ENERGY NORTHWEST

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November 2, 2000
GO2-00-189

Docket No. 50-397

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Gentlemen:

Subject: **WNP-2, OPERATING LICENSE NPF-21
REQUEST FOR AMENDMENT
OSCILLATION POWER RANGE MONITOR
TECHNICAL SPECIFICATIONS**

Reference: Letter GO2-99-174, dated September 24, 1999, DW Coleman (Energy Northwest) to NRC, "Reactor Stability Long Term Solution Schedule Change"

In accordance with the Code of Federal Regulations, Title 10, Parts 2.101, 50.59 and 50.90, Energy Northwest hereby submits a request for amendment to the WNP-2 Operating License. The proposed amendment implements Technical Specification changes associated with thermal-hydraulic stability monitoring. A new specification is added, which provides requirements for the Oscillation Power Range Monitor (OPRM) instrumentation.

The proposed change provides the operability requirements for the OPRM channels, the required actions when they become inoperable, and appropriate surveillance requirements. Associated changes are also proposed for existing Technical Specifications 3.4.1 and 5.6.5 to reflect the new OPRM specification.

The OPRM system was installed at WNP-2 during spring 1999 and is currently being operated in the "monitor only" mode to evaluate system performance. We will continue to operate within the bounds of the interim corrective actions described in our responses to Generic Letter 94-02 until the revised Technical Specifications are implemented and the OPRM trip function is enabled. Upon activation of the OPRM, we consider that commitments made in response to Generic Letter 94-02 will be fulfilled for WNP-2.

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Additional information is attached to this letter to complete the amendment request. Attachment 1 provides a detailed description and the basis for acceptability of the proposed change. Attachment 2 consists of the evaluation of significant hazards consideration. Attachment 3 contains the environmental considerations evaluation. Attachment 4 contains the marked-up pages of the Technical Specifications which, if approved, will be used to implement the proposed change. Attachment 5 consists of the typed Technical Specification pages as they would be revised by this amendment request. Attachment 6 consists of a marked-up copy of the Technical Specification Bases associated with this proposed change.

Energy Northwest has concluded that the proposed changes contained in this letter do not result in a significant hazards consideration. The changes proposed in this letter have also been evaluated using the identification criteria for licensing and regulatory actions requiring an environmental assessment as specified in 10 CFR 51.21. The proposed amendment meets the eligibility criteria for a categorical exclusion as set forth in 10 CFR 51.22. Therefore, an environmental assessment of the proposed change is not required.

This amendment request has been approved by the WNP-2 Plant Operations Committee and reviewed by the Energy Northwest Corporate Nuclear Safety Review Board. In accordance with 10 CFR 50.91, the State of Washington has been provided a copy of this letter.

Should you have any questions or require additional information, please call PJ Inserra, Licensing Manager, at (509) 377-4147.

Respectfully,

GO Smith
Vice President, Generation
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Attachments

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Discussion of the Proposed Changes

1.0 Introduction

Energy Northwest is requesting a revision to the WNP-2 Technical Specifications to incorporate long-term power stability solution requirements into the WNP-2 Technical Specifications. The proposed changes reflect: 1) addition of new Technical Specification Section 3.3.1.3, "Oscillation Power Range Monitoring (OPRM) Instrumentation;" 2) revision to Technical Specification Section 3.4.1, "Recirculation Loops Operating," to remove monitoring specifications that will no longer be necessary upon activation of the automatic OPRM instrumentation; and 3) revision to Technical Specification 5.6.5 to include in the Core Operating Limits Report (COLR) the applicable operating limits for the OPRMs, and also reference the topical report which describes the analytical methods used to determine the setpoint values for the OPRM.

We have installed the Option III long-term reactor stability solution at WNP-2 and this proposed amendment request is consistent with ABB Combustion Engineering (ABB CE) Topical Report CENPD-400-P-A, Revision 1, "ABB Option III Oscillation Power Range Monitor (OPRM)," and its associated NRC safety evaluation report. The OPRM system is designed to initiate a reactor scram by means of the 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 minimum critical power ratio (MCPR) safety limit under anticipated core-wide and regional thermal-hydraulic instability events.

The OPRM trip capabilities are currently deactivated, but the OPRM alarms and indications are operational to enhance operator ability to recognize and respond to an instability event. As part of this initial surveillance phase, the OPRM functions are being monitored to ensure that the OPRM algorithms perform according to design specifications and the system is evaluated under a variety of operating conditions. Consistent with the reference, current plans are to fully activate the OPRM system no later than startup from the R-15 refueling outage, pending satisfactory OPRM system performance during the current cycle in the "monitor only" mode and following staff approval of this amendment request. The R-15 refueling outage is currently scheduled for late spring 2001, with the subsequent startup planned for early summer 2001.

2.0 Background and System Description

2.1 Background

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 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 detects and suppresses conditions consistent with the onset of oscillations and prevents the MCPR safety limit from being exceeded during anticipated thermal-hydraulic instability events, which provides compliance with GDC-10 and GDC-12. Implementation of the OPRM replaces procedure-driven manual operator actions with instrumentation providing automatic action for the prevention of instability events with the possibility of exceeding the fuel MCPR safety limit.

The safety and effectiveness of the installed system in meeting the design requirement of detecting and suppressing reactor core thermal-hydraulic instabilities is demonstrated and documented in the following NRC reviewed and approved Licensing Topical Reports:

NEDO-31960-A: June 1991	BWR Owners' Group Long-Term Stability Solutions Licensing Methodology
NEDO-31960-A, Supp 1: March 1992	BWR Owners' Group Long-Term Stability Solutions Licensing Methodology, Supplement 1
NEDO-32465-A: August 1996	BWR Owners' Group Reactor Stability Detect and Suppress Solutions Licensing Basis Methodology for Reload Applications
CENPD-400-P-A, Rev 1: May 1995	Generic Topical Report for the ABB Option III Oscillation Power Range Monitor (OPRM)

The first three reports detail the safety analyses performed to support the development of the long-term solutions for the thermal-hydraulic stability issue. The last report describes the design of the monitors selected for use at WNP-2. Report CENPD-400-P-A, Revision 1, details the extensive controls used in the development, implementation, and onsite testing of both the OPRM hardware and software to ensure that oscillations will be detected and suppressed with a high degree of reliability.

The extensive controls described in the CENPD-400-P-A report help to ensure there will not be a significant increase in the number of plant scrams due to the new RPS trip functions. It is possible that these monitors may actually reduce the number of scram transients during the life of the plant. Currently, interim corrective actions (ICAs) require the operator to scram the plant upon entry into the "Manual Scram Required" portion of the power-to-flow map (high power, low flow), regardless of the presence of core oscillations due to thermal-hydraulic instability. Thus, under current licensing requirements, transients into this high power, low flow region unnecessarily require the scram of the reactor when no oscillation is present. Upon implementation of the OPRM trip, the reactor will only scram in this high power, low flow region when conditions consistent with imminent onset of an instability event are detected. Therefore, the expected frequency of scram transients is reduced when entry is made into the high power, low flow region of the power-to-flow map.

While the OPRM instrumentation was being designed, built, installed and tested, WNP-2 has operated under ICAs. These ICAs are extensive and consistent with the Boiling Water Reactor Owners' Group interim operating recommendations and our responses to Generic Letter 94-02, "Long-Term Solutions and Upgrade of Interim Operating Recommendations for Thermal-Hydraulic Instability Events in Boiling Water Reactors."

2.2 System Description

The digital-based OPRM described in ABB-CE Topical Report CENPD-400-P-A is designed to detect and suppress reactor core power instabilities. The design uses 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 accepted by the staff in safety evaluations. 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 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 OPRM cells that represent local neutron flux behavior 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 of the LPRM pages and is connected to selected LPRM flux amplifier card outputs in that page. Six of the LPRM pages contain components which perform APRM functions and are alternatively designated APRM pages. Each OPRM module located in an APRM page is connected to the APRM power and flow signals located in that page. For the two LPRM pages which are not also APRM pages, the OPRM module is connected to APRM power and flow signals from one APRM in the same RPS channel as the components of the LPRM page.

In the operate mode, each 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 OPRM 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 the number of operable OPRM cells reaches the setpoint, then 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 OPRM 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, thus, creating a half-scram condition.

The OPRM protection system provides the following control board annunciator outputs to the WNP-2 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)

Plant operators are also provided with the above information through the plant process computer by means of 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 (if connected) or plant computer by means of fiber optic data links. 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. The OPRM module repair is limited to module replacement.

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

3.0 Plant Specific Actions

The information in this section is provided pursuant to recommendations contained in the NRC safety evaluation reports (SERs) for CENPD-400-P, Revision 1, NEDO-31960-A, and NEDO-31960-A, Supplement 1.

In the SER for CENPD-400-P, Revision 1, the staff stated that licensees referencing CENPD-400 for implementation of the OPRM should provide the following information in their license amendment submittals:

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

<u>Response</u>

We have reviewed the plant-specific design against Generic Topical Report CENPD-400-P-A and confirmed that the document describes the design for the items appearing in CENPD-400-P-A, with the following acceptable deviation:

In CENPD-400-P-A, Section 3.1, "OPRM Module," it is stated that the OPRM module may be located in pre-existing free card slots or may be located in place of an existing LPRM voltage card. When the option is chosen to locate the OPRM module in place of an existing LPRM voltage card, the voltage regulator card in an adjacent card frame may be replaced, if necessary, with a dual voltage regulator card which supplies power to both card frames.

The OPRM module was installed in place of an existing LPRM voltage regulator card. However, the voltage regulator card in the adjacent card frame was not replaced with a dual voltage regulator. Instead, the existing voltage regulator was rewired to provide power to both card frames. The existing voltage regulator card has sufficient power to provide both card frames, as confirmed by in-plant tests. Therefore, a dual voltage regulator card was not necessary.

3.2 "Confirm the applicability of BWROG topical reports that address the OPRM and associated instability functions, set points and margins."

Response

Reports NEDO-32465-A and NEDO-31960-A were reviewed and determined to be applicable to WNP-2. In the SERs for NEDO-31960-A and Supplement 1, the staff found that Options III and III-A were acceptable long-term solutions for implementation in any type of BWR, subject to the following five conditions:

3.2.1 "All three algorithms described in NEDO-31960 and Supplement 1 should be used in Option III or III-A. These three algorithms are high LPRM oscillation amplitude, high-low detection algorithm, and period-based algorithm."

Response

All three algorithms are included in the Option III design. Automatic protection is actuated if any of the three algorithms meet their trip conditions. Only the period based algorithm, however, is used to demonstrate protection of the MCPR safety limit for anticipated reactor instabilities. The other two algorithms are included as defense-in-depth features.

The designations for the high LPRM oscillation magnitude and high-low detection algorithms used in the design documentation for the ABB-CE Option III solution are amplitude and growth rate respectively.

3.2.2 "The validity of the scram setpoints selected should be demonstrated by analysis. These analyses may be performed for a generic representative plant when applicable, but should include an uncertainty treatment that accounts for the number of failed sensors permitted by the Technical Specifications of the plant's applicant."

Response

The applicability of the scram setpoints has been demonstrated by cycle-specific analysis using the methodology described in NEDO-32465.

Analysis of sensor failure in the OPRM system is addressed in NEDO-32465. The analysis of NEDO-32465 demonstrated that it was more conservative to assume all LPRMs were operable because the sensitivity of the OPRM system increases as the number of LPRM failures increase. Due to the large number of LPRMs and OPRM cells, OPRM system operability is expected to be maintained under all conditions which satisfy operability of a sufficient number of APRM channels to maintain APRM system operability.

The period based algorithm is based upon explicit analysis methodology (NEDO-32465) that is applied to demonstrate a basis for concluding that the algorithm can be credited in the licensing basis for meeting the requirements of GDC-10 and GDC-12. The setpoints are selected to assure that a trip will occur for a reactor instability event.

3.2.3 "Implementation of Option III or III-A will require that the selected bypass region outside of which the detect and suppress action is deactivated be defined in the Technical Specifications."

Response

This region is included in Surveillance Requirement 3.3.1.3.5 (see Attachment 4). The exclusion region methodology (safety analyses contained in NEDO-31960) would define a curved region on the power-to-flow operating map cutting across the corner of the map near the intersection of the natural circulation line and the highest flow control line. The proximity of the line to the corner would depend upon plant-specific stability characteristics. To ease implementation of the solution in the WNP-2 design, conservative, squared off boundaries at 30% rated power and 60% rated core flow are specified.

It should be noted that the Option III trip function uses a single drive flow setpoint to represent core flow. It is intended to use the nominal value of drive flow that produces 60% core flow on the 100% rod line as the OPRM "60% core flow" setpoint.

This is consistent with the boundaries discussed in NEDO-32465, Section 2.2, "Licensing Compliance," which states, "The trip function will be enabled when both the power level is greater than 30% of rated power and the core flow is less than 60%."

3.2.4 "If the algorithms detect oscillations, an automatic protective action should be initiated. This action may be a full scram or an SRI. If an SRI is implemented with Option III or III-A, a backup full scram must take effect if the oscillations do not disappear in a reasonable period of time or if they reappear before control rod positions and operating conditions have been adjusted in accordance with appropriate procedural requirements to permit reset of the SRI protective action."

Response

The automatic protective action of the OPRMs at WNP-2 (when they are fully activated) will be a full reactor scram, rather than a select rod insert (SRI).

3.2.5 "The LPRM groupings defined in NEDO-31960 to provide input to the Option III or III-A algorithms are acceptable for the intended oscillation detection function. These LPRM groupings are the oscillation power range monitor for Option III or the octant-based arrangements for Option III-A. The requirements for a minimum OPERABLE number of LPRM detectors set forth in NEDO-31960 are acceptable."

Response

As described in NEDO-31960 and NEDO-32465-A, and as specified in the WNP-2 Licensing Basis Hot Bundle Oscillation Magnitude Analysis, the "Four LPRMs per OPRM Cell - 4BL" configuration is used at WNP-2. The 4BL arrangement is one of six approved configurations discussed in NEDO-32465-A, Appendix D. Two of the choices use only two LPRMs per cell, one uses three, and three use four LPRMs. In NEDO-31960, up to eight LPRMs were allowed, but none of the final configurations used that many because it reduced the sensitivity of the OPRMs due to averaging considerations.

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

Response

The proposed Technical Specification for the OPRM is contained in Attachment 4 of this submittal. Comparisons between new Technical Specification 3.3.1.3 and CENPD-400-P, Appendix A, "Generic Technical Specifications," are discussed in Section 4.1 of this 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."

Response

The OPRM system and components are mounted in main control room cabinets, which are located in a mild environment zone. The OPRM components, including the replacement bulk power supply are qualified to perform their Class 1E safety function pursuant to the WNP-2 Environment Design Conditions Specifications as follows:

Environmental Condition	Minimum	Maximum	Normal
Temperature	40.8°F	104.8°F	75 ± 3.8°F
Relative Humidity	10%	60%	40 – 50%
Radiation	2E+2 RAD TID		

For ease of reference, the WNP-2 plant-specific environmental conditions at the OPRM installation location for temperature, humidity, and radiation are compared to the OPRM qualification values in the following table. As shown in the table, the generic OPRM qualification values envelop the WNP-2 temperature and radiation environmental conditions. The generic OPRM qualification values for humidity do not envelop the WNP-2 environmental conditions (low humidity limit). However, operation at humidity levels lower than 30% are justified because the OPRM has been tested for electrostatic discharge and all OPRM circuit cards are coated with an acrylic urethane, which isolates the electronic equipment from direct contact with a low humidity environment (see Section 3.4.2).

Environmental Condition	WNP-2	OPRM
Temperature	4.9°C to 40.9°C (40.8°F to 104.8°F)	4.4°C to 48.9°C (40°F to 120°F)
Humidity	10% to 60% RH	30% to 95% RH
Radiation	200 RAD TID	<10,000 RAD TID

The following is discussion of the plant-specific temperature, humidity, radiation, electromagnetic and seismic environmental conditions pertaining to the OPRM at WNP-2:

3.4.1 Temperature/Heat Loading

The temperature qualification of the OPRM module was performed by test. The OPRM is designed to operate continuously in a normal ambient temperature range of 40°F to 120°F. The system is designed to operate continuously in an abnormal ambient temperature environment of 140.8°F for 48 hours. The WNP-2 control room temperature range is

40.8°F to 104.8°F, which is bounded by the design temperature range of the OPRM.

The net change in the control room heat load has not increased as a result of this modification. The additional power requirement for the OPRM hardware was offset by the replacement of two power supplies with more efficient power supplies. The heat generated in the neutron monitoring system cabinets housing the OPRM components is less than or equal to the previous cabinet heat load.

3.4.2 Humidity

The humidity qualification of the OPRM module was performed by test. The OPRM is designed to operate continuously in a humidity environment range of 30% to 95% relative humidity (RH), non-condensing.

The low end of the generic OPRM qualified humidity range is 30% RH. The WNP-2 mild environment equipment qualification range, which applies to the control room where the modules are installed, extends from 10% to 60% RH. The vendor (ABB-CE) has performed an engineering evaluation which justified operation at humidity levels as low as 10% (ABB-CE Letter TIC-97-632, dated September 16, 1997).

The primary concern at low humidity conditions is the chance for damage from electrostatic discharge. The OPRM equipment has been tested for electrostatic discharge. Also, for added protection, all the circuit cards were coated with an acrylic urethane. This isolates the electronic components from direct contact with a low humidity environment and addresses the primary concern of damage from electrostatic discharge which can occur in low humidity conditions. Thus, the OPRM equipment will continue to operate properly as low as 10% RH, which is bounded by the 10% to 60% RH mild environment condition range at WNP-2. It should also be noted that the relative humidity in the WNP-2 control room normally ranges from 40% to 50%.

3.4.3 Radiation

The OPRM is designed to operate and meet its performance requirements after a total integrated Co-60 gamma dose of less than 1E+4 RAD. The plant specific total integrated dose condition at the OPRM installation location of 2E+2 RAD is less than the tested configuration. Therefore, the OPRM is acceptable for use at WNP-2.

3.4.4 Electromagnetic Interference (EMI)

Topical Report CENPD-400-P-A states that the addition of the new OPRM equipment and plant modifications for its installation should not produce (or be susceptible to) 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.

Electromagnetic Interference testing of the OPRM equipment was performed by ABB to ensure it would not be adversely affected by the plant EMI environment (susceptibility), and to ensure the OPRM modules would not be detrimental to the existing plant EMI environment (emissions).

New equipment qualified for use at WNP-2 must be capable of withstanding the EMI levels for which they are designed. Assurance that there is no EMI impact on the existing plant equipment is provided by appropriate design standards stated in CENPD-400-P-A. Manufacturing and testing of the OPRM to these standards ensures compliance with design requirements. The WNP-2 design evaluation verified that the plant environment would not be adversely affected by the addition of the OPRM equipment. 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 WNP-2 standards, and restrictions on welding and portable transceiver use in the main control room area, ensure that the OPRM is protected from impacts of EMI. The WNP-2 main control room has also been tested for EMI environmental parameters. Therefore, the OPRM equipment is acceptable for use at WNP-2.

3.4.5 Seismic

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 effect of the additional OPRM equipment on the seismic qualification of the power range neutron monitoring system panel has been reviewed and the qualification was approved in accordance with the requirements of our design control program.

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

Response

Administrative procedures at WNP-2 provide controls for manually bypassing OPRM channels or protective functions when making setpoint adjustments and calibrations and will control access to the bypass controls.

Each OPRM module bypass is independent of all others. The module bypass is controlled by means of a local key locked switch. A common BYPASS annunciator exists at the control room main console to notify the operator that an OPRM has been placed in bypass. Access to the OPRM functions are controlled by means of the operate/test keylock switch on the front of the module. Both bypass and function keylock switches are under Operations control and are controlled in accordance with administrative procedures.

These controls comply with WNP-2 Final Safety Analysis Report Section 7.2.2.2, "Access to Means for Bypassing (IEEE Standard 279, Paragraph 4.14)," which states, "Access to means of bypassing any safety action or safety function is under the administrative control of the control room supervisor/shift manager. Other approved methods of controlling access to bypasses are also used. These include key locks with administrative control of the access to keys, procedurally controlled equipment lineups, e.g., locked valve checklists, and the use of mechanical locking devices and annunciators and other indications (e.g., bypass and inoperable status indication).

"These additional methods help to prevent inadvertent bypasses or to alert the plant operators to safety function bypasses occurring either from equipment failures or from manually induced bypasses that result as part of testing, maintenance, or equipment repair activities. Key-locked control switches that provide a means of controlling the access to a safety function bypass are designed to allow key removal only in the "safe" or "accident" positions. Access to the associated keys is procedurally controlled. When not in use, keys are under the administrative control of the control room supervisor/shift manager and stored in a key locker. The keys are audited once per day by the control room supervisor/shift manager. When operation of a key-locked control switch is required to be immediate, such as in the case of the reactor mode switch, the key may be left in the lock during normal plant operation to ensure timely actuation."

3.6 "Confirm that any changes to the plant operator's main control room panel have received human factors reviews per plant-specific procedures."

This modification was reviewed to ensure human factors considerations were part of the design. The modification incorporates adequate human factors principles consistent with WNP-2 human factors design specifications for control room/panel hardware (e.g., annunciators and controls). Human factors engineering principles, consistent with WNP-2 procedures and guidelines, were incorporated into the design of the OPRM.

4.0 Proposed Technical Specification Changes – Description and Basis

4.1 Technical Specification 3.3.1.3, "Oscillation Power Range Monitor (OPRM) Instrumentation"

This is a new specification that incorporates Limiting Condition for Operation (LCO) 3.3.1.3, Conditions, Required Actions, and Completion Times and also Surveillance Requirements (SR) associated with the OPRM Instrumentation. The new specifications are consistent with the Generic Technical Specifications for the OPRM that are contained in Topical Report CENPD-400-P-A, Appendix A, except for the following:

4.1.1 The proposed LCO 3.3.1.3 requirement for operability of the OPRM instrumentation is enhanced by adding the statement, "*within the limits as specified in the Core Operating Limits Report (COLR).*" This is consistent with LCOs associated with current Technical Specifications 3.2.1, "Average Planar Linear Heat Generation Rate (APLHGR)," 3.2.2, "Minimum Critical Power Ratio (MCPR)," and 3.2.3, "Linear Heat Generation Rate (LHGR)." Changes to the COLR are controlled pursuant to the provisions of Technical Specification 5.6.5, "Core Operating Limits Report (COLR)."

4.1.2 Required Action B.2 and its associated 120-day Completion Time are deleted. Condition B addresses situations when OPRM trip capability is not maintained. The most likely reason for such a situation would be a common-cause software error in all four channels of the OPRM. As stated by the NRC staff in the SER for Topical Report CENPD-400-P-A, a significant period of time would be necessary in order "to arrange a contract with the OPRM software developer, determine the cause of the potential software defect, repair the defect, test the software modification, and implement the software upgrade in the plant." This is evidenced by an actual case that occurred for this scenario due to the discovery of an OPRM defect that was reported to the staff by ABB pursuant to the requirements of 10CFR21 on June 29, 1999. The defect involved the random resetting of the slave OPRM module which had the potential for causing the OPRM trip channel to be out of service for a short period of time. That issue required several months from identification of the problem until the software upgrade was ready for implementation. Pursuant to Condition B in the CENPD-400-P-A report, in the interim period until the software was upgraded, the plant would be required by Required Action B.1 to be operated under the ICAs, similar to how the plant is operated today. Various versions of the ICAs have been successfully implemented for the past ten years throughout the industry. Operation under the ICAs beyond 120 days does not create a safety concern. The ICAs provide adequate plant safety and the problem leading to entry into Condition B will be required to be corrected in a timely fashion by the requirements of 10CFR50, Appendix B, Criterion XVI, "Corrective Action." This criterion requires that problems "are promptly identified and corrected." Also, management attention will continue to be focused on restoring OPRM operability, since the plant will be operating in an "Active LCO" (while in Condition B). This proposed change to Condition B from CENPD-400-P-A will avoid unnecessary plant shutdowns or processing of unnecessary Technical Specification changes, while maintaining plant safety.

4.1.3 The description of the enabled region in SR 3.3.1.3.5 was changed from "≥ 30% RTP and recirculation drive flow < 60% of rated recirculation drive flow," to "≥ 30% RTP and core flow ≤ 60% rated core flow." As discussed in Section 3.2.3 of this attachment, the exclusion region methodology (safety analyses contained in NEDO-31960) defines a curved region on the power-to-flow operating map cutting across the corner of the map near the intersection of the natural circulation line and the highest flow control line. The proximity of the line to the corner depends upon plant-specific stability characteristics. To ease implementation of the reactor long-term stability solution in the WNP-2 design, conservative, squared off boundaries at 30% rated power and 60% rated core flow are specified. This is consistent with the boundaries discussed in NEDO-32465, Section 2.2, "Licensing Compliance," which states, "The trip function will be enabled when both the power level is greater than 30% of rated power and the core flow is less than 60%."

4.2 Technical Specification 3.4.1, "Recirculation Loops Operating"

The proposed changes to Section 3.4.1 of the Technical Specifications remove monitoring specifications that will no longer be necessary upon activation of the automatic OPRM instrumentation. Specifically, references to regions defined on the power-to-flow map and actions and surveillance requirements associated with entry into these regions are deleted.

The following is a discussion of the specific Section 3.4.1 changes proposed by this amendment request:

4.2.1 Reference to the power-to-flow map is removed in two places from the LCO statement for Technical Specification 3.4.1. This change is acceptable because these references are no longer applicable.

4.2.2 Condition A of Technical Specification 3.4.1 is deleted. Action A is 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. Therefore, this action is no longer necessary.

4.2.3 Condition B of Technical Specification 3.4.1 is deleted. Action B is 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. Therefore, this action is no longer necessary.

4.2.4 Condition C of Technical Specification 3.4.1 is deleted. Action C is 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. Therefore, this action is no longer necessary.

4.2.5 Condition D of Technical Specification 3.4.1 is deleted. Action D is 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. Therefore, this action is no longer necessary.

4.2.6 Condition E and associated Required Action E.1 of Technical Specification 3.4.1 are renamed as Condition A and Required Action A.1 respectively. This change is made to reflect the deletion of Conditions A through D of Technical Specification 3.4.1.

4.2.7 Condition F and associated Required Action F.1 of Technical Specification 3.4.1 are renamed as Condition B and Required Action B.1 respectively. In addition, references to Conditions B, C, D and E are deleted. This change is made to reflect the deletion of Conditions A through D of Technical Specification 3.4.1.

4.2.8 Condition G and associated Required Action G.1 of Technical Specification 3.4.1 are renamed as Condition C and Required Action C.1 respectively. This change is made to reflect the deletion of Conditions A through D of Technical Specification 3.4.1. In addition, reference to the power-to-flow map is removed because the reference is no longer applicable.

4.2.9 Surveillance Requirement 3.4.1.2 is deleted. This surveillance requirement ensures that the plant is operated in the unrestricted region of the power-to-flow map. With implementation of the OPRM, this surveillance requirement is no longer needed.

The remainder of Technical Specification 3.4.1 is unchanged, including the requirements associated with recirculation loop flow mismatches and no recirculation loops in operation.

4.3 Technical Specification 5.6.5, "Core Operating Limits Report (COLR)"

Administrative Controls Specification 5.6.5 is revised to require that the COLR include the applicable operating limits for the OPRM, and to specify the topical report which describes the analytical methods used to determine the setpoint value for the OPRM.

5.0 Summary

We are requesting a revision to the WNP-2 Technical Specifications to incorporate long-term power stability solution requirements into the WNP-2 Technical Specifications. We have installed the Option III long-term reactor stability solution at WNP-2 and this proposed amendment request is consistent with ABB CE Topical Report CENPD-400-P-A, Revision 1, and its associated NRC SER. The OPRM system is designed to initiate a reactor scram by means of the existing 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 ensure that the MCPR safety limit is not exceeded during anticipated core-wide and regional thermal-hydraulic instability events. The capability of the OPRM system to maintain margin to the MCPR safety limit during an anticipated instability event also assures compliance with GDC-10 and GDC-12 by providing the capability to reliably and readily detect and suppress power oscillations due to thermal-hydraulic instability.

Consistent with the NRC SER for CENPD-400-P-A, the ABB-CE digital OPRM system functions and design meet the requirements of IEEE Standard 279-1971 and 10 CFR 50, Appendix B, for digital reactor protection system design. The OPRM software development methodology is consistent with the guidance provided in Regulatory Guide 1.152, which endorses IEEE Standard 7-4.3.2-1993 for ensuring software quality. It is further concluded that the proposed OPRM technical specifications will ensure appropriate system operability. Therefore, the ABB-CE OPRM design, as described in CENPD-400-P-A, is considered to be acceptable with the plant-specific actions incorporated.

Evaluation of Significant Hazards Consideration

Summary of Proposed Change

Energy Northwest is requesting a revision to the WNP-2 Technical Specifications to incorporate long-term power stability solution requirements into the WNP-2 Technical Specifications. The proposed changes reflect: 1) addition of a new Technical Specification Section 3.3.1.3, "Oscillation Power Range Monitoring (OPRM) Instrumentation;" 2) revision to Technical Specification Section 3.4.1, "Recirculation Loops Operating," to remove monitoring specifications that will no longer be necessary upon activation of the automatic OPRM instrumentation; and 3) revision to Technical Specification 5.6.5 to include in the Core Operating Limits Report (COLR) the applicable operating limits for the OPRMs, and also the topical report which describes the analytical methods used to determine the setpoint value for the OPRM.

We have installed the Option III long-term reactor stability solution at WNP-2 consistent with ABB Combustion Engineering (ABB CE) Topical Report CENPD-400-P-A, Revision 1, "ABB Option III Oscillation Power Range Monitor (OPRM)," and its associated NRC safety evaluation report. The OPRM system, which is currently in the "monitor only" mode at WNP-2, is designed to initiate a reactor scram by means of the 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, upon arming of the system, assure protection of the minimum critical power ratio (MCPR) safety limit under all anticipated core-wide and regional thermal-hydraulic instability events.

While the OPRM instrumentation was being designed, built, installed and tested, WNP-2 has operated under interim corrective actions (ICAs). These ICAs are extensive and consistent with the Boiling Water Reactor Owners' Group interim operating recommendations and our responses to Generic Letter 94-02, "Long-Term Solutions and Upgrade of Interim Operating Recommendations for Thermal-Hydraulic Instability Events in Boiling Water Reactors." During the period of time prior to full implementation, we will continue those controls which are currently in place to avoid power oscillations and to detect and suppress them if they occur.

No Significant Hazards Consideration Determination

The standards used to arrive at a determination that an amendment request does not involve a significant hazard are included in 10 CFR 50.92. Energy Northwest has evaluated the proposed change to the Technical Specifications using the criteria established in 10 CFR 50.92(c) and has determined that it does not represent a significant hazards consideration as described as follows:

- **The operation of WNP-2 in accordance with the proposed amendment will not involve a significant increase in the probability or consequences of an accident previously evaluated.**

  The proposed change specifies limiting conditions for operation, required actions and surveillance requirements for 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 Specification 3.4.1. The restrictions of the ICAs and Technical Specification 3.4.1 were imposed to ensure adequate capability to detect and suppress conditions consistent with the onset of thermal-hydraulic oscillations that may develop into a thermal-hydraulic instability event. A thermal-hydraulic instability event has the potential to challenge the minimum critical power ratio (MCPR) safety limit. The OPRM system can automatically detect and suppress conditions necessary for thermal-hydraulic instability. With the installation of the OPRM system, the restrictions of the ICAs and Technical Specification 3.4.1 are no longer required to prevent a potential challenge to the MCPR safety limit during an anticipated instability event.

  The probability of a thermal-hydraulic event is dependent on 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 thermal-hydraulic instability can occur. When the OPRM system is operable, conditions consistent with the imminent onset of oscillations are automatically detected and the conditions necessary for oscillations are suppressed, which decreases the probability of an instability event. In the event the trip capability of the OPRM is not maintained, the proposed change limits the period of time before an alternate method to detect and suppress thermal-hydraulic oscillations is required. The probability of a thermal-hydraulic instability event may be increased during the limited period of time that operation is allowed at conditions otherwise requiring the trip capability of the OPRM to be maintained. However, since the duration of this period of time is limited, the increase in the probability of a thermal-hydraulic instability event is not significant.

  The proposed change requires the OPRM system to be operable and, thereby, ensures mitigation of thermal-hydraulic instability events with a potential to challenge the MCPR safety limit when 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 thermal-hydraulic instability events initiated from unanticipated, but postulated conditions. These mitigating capabilities of the OPRM system will become available as a result of the proposed change and have the potential to reduce the consequences of anticipated and postulated thermal-hydraulic instability events. The OPRM installation has been evaluated and does not alter the function or capability of any other installed equipment such as the average power range monitoring (APRM) system or the RPS to mitigate the consequences of postulated events.

Therefore, operation of WNP-2 in accordance with the proposed amendment will not involve a significant increase in the probability or consequences of an accident previously evaluated.

- **The operation of WNP-2 in accordance with the proposed amendment will not create the possibility of a new or different kind of accident from any accident previously evaluated.**

  The proposed change specifies limiting conditions for operation, 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 Technical Specification 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.

  Operation in regions currently restricted by the requirements of ICAs and Technical Specification 3.4.1 is within the nominal operating domain and ranges of plant systems and components, and within the range for which postulated equipment and accidents have been previously evaluated.

  Therefore, operation of WNP-2 in accordance with the proposed amendment will not create the possibility of a new or different kind of accident from any accident previously evaluated.

- **The operation of WNP-2 in accordance with the proposed amendment will not involve a significant reduction in the margin of safety.**

  The proposed change specifies limiting conditions for operation, 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 Technical Specification 3.4.1.

  The OPRM system monitors small groups of LPRM signals for indication of local variations of core power consistent with thermal-hydraulic oscillations and generates an RPS trip when conditions consistent with the onset of oscillations are detected. An unmitigated thermal-hydraulic 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 thermal-hydraulic 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 limits the period of time before an alternate method to detect and suppress thermal-hydraulic oscillations is required. The alternate method to detect and suppress oscillations would be comparable to current actions required by the interim corrective actions and no significant reduction in the margin of safety would result in the event that an unmitigated instability event occurred.

Operation in regions currently restricted by the requirements of ICAs and Technical Specification 3.4.1 is within the nominal operating domain and ranges of plant systems and components, and within the range assumed for initial conditions considered in the analysis of anticipated operational occurrences and postulated accidents.

Therefore, operation of WNP-2 in accordance with the proposed amendment will not involve a significant reduction in the margin of safety.

In summary and based upon the above considerations, we have concluded that a significant hazard would not be introduced as a result of this proposed change. Also, since NRC approval of this proposed change must be obtained prior to implementation, no unreviewed safety question can exist.

Environmental Assessment Applicability Review

The proposed Technical Specification amendment request changes 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 also involves a change in surveillance requirements. Energy Northwest has evaluated the proposed amendment against the criteria for identification of licensing and regulatory actions requiring environmental assessment in accordance with 10 CFR 51.21.

It has been determined that the proposed change meets the criteria for categorical exclusion as provided for under 10 CFR 51.22(c)(9). This conclusion has been determined because the change requested does not pose a significant hazards consideration nor does it involve an increase in the amounts, or a change in the types, of any effluent that may be released off site.

Furthermore, this proposed request does not involve an increase in individual or cumulative occupational exposure.

REQUEST FOR AMENDMENT
OPRM TECHNICAL SPECIFICATIONS
Attachment 4

Marked-Up Version of Technical Specifications

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(continued)

INSERT

NEW SPECIFICATION

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 within the limits as specified in the COLR.

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

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. OPRM trip capability not maintained.	B.1 Initiate alternate method to detect and suppress thermal hydraulic instability oscillations.	12 hours
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

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.1.3.2	Calibrate the local power range monitors.	1000 MWD/T 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% rated core flow.	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. in the "Unrestricted" Region of the power-to-flow map specified in the COLR. DELETE

<u>OR</u>

One recirculation loop shall be in operation provided that in the "Unrestricted" Region of the power-to-flow map specified in the COLR with the following limits applied when the are associated LCO is applicable: DELETE

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

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

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. No, one, or two recirculation loops in operation in Region A of the power-to-flow map.	A.1 Place the reactor mode switch in the shutdown position.	10 minutes

DELETE

(continued)

ACTIONS

DELETE

CONDITION	REQUIRED ACTION	COMPLETION TIME
B. Two recirculation loops in operation in Region B or C of the power-to-flow map. OR One recirculation loop in operation in Region C of the power-to-flow map.	B.1 Verify the stability monitoring system decay ratio < 0.75.	15 minutes AND Once per hour thereafter
C. Required Action and associated Completion Time of Condition B not met.	C.1 Restore operation to the "Unrestricted" Region of the power-to-flow map.	1 hour
D. One recirculation loop in operation in Region B of the power-to-flow map.	D.1 Restore operation to Region C or the "Unrestricted" Region of the power-to-flow map.	1 hour
A. ~~E.~~ Recirculation loop flow mismatch not within limits.	A.1 ~~E.1~~ Declare the recirculation loop with lower flow to be "not in operation."	2 hours

(continued)

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
~~F.~~ B. Requirements of the LCO not met for reasons other than Condition A~~, B, C, D, or E~~.	~~F.1~~ B.1 Satisfy the requirements of the LCO.	4 hours
~~G.~~ C. Required Action and associated Completion Time of Condition ~~F~~ B not met. OR No recirculation loops in operation~~ in a Region other than Region A of the power-to-flow map~~.	~~G.1~~ C.1 Be in MODE 3.	12 hours

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 drive flow mismatch with both recirculation loops in operation is: a. ≤ 10% of rated recirculation loop drive flow when operating at < 70% of rated core flow; and b. ≤ 5% of rated recirculation loop drive flow when operating at ≥ 70% of rated core flow.	24 hours
SR 3.4.1.2	Verify operation is in the "Unrestricted" Region of the power-to-flow map specified in the COLR.	24 hours

DELETE

5.6 Reporting Requirements

5.6.2 Annual Radiological Environmental Operating Report (continued)

report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted in a supplementary report as soon as possible.

5.6.3 Radioactive Effluent Release Report

The Radioactive Effluent Release Report covering the operation of the unit shall be submitted in accordance with 10 CFR 50.36a. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The material provided shall be consistent with the objectives outlined in the ODCM and the Process Control Program and in conformance with 10 CFR 50.36a and 10 CFR 50, Appendix I, Section IV.B.1.

5.6.4 Monthly Operating Reports

Routine reports of operating statistics and shutdown experience, including documentation of all challenges to the safety/relief valves, shall be submitted on a monthly basis no later than the 15th of each month following the calendar month covered by the report.

5.6.5 CORE OPERATING LIMITS REPORT (COLR)

a. Core operating limits shall be established prior to each reload cycle, or prior to any remaining portion of a reload cycle, and shall be documented in the COLR for the following:

   1. The APLHGR for Specification 3.2.1;

   2. The MCPR for Specification 3.2.2;

   3. The LHGR for Specification 3.2.3; and

   4. ~~The power-to-flow map for Specification 3.4.1.~~ DELETE

INSERT: LCO 3.3.1.3, "OSCILLATION POWER RANGE MONITOR (OPRM) INSTRUMENTATION"

(continued)

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

1. ANF-1125(P)(A), and Supplements 1 and 2, "ANFB Critical Power Correlation," April 1990;

2. ANF-NF-524(P)(A), Revision 2 and Supplements 1 and 2, "Advanced Nuclear Fuels Corporation Critical Power Methodology for Boiling Water Reactors," November 1990;

3. ANF-89-014(P)(A), Revision 1 and Supplements 1 and 2, "Advanced Nuclear Fuels Corporation Generic Mechanical Design for Advanced Nuclear Fuels Corporation 9x9-IX and 9x9-9X BWR Reload Fuel," October 1991;

4. XN-NF-81-22(P)(A), "Generic Statistical Uncertainty Analysis Methodology," November 1983;

5. NEDE-23785-1-PA, Revision 1, "The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident, Volume III, SAFER/GESTR Application Methodology," October 1984;

6. NEDO-20566A, "General Electric Company Analytical Model for Loss-of-Coolant Analysis in Accordance with 10 CFR 50, Appendix K," September 1986;

7. CENPD-300-P-A, "Reference Safety Report for Boiling Water Reactor Reload Fuel," July 1996; ~~and~~ DELETE

8. WPPSS-FTS-131(A), Revision 1, "Applications Topical Report for BWR Design and Analysis," March 1996;

9. ANFB Critical Power Correlation Uncertainty for Limited Data Sets, ANF-1125(P)(A), Supplement 1, Appendix D, Siemens Power Corporation - Nuclear Division, July 1998; and

(continued)

INSERT

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

REQUEST FOR AMENDMENT
OPRM TECHNICAL SPECIFICATIONS
Attachment 5

Typed Version of Technical Specifications

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(continued)

(continued)

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 within the limits as specified in the COLR.

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

(continued)

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. OPRM trip capability not maintained.	B.1	Initiate alternate method to detect and suppress thermal hydraulic instability oscillations.	12 hours
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

(continued)

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.3.1.3.2	Calibrate the local power range monitors.	1000 MWD/T 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% rated core flow.	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 shall be in operation provided that 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; and

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

APPLICABILITY: MODES 1 and 2.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Recirculation loop flow mismatch not within limits.	A.1	Declare the recirculation loop with lower flow to be "not in operation."	2 hours
B. Requirements of the LCO not met for reasons other than Condition A.	B.1	Satisfy the requirements of the LCO.	4 hours

(continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
C. Required Action and associated Completion Time of Condition B not met. OR No recirculation loops in operation.	C.1 Be in MODE 3.	12 hours

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 drive flow mismatch with both recirculation loops in operation is: a. $\leq$ 10% of rated recirculation loop drive flow when operating at < 70% of rated core flow; and b. $\leq$ 5% of rated recirculation loop drive flow when operating at $\geq$ 70% of rated core flow.	24 hours

5.0 ADMINISTRATIVE CONTROLS

5.6 Reporting Requirements

The following reports shall be submitted in accordance with 10 CFR 50.4.

5.6.1 Occupational Radiation Exposure Report

A tabulation on an annual basis of the number of station, utility, and other personnel (including contractors) for whom monitoring was performed, receiving an annual deep dose equivalent of > 100 mrems and the associated collective deep dose equivalent (reported in man-rem) according to work and job functions (e.g., reactor operations and surveillance, inservice inspection, routine maintenance, special maintenance (describe maintenance), waste processing, and refueling). This tabulation supplements the requirements of 10 CFR 20.2206. The dose assignments to various duty functions may be estimated based on electronic or pocket dosimeter, thermoluminescent dosimeter (TLD), or film badge measurements. Small exposures totalling < 20% of the individual total dose need not be accounted for. In the aggregate, at least 80% of the total whole body dose received from external sources should be assigned to specific major work functions. The report shall be submitted by April 30 of each year.

5.6.2 Annual Radiological Environmental Operating Report

The Annual Radiological Environmental Operating Report covering the operation of the unit during the previous calendar year shall be submitted by May 15 of each year. The report shall include summaries, interpretations, and analyses of trends of the results of the Radiological Environmental Monitoring Program for the reporting period. The material provided shall be consistent with the objectives outlined in the Offsite Dose Calculation Manual (ODCM), and in 10 CFR 50, Appendix I, Sections IV.B.2, IV.B.3, and IV.C.

The Annual Radiological Environmental Operating Report shall include the results of analyses of all radiological environmental samples and of all environmental radiation measurements taken during the period pursuant to the locations specified in the table and figures in the ODCM, as well as summarized and tabulated results of these analyses and measurements in the format of the table in the Radiological Assessment Branch Technical Position, Revision 1, November 1979. In the event that some individual results are not available for inclusion with the report, the

(continued)

5.6 Reporting Requirements

5.6.2 Annual Radiological Environmental Operating Report (continued)

report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted in a supplementary report as soon as possible.

5.6.3 Radioactive Effluent Release Report

The Radioactive Effluent Release Report covering the operation of the unit shall be submitted in accordance with 10 CFR 50.36a. The report shall include a summary of the quantities of radioactive liquid and gaseous effluents and solid waste released from the unit. The material provided shall be consistent with the objectives outlined in the ODCM and the Process Control Program and in conformance with 10 CFR 50.36a and 10 CFR 50, Appendix I, Section IV.B.1.

5.6.4 Monthly Operating Reports

Routine reports of operating statistics and shutdown experience, including documentation of all challenges to the safety/relief valves, shall be submitted on a monthly basis no later than the 15th of each month following the calendar month covered by the report.

5.6.5 CORE OPERATING LIMITS REPORT (COLR)

a. Core operating limits shall be established prior to each reload cycle, or prior to any remaining portion of a reload cycle, and shall be documented in the COLR for the following:

   1. The APLHGR for Specification 3.2.1;

   2. The MCPR for Specification 3.2.2;

   3. The LHGR for Specification 3.2.3; and

   4. LCO 3.3.1.3, "Oscillation Power Range Monitor (OPRM) Instrumentation."

(continued)

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

b. The analytical methods used to determine the core operating limits shall be those previously reviewed and approved by the NRC, specifically those described in the following documents:

1. ANF-1125(P)(A), and Supplements 1 and 2, "ANFB Critical Power Correlation," April 1990;

2. ANF-NF-524(P)(A), Revision 2 and Supplements 1 and 2, "Advanced Nuclear Fuels Corporation Critical Power Methodology for Boiling Water Reactors," November 1990;

3. ANF-89-014(P)(A), Revision 1 and Supplements 1 and 2, "Advanced Nuclear Fuels Corporation Generic Mechanical Design for Advanced Nuclear Fuels Corporation 9x9-IX and 9x9-9X BWR Reload Fuel," October 1991;

4. XN-NF-81-22(P)(A), "Generic Statistical Uncertainty Analysis Methodology," November 1983;

5. NEDE-23785-1-PA, Revision 1, "The GESTR-LOCA and SAFER Models for the Evaluation of the Loss-of-Coolant Accident, Volume III, SAFER/GESTR Application Methodology," October 1984;

6. NEDO-20566A, "General Electric Company Analytical Model for Loss-of-Coolant Analysis in Accordance with 10 CFR 50, Appendix K," September 1986;

7. CENPD-300-P-A, "Reference Safety Report for Boiling Water Reactor Reload Fuel," July 1996;

8. WPPSS-FTS-131(A), Revision 1, "Applications Topical Report for BWR Design and Analysis," March 1996;

9. ANFB Critical Power Correlation Uncertainty for Limited Data Sets, ANF-1125(P)(A), Supplement 1, Appendix D, Siemens Power Corporation - Nuclear Division, July 1998; and

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

(continued)

5.6 Reporting Requirements

5.6.5 CORE OPERATING LIMITS REPORT (COLR) (continued)

c. The core operating limits shall be determined such that all applicable limits (e.g., fuel thermal mechanical limits, core thermal hydraulic limits, Emergency Core Cooling Systems (ECCS) limits, nuclear limits such as SDM, transient analysis limits, and accident analysis limits) of the safety analysis are met.

d. The COLR, including any midcycle revisions or supplements, shall be provided upon issuance for each reload cycle to the NRC.

5.6.6 Post Accident Monitoring (PAM) Instrumentation Report

When a report is required by Condition B or F of LCO 3.3.3.1, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.

REQUEST FOR AMENDMENT
OPRM TECHNICAL SPECIFICATIONS
Attachment 6

Marked-Up Version of Technical Specification Bases

(continued)

INSERT

NEW BASES SECTION

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 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 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. 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.

(continued)

BASES

BACKGROUND (continued)

The OPRM System consits 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 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 affects 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 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

(continued)

BASES

LCO (continued)

LCO 3.3.1.1. The Allowable Value for the OPRM Period Based Algorithm setpoint (Sp) is derived from Analytic Limit corrected for the 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% rated core flow. 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. Therefore, the OPRM is required to be OPERABLE with THERMAL POWER ≥ 25% RTP. 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 base 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.

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 (Reference 7) to permit restoration of any inoperable channel to OPERABLE status. However, this out of

(continued)

BASES

ACTIONS

A.1, A.2, and A.3 (continued)

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 place 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.

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

(continued)

BASES

ACTIONS

B.1 (continued)

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 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 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 during the period when corrective actions are underway to resolve the inoperability that led to entry into Condition B. One reason this Condition may be used is to provide time to implement a software upgrade in the plant if a common-cause software problem is identified.

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 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.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.3.1.3.1

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 (Reference 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/T Frequency is based on operating experience with LPRM sensitivity changes.

SR 3.3.1.3.3

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 (COLR). 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/T 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 (Reference 7).

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

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 3.1.3, "Control Rod Operability," and 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 judgment and reliability of the components and Operating experience.

SR 3.3.1.3.5

This SR ensures that trips initiated from the OPRM System will not be inadvertently bypassed when THERMAL POWER is ≥ 30% RTP and core flow is ≤ 60% rated core flow. 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 ≤ 60% rated core flow),then the affected OPRM module is considered inoperable. Alternatively, the bypass channel can be placed in the conservative condition (Manual Enable). If placed in the Manual Enable condition, this SR is met and the module is considered OPERABLE.

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

SR 3.3.1.3.6

This SR ensures that the individual channel response times are less than or equal to the maximum values assumed in the accident analysis (Reference 6). The OPRM self-test function may be utilized to perform this testing for those components it is designed to monitor. The LPRM amplifier

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.3.1.3.6 (continued)

cards inputting to the OPRM are excluded from the OPRM response time testing. 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 a 24 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.

REFERENCES

1. NEDO-31960-A, "BWR Owners Group Long-Term Stability Solutions Licensing Methodology," November 1995 (Sus) June 1991.

2. NEDO 31960-A, Supplement 1" BWR Owners Group Long-Term Stability Solutions Licensing Methodology," November 1995 (Sus) March 1992.

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 Solution Licensing Basis Methodology and Reload Application," August 1996 & May 1995.

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

8. Licensee Controlled Specification Table 1.3.1.1-1

INSERT

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.1 Recirculation Loops Operating

BASES

BACKGROUND

The Reactor Recirculation (RRC) System is designed to provide a forced coolant flow through the core to remove heat from the fuel. The forced coolant flow removes heat at a faster rate 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 RRC 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 RRC 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 two channel adjustable speed drive (ASD) unit to control pump speed, and associated piping, jet pumps, valves, and instrumentation. The recirculation loops 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 driven 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 driven flow are mixed in the jet pump throat section and result in partial pressure recovery. 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.

(continued)

BASES

BACKGROUND (continued)	The subcooled water enters the bottom of the fuel channels and contacts the fuel cladding, where heat 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 (i.e., 65 to 100% RTP) without having to move control rods and disturb desirable flux patterns. In addition, the combination of core flow and THERMAL POWER is normally maintained such that core thermal-hydraulic oscillations do not occur. These oscillations can occur during two-loop operation, as well as single-loop and no-loop operation. Plant procedures include requirements of this LCO as well as other vendor and NRC recommended requirements and actions to minimize the potential of core thermal-hydraulic oscillations. Each recirculation loop is manually started from the control room. The ASD provides regulation of individual recirculation loop drive flows. The flow in each loop is manually controlled.
APPLICABLE SAFETY ANALYSES	The operation of the RRC 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 (Refs. 2, 3, and 4). 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

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

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 (Ref. 4). The recirculation system is also assumed to have sufficient flow coastdown characteristics to maintain fuel thermal margins during abnormal operational transients (Ref. 5), which are analyzed in Chapter 15 of the FSAR.

A plant specific LOCA analysis has been performed assuming only one operating recirculation loop. This analysis has 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 the APLHGR requirements are modified accordingly (Refs. 3 and 4).

The transient analyses in Chapter 15 of the FSAR have also been performed for single recirculation loop operation (Ref. 6) 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 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 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."

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Safety analyses performed in Refs. 1, 3, 4, and 7 implicitly assume core conditions are stable. However, at the high power/low flow corner of the operating domain, a small probability of limit cycle neutron flux oscillations exists (Ref. 8) depending on combinations of operating conditions (e.g., power shape, bundle power, and bundle flow).

General Electric Service Information Letter (SIL) No. 380 (Ref. 8) addressed boiling instability and made several recommendations. In this SIL, the power-to-flow map was divided into several regions of varying concern. It also

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BASES

APPLICABLE SAFETY ANALYSES (continued)

discussed the objectives and philosophy of "detect and suppress." The SIL recommends that Region A be bounded by the 100% rod line and Regions B and C be bounded by the 80% rod line.

NRC Generic Letter 86-02 (Ref. 9) discussed both the GE and Siemens stability methodology and stated that due to uncertainties, General Design Criteria 10 and 12 could not be met using available analytical procedures on a BWR. The letter discussed SIL 380 and stated that General Design Criteria 10 and 12 could be met by imposing SIL 380 recommendations in operating regions of potential instabilities. The NRC concluded that regions of potential instability constituted decay ratios of 0.8 and greater by the GE methodology and 0.75 by the Siemens Power Corporation methodology which existed at that time.

Subsequently, a Siemens Power Corporation (SPC) topical report (Ref. 10) was issued which describes an improved stability computer code (STAIF) and was used to establish the current stability boundaries (Regions) for SPC fuel.

The lower boundary of Region A was defined to assure it bounds a decay ratio of 0.9. Therefore, Region A of the power-to-flow map specified in the COLR is bounded by the lower of the 100% rod line and a line that bounds a decay ratio of 0.9. Regions B and C, where applicable, were conservatively defined to bound a decay ratio of 0.75. Therefore, Region C of the power-to-flow map specified in the COLR is bounded only by the 80% rod line, and Region B is bounded by the lower of the 80% rod line and line that bounds a decay ratio of 0.75. In addition, the division between Region B and Region C is at 39% rated core flow. For ABB CENO fuel, the ABB CENO stability analysis methodology and methods (Refs. 11 and 12) are used to confirm the region boundaries described above.

Recirculation loops operating satisfies Criterion 2 of Reference ~~13~~ 8.

LCO

Two recirculation loops are normally 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.

(continued)

BASES

LCO (continued)

Alternately, with only one recirculation loop in operation, modifications to the required APLHGR limits (LCO 3.2.1, "AVERAGE PLANAR LINEAR HEAT GENERATION RATE (APLHGR)"), and MCPR limits (LCO 3.2.2, "MINIMUM CRITICAL POWER RATIO (MCPR)") must be applied to allow continued operation consistent with the assumptions of Reference 3. In addition, during two-loop and single-loop operation, the combination of core flow and THERMAL POWER must be in the "Unrestricted" Region of the power-to-flow map specified in the COLR to ensure core thermal-hydraulic oscillations do not occur. The "Unrestricted Region" includes any area not shown as "Region A, B, or C" in the power-to-flow map. The full power-to-flow map is not shown to enhance the readability of the bounds of "Regions A, B, and C."

DELETE

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

DELETE

A.1

If the plant is operating in Region A of the power-to-flow map (with any number of recirculation loops in operation), the probability of thermal-hydraulic oscillations is greatly increased. Therefore, action must be taken as soon as practicable to place the reactor mode switch in the shutdown position within 15 minutes.

B.1

With two recirculation loops in operation in Region B or C of the power-to-flow map or with one recirculation loop in operation in Region C of the power-to-flow map, the plant is operating in a region where the potential for thermal-hydraulic oscillations exists. To ensure oscillations are not occurring, the stability monitoring system decay ratio must be verified to be < 0.75 within 15 minutes and every hour thereafter. Stability monitoring is performed

(continued)

BASES

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ACTIONS

B.1 (continued)

utilizing the Advanced Neutron Noise Analysis (ANNA) System. The ANNA System is used to monitor average power range monitor (APRM) and local power range monitor (LPRM) signal decay ratio and peak-to-peak noise values when operating in Region B and C of the power-to-flow map. A total of 18 LPRMs, with two LPRMs (levels A and C or levels B and D) per LPRM string in each of the nine core regions, shall be monitored. Four APRMs are also required to be monitored. Both LPRM and APRM signals are required to be monitored to assure that both global (in-phase) and regional (out-of-phase) oscillations can be detected. Decay ratios are calculated from 30 seconds worth of data at a sample rate of 10 samples/second. This sample interval results in some inaccuracy in the decay ratio calculation, but provides rapid update in decay ratio data. The decay ratio limit of 0.75 was selected to provide adequate time for operators to respond such that sufficient margin to an instability occurrence is maintained. The decay ratio limit is not met if the decay ratio of any two or more neutron signals is ≥ 0.75 or if two consecutive decay ratios of any single neutron signal is ≥ 0.75.

The Completion Times of this verification are acceptable for ensuring potential thermal-hydraulic oscillations are detected to allow operator response to suppress the oscillations. These Completion Times were developed considering the operator's inherent knowledge of reactor status and sensitivity to potential thermal-hydraulic instabilities when operating in the associated Regions, and the alarms provided by the ANNA System to alert the operator when near the required decay ratio limit.

C.1

With the Required Action and associated Completion Time of Condition B not met, sufficient margin may not be available for operator response to suppress potential thermal-hydraulic oscillations since the neutron decay ratio is ≥ 0.75. As a result, action must be taken as soon as practicable to restore operation to the "Unrestricted" Region of the power-to-flow map. This can be accomplished by either decreasing THERMAL POWER with control rod insertion or increasing core flow. The starting of a

(continued)

BASES

DELETE

ACTIONS

C.1 (continued)

recirculation pump shall not be used as a means to enter the "Unrestricted" Region. The 1 hour Completion Time provides a reasonable amount of time to complete the Required Action and is considered acceptable based on the alarms and indication provided by the ANNA System to alert the operator to a deteriorating condition.

D.1

With one recirculation loop in operation in Region B of the power-to-flow map, the plant is operating in a region where the potential for thermal-hydraulic oscillations is increased and sufficient margin may not be available for operator response to suppress potential thermal-hydraulic oscillations. As a result, action must be taken as soon as practicable to restore operation to Region C or the "Unrestricted" Region of the power-to-flow map. This can be accomplished by either decreasing THERMAL POWER with control rod insertion or increasing core flow. The starting of a recirculation pump shall not be used as a means to enter the required Regions. The 1 hour Completion Time provides a reasonable amount of time to complete the Required Action and is considered acceptable based on the alarms and indication provided by the ANNA System to alert the operator of a deteriorating condition.

(A) (B)
E.1 and F.1

With both recirculation loops operating but the flows not matched, the recirculation loops must be restored to operation within 2 hours. If matched flows are not restored, the recirculation loop with lower flow must be declared "not in operation," as required by Required Action (A) E.1. This Required Action does 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 pump speeds to re-establish forward flow or by tripping the pump.

(continued)

BASES

ACTIONS

E.1 and F.1 (continued)

With the requirements of the LCO not met for reasons other than Condition A, B, C, D, or E (e.g., one loop is "not in operation"), the recirculation loops must be restored to operation with matched flows within 4 hours. A recirculation loop is considered not in operation when the pump in that loop is idle or when the mismatch between total jet pump flows of the two loops is greater than required limits for greater than 2 hours (i.e., Required Action E.1 has been taken). Should a LOCA occur with one recirculation loop not in operation, the core flow coastdown and resultant core response may not be bounded by the LOCA analyses. Therefore, only a limited time is allowed to restore the inoperable loop to operating status.

Alternatively, if the single loop requirements of the LCO are applied to operating limits, operation with only one recirculation loop would satisfy the requirements of the LCO and the initial conditions of the accident sequence.

The 2 and 4 hour Completion Times are based on the low probability of an accident occurring during this time period, on a reasonable time to complete the Required Action, and on frequent core monitoring by operators allowing abrupt changes in core flow conditions to be quickly detected.

G.1

With no recirculation loops in operation while in a Region other than Region A of the power-to-flow map, or the Required Action and associated Completion Time of Condition F not met, the unit is required to be brought to a MODE in which the LCO does not apply. To achieve this status, the plant must be brought to MODE 3 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, based on operating experience, to reach MODE 3 from full power conditions in an orderly manner and without challenging plant systems.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.4.1.1

This SR ensures the recirculation loop flows are within the allowable limits for mismatch. At low core flow (i.e., < 70% of rated core flow, 75.95 x 10^6 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 < 70% of rated core flow.

The mismatch is measured in terms of percent of rated recirculation loop drive flow. If the flow mismatch exceeds the specified limits, the loop with the lower flow is considered not in operation. (However, for the purpose of performing SR 3.4.1.2, the flow rate of both loops shall be used.) This 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 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

This SR ensures the combination of core flow and THERMAL POWER are within appropriate limits to prevent uncontrolled thermal-hydraulic oscillations. At low recirculation flows and high reactor power, the reactor exhibits increased susceptibility to thermal-hydraulic instability. The power-to-flow map specified in the COLR is based on guidance provided in References 8, 9, and 10. The 24 hour Frequency is based on operating experience and the operator's inherent knowledge of the reactor status, including significant changes in THERMAL POWER and core flow.

(continued)

BASES (continued)

REFERENCES

1. FSAR, Sections 6.3 and 15.F.6.

2. FSAR, Section 6.3.3.7.2.

3. NEDC-32115P, Washington Public Power Supply System Nuclear Project 2, "SAFER/GESTR-LOCA Loss-of-Coolant Accident Analysis," Revision 2, July 1993.

4. CE-NPSD-801-P, "WNP-2 LOCA Analysis Report," May 1996.

5. FSAR, Section 5.4.1.1.

6. CE-NPSD-802-P, "WNP-2 Cycle 12 Transient Analysis Report," May 1996.

7. CE-NPSD-803-P, "WNP-2 Cycle 12 Reload Report," May 1996.

DELETE

8. GE Service Information Letter No. 380, "BWR Core Thermal Hydraulic Stability," Revision 1, February 10, 1984.

9. NRC Generic Letter 86-02, "Technical Resolution of Generic Issue B-19, Thermal Hydraulic Stability," January 22, 1986.

10. EMF-CC-074(P)(A), "STAIF - A Computer Program for BWR Stability in the Frequency Domain (Volume 1)" and "STAIF - A Computer Program for BWR Stability in the Frequency Domain, Code Qualification Report (Volume 2)," July 1994.

11. CENPD-294-P-A, "Thermal Hydraulic Stability Methods for Boiling Water Reactors," July 1996.

12. CENPD-295-P-A, "Thermal Hydraulic Stability Methodology for Boiling Water Reactors," July 1996.

8 ~~13~~. 10 CFR 50.36(c)(2)(ii).