core, thus, the requirement for shutdown of the facility with a jet pump inoperable. Jet pump failure can be detected by monitoring jet pump performance on a prescribed schedule for significant degradation.

Recirculation loop flow mismatch limits are in compliance with the ECCS LOCA analysis design criteria for two recirculation loop operation. The limits will ensure an adequate core flow coastdown from either recirculation loop following a LOCA. In the case where the mismatch limits cannot be maintained during two loop operation, continued operation is permitted in a single recirculation loop mode.

In order to prevent undue stress on the vessel nozzles and bottom head region, the recirculation loop temperatures shall be within 50°F of each other prior to startup of an idle loop. The loop temperature must also be within 50°F of the reactor pressure vessel coolant temperature to prevent thermal shock to the recirculation pump and recirculation nozzles. Sudden equalization of a temperature difference > 145°F between the reactor vessel bottom head coolant and the coolant in the upper region of the reactor vessel by increasing core flow rate would cause undue stress in the reactor vessel bottom head.

~~The objective of BWR plant and fuel design is to provide stable operation with margin over the normal operating domain. However, at the high power/low flow corner of the operating domain, a small probability of limit cycle neutron flux oscillations exists depending on combinations of operating conditions (e.g., rod pattern, power shape). To provide assurance that neutron flux limit cycle oscillations are detected and suppressed, APRM and LPRM neutron flux noise levels should be monitored while operating in this region.~~

~~Stability tests at operating BWRs were reviewed to determine a generic region of the power/flow map in which surveillance of neutron flux noise levels should be performed. A conservation decay ratio of 0.6 was chosen as the bases for determining the generic region for surveillance to account for the plant to plant variability of decay ratio with core and fuel designs. This generic region has been determined to correspond to a core flow of less than or equal to 45% of rated core flow and a THERMAL POWER greater than that specified in Figure 3.4.1.1-1.~~

~~Plant specific calculations can be performed to determine an applicable region for monitoring neutron flux noise levels. In this case the degree of conservatism can be reduced since plant to plant variability would be eliminated. In this case, adequate margin will be assured by monitoring the region which has a decay ratio greater than or equal to 0.8.~~

~~Neutron flux noise limits are also established to ensure early detection of limit cycle neutron flux oscillations. BWR cores typically operate with neutron flux noise caused by random boiling and flow noise. Typical neutron flux noise levels of 1-12% of rated power (peak-to-peak) have been reported for the range of low to high recirculation loop flow during both single and dual recirculation loop operation. Neutron flux noise levels which significantly bound these values are considered in the thermal/mechanical design of BWR fuel and are found to be of negligible consequence. In addition, stability tests at operating BWRs have demonstrated that when stability related neutron flux limit cycle oscillations occur they result in peak-to-peak neutron flux limit cycles of 5-10 times the typical values. Therefore, actions taken to reduce neutron flux noise levels exceeding three (3) times the typical value are sufficient to ensure early detection of limit cycle neutron flux oscillations.~~

~~Typically, neutron flux noise levels show a gradual increase in absolute magnitude as core flow is increased (constant control rod pattern) with two reactor recirculation loops in operation. Therefore, the baseline neutron flux noise level obtained at a specific core flow can be applied over a range of core flows. To maintain a reasonable variation between the low flow and high flow end of the flow range, the range over which a specific baseline is applied should not exceed 20% of rated core flow with two recirculation loops in operation. Data from tests and operating plants indicate that a range of 20% of rated core flow will result in approximately a 50% increase in neutron flux noise level during operation with two recirculation loops. Baseline data should be taken near the maximum rod line at which the majority of operation will occur. However, baseline date taken at lower rod lines (i.e., lower power) will result in a conservative value since the neutron flux noise level is proportional to the power level at a given core flow.~~

3/4.4.2 SAFETY/RELIEF VALVES

The safety valve function of the safety/relief valves operates to prevent the reactor coolant system from being pressurized above the Safety Limit of 1375 psig in accordance with the ASME Code. A total of 13 OPERABLE safety/relief valves is required to limit reactor pressure to within ASME III allowable values for the worst case transient.

Demonstration of the safety relief valve lift settings occurs only during shutdown. The safety relief valve pilot stage assemblies are set pressure tested in accordance with the recommendations of General Electric SIL No. 196, Supplement 14 (April 23, 1984), "Target Rock 2-Stage SRV Set-Point Drift." Set pressure tests of the safety relief valve main (mechanical) stage are conducted at least once every 5 years.

The low-low set system ensures that safety/relief valve discharges are minimized for a second opening of these valves, following any overpressure transient. This is achieved by automatically lowering the closing setpoint of two valves and lowering the opening setpoint of two valves following the initial opening. In this way, the frequency and magnitude of the containment blowdown duty cycle is substantially reduced. Sufficient redundancy is provided for the low-low set system such that failure of any one valve to open or close at its reduced setpoint does not violate the design basis.

MONTHLY OPERATING REPORTS

6.9.1.8 Routine reports of operating statistics and shutdown experience shall be submitted on a monthly basis to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, D.C. 20555, with a copy to the USNRC Administrator, Region 1, no later than the 15th of each month following the calendar month covered by the report.

CORE OPERATING LIMITS REPORT

6.9.1.9 Core operating limits shall be established and documented in the PSEG Nuclear LLC generated CORE OPERATING LIMITS REPORT before each reload cycle or any remaining part of a reload cycle for the following Technical Specifications:

3/4.2.1 AVERAGE PLANAR LINEAR HEAT GENERATION RATE
3/4.2.3 MINIMUM CRITICAL POWER RATIO
3/4.2.4 LINEAR HEAT GENERATION RATE
3/4.3.10 OSCILLATION POWER RANGE MONITOR (OPRM)

CORE OPERATING LIMITS REPORT (Continued)

The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by NRC, as applicable in References ~~1 and 2.~~ 1, 2 and 3.

The core operating limits shall be determined so that all applicable limits (e.g., fuel thermal-mechanical limits, core thermal-hydraulic limits, ECCS limits, nuclear limits such as shutdown margin, and transient and accident analysis limits) of the safety analysis are met.

The CORE OPERATING LIMITS REPORT, including any mid-cycle revisions or supplements thereto, shall be provided upon issuance, for each reload cycle, to the NRC Document Control Desk with copies to the Regional Administrator and Resident Inspector.

SPECIAL REPORTS

6.9.2 Special reports shall be submitted to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, DC 20555, with a copy to the USNRC Administrator, Region 1, within the time period specified for each report.

6.9.3 Violations of the requirements of the fire protection program described in the Final Safety Analysis Report which would have adversely affected the ability to achieve and maintain safe shutdown in the event of a fire shall be submitted to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, DC 20555, with a copy to the USNRC Administrator, Region 1, via the Licensee Event Report System within 30 days.

6.10 RECORD RETENTION

6.10.1 In addition to the applicable record retention requirements of Title 10, Code of Federal Regulations, the following records shall be retained for at least the minimum period indicated.

SPECIAL REPORTS

6.10.2 The following records shall be retained for at least 5 years:

a. Records and logs of unit operation covering time interval at each power level.

b. Records and logs of principal maintenance activities, inspections, repair, and replacement of principal items of equipment related to nuclear safety.

c. All REPORTABLE EVENTS submitted to the Commission.

d. Records of surveillance activities, inspections, and calibrations required by these Technical Specifications.

e. Records of changes made to the procedures required by Specification 6.8.1.

f. Records of radioactive shipments.

g. Records of sealed source and fission detector leak tests and results.

REFERENCES

1. CENPD-300-P-A, "Reference Safety Report for Boiling Water Reactors Reload Fuel," (latest approved revision)

2. NEDE-24011-P-A (latest approved revision), "General Electric Standard Application for Reactor Fuel (GESTAR-II)"

3. NEDO-32465-A, REACTOR STABILITY DETECT AND SUPPRESS SOLUTIONS LICENSING BASIS METHODOLOGY FOR RELOAD APPLICATIONS, AUGUST, 1996.

3/4.3.10 OSCILLATION POWER RANGE MONITOR

LIMITING CONDITION FOR OPERATION

3.3.10 Four channels of the OPRM instrumentation shall be OPERABLE*. Each OPRM channel period based algorithm amplitude trip setpoint (Sp) shall be less than or equal to the Allowable Value as specified in the CORE OPERATING LIMITS REPORT

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

ACTIONS

a. With one or more required channels inoperable:
   1. Place the inoperable channels in trip within 30 days, or
   2. Place associated RPS trip system in trip within 30 days, or
   3. Initiate an alternate method to detect and suppress thermal hydraulic instability oscillations within 30 days.

b. With OPRM trip capability not maintained:
   1. Initiate alternate method to detect and suppress thermal hydraulic instability oscillations within 12 hours.

c. Otherwise, reduce THERMAL POWER to less than 25% RTP within 4 hours.

SURVEILLANCE REQUIREMENTS

4.3.10.1 Perform CHANNEL FUNCTIONAL TEST at least once per 184 days.

4.3.10.2 Calibrate the local power range monitor once per 1000 Effective Full Power Hours (EFPH) in accordance with Note f, Table 4.3.1.1-1 of TS 3/4.3.1.

4.3.10.3 Perform CHANNEL CALIBRATION once per 18 months. Neutron detectors are excluded.

4.3.10.4 Perform LOGIC SYSTEM FUNCTIONAL TEST once per 18 months.

4.3.10.5 Verify OPRM is enabled when THERMAL POWER is $\geq$ 30% RTP and recirculation drive flow $\leq$ the value corresponding to 60% of rated core flow once per 18 months

4.3.10.6 Verify the RPS RESPONSE TIME is within limits once per 18 months on a STAGGERED TEST BASIS. Neutron detectors are excluded.

* When a channel is placed in an inoperable status solely for performance of required Surveillances, entry into associated ACTIONS may be delayed for up to 6 hours, provided the OPRM maintains trip capability.

3/4.3.10 Oscillation Power Range Monitor (OPRM)

General Design Criterion 10 (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 affects 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 minimum critical power ratio (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, installed in local power range monitor (LPRM) flux amplifier slots in the Neutron Monitoring System (NMS) cabinets, 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 Specification 3.3.1, "RPS Instrumentation." Only the period based detection algorithm is used in the safety analysis. 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 4 OPRM trip channels, each channel consisting of two OPRM modules. Each OPRM module receives input from LPRMs. Each OPRM module also receives input from the RPS 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.

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 Criteria 3 of the Final Commission Policy Statement on Technical Specifications Improvements for Nuclear Power Reactors, dated July 22, 1993 (58 FR 39132).

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 highly redundant and low minimum number of required LPRMs in the OPRM cell design ensures that large numbers of cells will remain operable, even with large numbers of LPRMs bypassed.

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 region of anticipated oscillation is defined by THERMAL POWER ≥ 30% RTP and recirculation drive flow ≤ the value corresponding to 60% of rated core flow. Therefore, the OPRM trip is required to be enabled in this region. However, to protect against anticipated transients, the OPRM is required to be OPERABLE with THERMAL POWER ≥ 25% RTP. This provides sufficient margin to potential instabilities as a result of a loss of feedwater heater transient. It is not necessary for the OPRM to be OPERABLE with THERMAL POWER < 25% RTP because instabilities are not anticipated to result from any expected transients below this power.

ACTIONS a.1, a.2 and a.3

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 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 Action b.1). The remaining OPERABLE OPRM channels continue to provide trip capability 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, restore 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 suppressing 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.

ACTION b.1

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 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 one OPRM channel OPERABLE or in trip (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 suppressing thermal hydraulic instability oscillations described in Reference 5. 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 oscillation, 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 without OPRM trip capability is considered acceptable with implementation of the alternate method of detecting and suppressing thermal hydraulic instability oscillations.

ACTION c

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 region where instabilities cannot 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.

SR 4.3.10.1

A CHANNEL FUNCTIONAL TEST is performed on each required channel to ensure that the entire channel will perform the intended function. A Frequency of 184 days provides an acceptable level of system average availability over the Frequency and is based on the reliability of the channel (Ref. 7).

SR 4.3.10.2

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 EFPH Frequency is based on operating experience with LPRM sensitivity changes. This surveillance is satisfied in accordance with Note f, Table 4.3.1.1-1 of TS 3/4.3.1.

SR 4.3.10.3

The CHANNEL CALIBRATION is a complete check of the instrument loop. This test verifies 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, consistent with the plant specific setpoint methodology.

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 converters. The Allowable Values are specified in the CORE OPERATING LIMITS REPORT.

As noted, neutron detectors are excluded from CHANNEL CALIBRATION because of the difficulty of simulating a meaningful signal. Changes in neutron detector sensitivity are compensated for by performing the 1000 EFPH LPRM calibration using the TIPs (SR 4.3.10.2).

The Frequency of 18 months is based upon the design objective that the OPRM operate over a complete fuel cycle, as a minimum, without requiring calibration.

SR 4.3.10.4

The LOGIC SYSTEM FUNCTIONAL TEST demonstrates the OPERABILITY of the required trip logic for a specific channel. The functional testing of control rods and scram discharge volume (SDV) vent and drain valves in Specification 3.1.3.1, "Control Rod OPERABILITY" 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 18-month Frequency is based on engineering judgment and reliability of the components. Operating experience has shown that these components usually pass the surveillance when performed at the 18 month Frequency.

SR 4.3.10.5

This SR ensures that trips initiated from the OPRM system are not inadvertently bypassed when the capability of the OPRM system to initiate an RPS trip is required. The trip capability of the OPRM system is only required during operation under conditions susceptible to anticipated T-H instability oscillations. The region of anticipated oscillation is defined by THERMAL POWER ≥ 30% RTP and recirculation drive flow ≤ the value corresponding to 60% of rated core flow.

The trip capability of individual OPRM modules are automatically enabled based on the APRM power and flow signals associated with each OPRM channel during normal operation. These channel specific values of APRM power and recirculation drive flow are subject to surveillance requirements associated with other RPS functions such as APRM flux and flow biased simulated thermal power with respect to the accuracy of the signal to the process variable. The OPRM is a digital system with calibration and manually initiated tests to verify digital input including input to the auto-enable calculations. Periodic calibration confirms that the auto-enable function occurs at appropriate values of APRM power and recirculation flow signal. Therefore, verification that OPRM modules are enabled at any time that THERMAL POWER ≥ 30% RTP and recirculation drive flow ≤ the value corresponding to 60% of rated core flow adequately ensures that trips initiated from the OPRM system are not inadvertently bypassed.

The trip capability of individual OPRM modules can also be enabled by placing the module in the non-bypass (Manual Enable) mode. If placed in the non-bypass or Manual Enable mode the trip capability of the module is enabled and this SR is met. The frequency of 18 months is based on engineering judgement and reliability of the components.

SR 4.3.10.6

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

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 18 month STAGGERED TEST BASIS. This Frequency is based upon operating experience, which shows that random failures of instrumentation components causing serious time degradation, but not channel failure, are infrequent.

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3. NRC Letter, A. Thadani to L. A. England, "Acceptance for Referencing of Topical Reports NEDO-31960 and NEDO-31960, Supplement 1, 'BWR Owners Group Long-Term Stability Solutions Licensing Methodology'," July 12, 1993.

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.

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

8. GE-NE-A13-00381-04, "Reactor Long-Term Stability Solution Option III: Licensing basis Hot Bundle Oscillation Magnitude for Hope Creek, " March 1999.

9. OG96-630-169, "Guidelines for Stability Option III Enable Region," September 1996