Consumers Energy

A CMS Energy Company

Palisades Nuclear Plant
27780 Blue Star Memorial Highway
Covert, MI 49043

Tel: 616 764 2276
Fax: 616 764 3265

**Nathan L. Haskell**
*Director, Licensing and Performance Assessment*

April 2, 2001

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

**DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT**
TECHNICAL SPECIFICATIONS CHANGE REQUEST
DELETION OF ASSEMBLY RADIAL PEAKING FACTOR LIMIT

A request for a change to the Palisades Technical Specifications is enclosed. The proposed revisions remove requirements for, and references to, the "Assembly Radial Peaking Factor." Our nuclear fuel vendor, Siemens Power Corporation, has revised the Palisades fuel design and safety analysis such that the Assembly Radial Peaking Factor is no longer utilized as a design limit.

It is requested that these proposed changes be approved on or before October 1, 2001. It is also requested that a period of 60 days be allowed, following approval, for implementation.

A copy of this letter has been sent to the appropriate official of the State of Michigan.

SUMMARY OF COMMITMENTS

This letter makes no new commitments and affects no existing commitments.

Nathan L. Haskell

Nathan L. Haskell
Director, Licensing and Performance Assessment

CC: Administrator, Region III, USNRC
Project Manager, NRR, USNRC
NRC Resident Inspector - Palisades
Lou Brandon, Michigan Department of Environmental Quality

Enclosure

A001

**CONSUMERS ENERGY COMPANY**

**TECHNICAL SPECIFICATIONS CHANGE REQUEST**

To the best of my knowledge, the content of this Technical Specifications change request, which deletes Technical Specifications references to the Assembly Radial Peaking Factor, $F_R^A$, (a peaking factor no longer used in core design or safety analyses) is truthful and complete.

Nathan L. Haskell

Nathan L. Haskell
Director, Licensing and Performance Assessment

Sworn and subscribed to before me this 2nd day of April 2000

Janice M. Milan

Janice M. Milan, Notary Public
Allegan County, Michigan
(Acting in Van Buren County, Michigan)
My commission expires September 6, 2003

(Seal)

**ENCLOSURE**

**CONSUMERS ENERGY COMPANY**
**PALISADES PLANT**
**DOCKET 50-255**

**TECHNICAL SPECIFICATIONS CHANGE REQUEST**
**DELETION OF ASSEMBLY RADIAL PEAKING FACTOR LIMIT**

33 Pages

**CONSUMERS ENERGY COMPANY**
**Docket 50-255**
**License DPR-20**

**Technical Specifications Change Request**
**DELETION OF ASSEMBLY RADIAL PEAKING FACTOR LIMIT**

It is requested that the Technical Specifications (TS) contained in the Facility Operating License DPR-20, Docket 50-255, for the Palisades Plant, be changed as described below.

The following attachments are included with this TS Change Request :

1. The proposed TS pages. The changed area is marked with a vertical line in the margin.

2. The existing TS pages marked to show the proposed change. Deleted text is shown as strike-out; added text is circled and shown with a shaded background.

3. For information only, the existing TS Bases pages marked to show the expected changes. Deleted text is shown as strike-out; added text is circled and shown with a shaded background.

## I. <u>Proposed Changes:</u>

A. Section 1.0:

1. The Assembly Radial Peaking Factor definition has been deleted.

2. The Total Radial Peaking Factor definition has been editorially corrected. The current definition reads:

   *$F_R^T$ shall be the maximum product of the ratio of the individual fuel pin power to the core average pin power integrated over the total core height, including tilt.*

   This is revised to read:

   *$F_R^T$ shall be the maximum ratio of the individual fuel pin power to the core average pin power integrated over the total core height, including tilt.*

B. LCO 3.2.2:

1. The title for LCO 3.2.2 has been revised to reflect the deletion of the Assembly Radial Peaking Factor, $F_R^A$, and to more closely emulate the CE Standard Technical Specifications, NUREG 1432, Rev. 2. (The Table of Contents has been revised accordingly.) The existing Title is:

   *Radial Peaking Factors*

   The proposed title is:

   *TOTAL RADIAL PEAKING FACTOR ($F_R^T$)*

**I. Proposed Changes:** (Continued)

2. The LCO wording has been revised to delete reference to the Assembly Radial Peaking Factor, $F_R^A$. The existing wording is:

   *The Assembly Radial Peaking Factor, $F_R^A$, and Total Radial Peaking Factor, $F_R^T$, shall be within the limits specified in the COLR.*

   The proposed LCO wording is:

   *$F_R^T$ shall be within the limits specified in the COLR.*

3. Condition A wording has been revised to only refer to the Total Radial Peaking Factor, $F_R^T$. The existing wording is:

   *One or more Radial Peaking Factors not within limits specified in the COLR.*

   The proposed Condition wording is:

   *$F_R^T$ not within limits specified in the COLR.*

4. Required Action A.1 wording has been revised to only refer to $F_R^T$. The existing wording is:

   *Restore Radial Peaking Factor(s) to within limits.*

   The proposed Required Action wording is:

   *Restore $F_R^T$* to within limits.

5. Surveillance Requirement (SR) 3.2.2.1 wording has been revised to only refer to $F_R^T$. The existing wording is:

   *Verify $F_R^A$ and $F_R^T$ are within limits specified in the COLR.*

   The proposed LCO wording is:

   *Verify $F_R^T$ is within limits specified in the COLR.*

C. LCO 3.2.3:

1. Required Action A.1 wording has been revised to only refer to $F_R^T$. The existing wording is:

   *Verify $F_R^A$ and $F_R^T$ are within the limits of LCO 3.2.2, "Radial Peaking Factors."*

## I. **Proposed Changes:** (Continued)

The proposed Required Action wording is:

*Verify $F_R^T$ is within the limits of LCO 3.2.2, "Total Radial Peaking Factor ($F_R^T$)."*

D. Bases Changes:

1. Upon approval of the TS changes, corresponding changes will be made to the Bases for Safety Limits Section 2.1.1 and for LCOs 3.1.4, 3.1.6, 3.2.1, and 3.2.2. For NRC information and use in reviewing this request, the following Bases pages, marked to show the expected changes, are attached.

   a. Table of Contents, page i
   b. B 2.1.1-3
   c. B 3.1.4-8
   d. B 3.1.6-1
   e. B 3.1.6-2
   f. B 3.1.6-4
   g. B 3.2.1-2
   h. B 3.2.1-3
   i. B 3.2.1-5
   j. B 3.2.2-1
   k. B 3.2.2-2
   l. B 3.2.2-3
   m. B 3.2.3-2

## II. **Discussion of Proposed Changes:**

Palisades is currently near the end of Fuel Cycle 15. The Assembly Radial Peaking Factor ($F_R^A$) is not part of the latest core design and safety analyses methodology. It was not used in those calculations for Cycle 15, and will not be used for subsequent fuel cycles.

Siemens Power Corporation supplies the Palisades nuclear fuel. Siemens performed the Cycle 15 neutronic design analysis of the reload core using the PRISM reactor simulator code. The CASMO/MICBURN assembly depletion model was used for the nuclear cross section input data. An XCOBRA-IIIC model that incorporated limiting radial and axial power distributions was used for the safety analysis calculations. That model did not use the $F_R^A$ peaking limit. The Minimum Departure from Nucleate Boiling Ratio (MDNBR) values for limiting Anticipated Operational Occurrences (AOOs) and Postulated Accidents (PAs), as evaluated with the High Thermal Performance (HTP) fuel design DNB correlation calculated for Cycle 15, were above the associated Safety Limit minimum.

Elimination of the $F_R^A$ limit improves flexibility of core design by allowing fresh assemblies to be adjacent to one another in the interior of the core, thereby allowing decreases in the cycle averaged reload enrichment and in the number of reload assemblies, while reducing the fluence on the reactor vessel.

## II. Discussion of Proposed Changes: (Continued)

$F_R^A$ was introduced to the Palisades Technical Specifications by Amendment 43, September 8, 1978. That amendment revised the limitations on linear heat generation rate and on axial power distribution. The Technical Specifications Basis states that the $F_R^A$ limit was added "to ensure that the assumptions used in the analysis for establishing the DNB margin, linear heat generation rate, thermal margin/low pressure and high pressure trip set points remain valid during operation at the various allowable control rod group insertion limits."

Since that time, Siemens has upgraded the safety analysis methodology applied to the Palisades plant several times in response to plant changes and new technology that they have developed for safety analysis calculations. During the refueling outage between Cycle 8 and 9, Consumers replaced the steam generators that resulted in a significant increase in primary coolant flow rate. A significant fuel design change was made in Cycle 9 by inserting the first reload of the HTP fuel design which provided significant additional thermal margin. Cycle 9 was also the first low radial leakage core design for Palisades. To accommodate the higher radial peaking required for the low radial leakage core, Siemens revised safety analysis methodology replaced the interior rod peaking factor ($F_R^{\Delta H}$) with the current Total Radial Peaking Factor ($F_R^T$). Amendment 137, January 10, 1995, incorporated that change along with revised TM/LP trip setpoint equations. The current definition of $F_R^T$ incorrectly states that a "product" is involved. The corrected definition wording is consistent with that used for the PIDAL-3 core monitoring system.

The Palisades fuel designs continue to incorporate changes to improve fuel performance, to gain additional thermal margin and to reduce fuel costs. The current core contains all HTP fuel assemblies and the majority of the fuel assemblies in Cycle 16 will also incorporate the FUELGUARD™ inlet nozzle debris filter.

The Cycle 15 disposition of Standard Review Plan (SRP) Chapter 15 events, the setpoint verification, the fuel centerline melt and MDNBR analysis (EMF-2259) considered the impact of several changes in fuel design and plant operations, including the removal of the $F_R^A$ peaking limit. The events were dispositioned in accordance with Siemens approved methodology and the safety analyses are based on NRC approved methodology. The completed safety analysis supports Palisades plant operation at 2530 MWt.

## IV. Analysis of No Significant Hazards Consideration

The proposed Technical Specifications changes would delete Improved Technical Specifications references to the Assembly Radial Peaking Factor, $F_R^A$, (a peaking factor no longer used in core design or safety analyses).

### A. Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?

There are no changes in plant systems, plant control operating procedures or instrument alarm or trip settings associated with this TSCR. Because neither physical equipment, nor operating methods for that equipment change, the probability of accident initiation would not change. Therefore, the proposed technical

## IV. <u>Analysis of No Significant Hazards Consideration</u> (Continued)

specification change would not involve a significant increase in the probability of an accident previously evaluated.

The assembly radial peaking ($F_R^A$) has been used in the past safety analyses and radiological consequence analyses. These analyses utilized the assumption that $F_R^A$ would remain within the Technical Specifications limit during plant operations. These analyses verify, for Anticipated Operational Occurrences (AOOs) and Postulated Accidents (PAs), that:

1) The Departure from Nucleate Boiling Ratio (DNBR) remains above the appropriate Technical Specifications Safety Limit, and

2) The calculated offsite doses and control room dose for the affected events remained within the guidelines of 10 CFR 100, Section 11, "Determination of exclusion area, low population zone and population center distance," and 10 CFR 50, Appendix A, General Design Criteria (GDC) 19, "Control room."

Improved DNB correlations and better spacer grid design have allowed the safety analysis calculations to be performed using only the total radial peaking factor ($F_R^T$) limit (which remains unchanged), without exceeding the specified Safety Limits. The radiological consequence events that previously used the $F_R^A$ limit have been re-analyzed using the slightly higher $F_R^T$ limit to determine the source strength. The revised calculated offsite dose and control room dose for the affected events remained within the guidelines of 10 CFR 100 and GDC 19.

Because the results of the transient analyses, which were performed without $F_R^A$ assumptions, continue to meet the Safety Limits, and because the dose consequence of all analyzed events, which were also performed without $F_R^A$ assumptions, continue to be within the guidelines of 10 CFR 100 and GDC 19, the proposed technical specification change would not involve a significant increase in the consequences of an accident previously evaluated.

Therefore, operation of the plant in accordance with the proposed Technical Specifications would not involve a significant increase in the probability or consequences of an accident previously evaluated.

### B. Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?

Operation of the plant in accordance with the proposed Technical Specifications would not add any new equipment, settings, or alter any plant operating practices. The only change is the deletion of all Technical Specifications references to the Assembly Radial Peaking Factor, $F_R^A$, (a peaking factor no longer used in core design or safety analyses). Since there will be no change in operating plant equipment, settings, or normal operating practices, operation in accordance with the proposed Technical Specifications would not create the possibility of a new or different kind of accident from any accident previously evaluated.

## IV. Analysis of No Significant Hazards Consideration (Continued)

### C. Does this change involve a significant reduction in a margin of safety?

The disposition of the SRP Chapter 15 events, the setpoint verification, the FCM and the MDNBR analyses documented in Siemens report EMF-2259 Revision 1, 'Palisades Cycle 15 Safety Analysis Report' dated August 1999 considered the impact of several changes in fuel design and plant operations for Cycle 15. A detailed and simplified XCOBRA-IIIC model that incorporated limiting radial and axial power distributions, as well as the removal of the $F_R^A$ peaking limit, were developed for Cycle 15. This model was applied to all DNB event analyses for Cycle 15 and the MDNBR values for limiting AOOs and PAs were evaluated with the HTP DNB correlation. The limiting MDNBR is calculated for SRP event 15.3.3 Reactor Coolant Pump Rotor Seizure and the limiting FCM is calculated for SRP event 15.4.3 Single Rod Withdrawal. The calculated results for the limiting events meet the Safety Limits specified in TS LCO 2.1.

The SRP events were dispositioned in accordance with Siemens approved methodologies listed in Palisades TS Section 5.6.5, Amendment 189. The completed safety analysis supports Palisades plant operation at 2530 Mwt.

The results of the transient analyses, which were performed without $F_R^A$ assumptions, continue to meet the Safety Limits, and the dose consequence of all analyzed events, which were also performed without $F_R^A$ assumptions, continue to be within the guidelines of 10 CFR 100 and GDC 19, operation of the Facility in accordance with the proposed technical specification change would not involve a significant reduction in the margin of safety.

Therefore, operation of the plant in accordance with the proposed Technical Specifications would not involve a significant reduction in the margin of safety.

## V. Environmental Consideration

A review has determined that the proposed amendment would not change requirements with respect to installation or use of a facility component located within the restricted area, as defined in 10 CFR 20. The proposed amendment will change an inspection or surveillance requirement. However, it has also been determined that the proposed amendment does not involve (1) a significant hazards consideration, (2) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (3) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets to eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), an environmental assessment of the proposed amendment is not required.

## VI. Conclusion

The Palisades Plant Review Committee has reviewed this Technical Specifications change request and has determined that operation of the plant in accordance with the proposed changes would not involve a significant hazards consideration.

**ENCLOSURE**
**ATTACHMENT 1**

**CONSUMERS ENERGY COMPANY**
**PALISADES PLANT**
**DOCKET 50-255**

**TECHNICAL SPECIFICATIONS CHANGE REQUEST**
**DELETION OF ASSEMBLY RADIAL PEAKING FACTOR LIMIT**

**TECHNICAL SPECIFICATIONS**
**PROPOSED PAGES**

6 Pages

# 1.0 USE AND APPLICATION

## 1.1 Definitions

-----NOTE-----

The defined terms of this section appear in capitalized type and are applicable throughout these Technical Specifications and Bases.

---

| Term | Definition |
|---|---|
| ACTIONS | ACTIONS shall be that part of a Specification that prescribes Required Actions to be taken under designated Conditions within specified Completion Times. |
| AVERAGE DISINTEGRATION ENERGY - $\bar{E}$ | $\bar{E}$ shall be the average (weighted in proportion to the concentration of each radionuclide in the primary coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration (in MeV) for isotopes, other than iodines, with half lives > 15 minutes, making up at least 95% of the total noniodine activity in the coolant. |
| AXIAL OFFSET (AO) | AO shall be the power generated in the lower half of the core less the power generated in the upper half of the core, divided by the sum of the power generated in the lower and upper halves of the core (determined using the incore monitoring system). |
| AXIAL SHAPE INDEX (ASI) | ASI shall be the power generated in the lower half of the core less the power generated in the upper half of the core, divided by the sum of the power generated in the lower and upper halves of the core (determined using the excore monitoring system). |

## 1.1 Definitions

| | |
|---|---|
| STAGGERED TEST BASIS | A STAGGERED TEST BASIS shall consist of the testing of one of the systems, subsystems, channels, or other designated components during the interval specified by the Surveillance Frequency, so that all systems, subsystems, channels, or other designated components are tested during *n* Surveillance Frequency intervals, where *n* is the total number of systems, subsystems, channels, or other designated components in the associated function. |
| THERMAL POWER | THERMAL POWER shall be the total reactor core heat transfer rate to the primary coolant. |
| TOTAL RADIAL PEAKING FACTOR ($F_R^T$) | $F_R^T$ shall be the maximum ratio of the individual fuel pin power to the core average pin power integrated over the total core height, including tilt. |

## 3.2 POWER DISTRIBUTION LIMITS

### 3.2.2 TOTAL RADIAL PEAKING FACTOR ($F_R^T$)

LCO 3.2.2 $F_R^T$ shall be within the limits specified in the COLR.

APPLICABILITY: MODE 1 with THERMAL POWER > 25% RTP.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. $F_R^T$ not within limits specified in the COLR. | A.1 Restore $F_R^T$ to within limits. | 6 hours |
| B. Required Action and associated Completion Time not met. | B.1 Reduce THERMAL POWER to ≤ 25% RTP. | 4 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.2.2.1 | Verify $F_R^T$ is within limits specified in the COLR. | Prior to operation > 50% RTP after each fuel loading<br><br><u>AND</u><br><br>31 EFPD thereafter |

## 3.2 POWER DISTRIBUTION LIMITS

### 3.2.3 QUADRANT POWER TILT ($T_q$)

LCO 3.2.3 $T_q$ shall be ≤ 0.05.

APPLICABILITY: MODE 1 with THERMAL POWER > 25% RTP.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. $T_q$ > 0.05. | A.1 Verify $F_R^T$ is within the limits of LCO 3.2.2, "TOTAL RADIAL PEAKING FACTOR ". | 2 hours<br><br>AND<br><br>Once per 8 hours thereafter |
| B. $T_q$ > 0.10. | B.1 Reduce THERMAL POWER to < 50% RTP. | 4 hours |
| C. Required Action and associated Completion Time not met.<br><br>OR<br><br>$T_q$ > 0.15. | C.1 Reduce THERMAL POWER to ≤ 25% RTP. | 4 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.2.3.1 | Verify $T_q$ is ≤ 0.05. | 12 hours |

**ENCLOSURE**
**ATTACHMENT 2**

**CONSUMERS ENERGY COMPANY**
**PALISADES PLANT**
**DOCKET 50-255**

**TECHNICAL SPECIFICATIONS CHANGE REQUEST**
**DELETION OF ASSEMBLY RADIAL PEAKING FACTOR LIMIT**

**TECHNICAL SPECIFICATIONS**
**EXISTING PAGES MARKED TO SHOW PROPOSED CHANGES**

6 Pages

# 1.0 USE AND APPLICATION

## 1.1 Definitions

-----NOTE-----

The defined terms of this section appear in capitalized type and are applicable throughout these Technical Specifications and Bases.

---

| Term | Definition |
|---|---|
| ACTIONS | ACTIONS shall be that part of a Specification that prescribes Required Actions to be taken under designated Conditions within specified Completion Times. |
| ~~ASSEMBLY RADIAL PEAKING FACTOR ($F_R^*$)~~ | ~~$F_R^*$ shall be the maximum ratio of the individual fuel assembly power to the core average fuel assembly power integrated over the total core height, including tilt.~~ |
| AVERAGE DISINTEGRATION ENERGY - $\bar{E}$ | $\bar{E}$ shall be the average (weighted in proportion to the concentration of each radionuclide in the primary coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration (in MeV) for isotopes, other than iodines, with half lives > 15 minutes, making up at least 95% of the total noniodine activity in the coolant. |
| AXIAL OFFSET (AO) | AO shall be the power generated in the lower half of the core less the power generated in the upper half of the core, divided by the sum of the power generated in the lower and upper halves of the core (determined using the incore monitoring system). |
| AXIAL SHAPE INDEX (ASI) | ASI shall be the power generated in the lower half of the core less the power generated in the upper half of the core, divided by the sum of the power generated in the lower and upper halves of the core (determined using the excore monitoring system). |

1.1 Definitions

| | |
|---|---|
| STAGGERED TEST BASIS | A STAGGERED TEST BASIS shall consist of the testing of one of the systems, subsystems, channels, or other designated components during the interval specified by the Surveillance Frequency, so that all systems, subsystems, channels, or other designated components are tested during *n* Surveillance Frequency intervals, where *n* is the total number of systems, subsystems, channels, or other designated components in the associated function. |
| THERMAL POWER | THERMAL POWER shall be the total reactor core heat transfer rate to the primary coolant. |
| TOTAL RADIAL PEAKING FACTOR ($F_R^T$) | $F_R^T$ shall be the maximum ~~product of the~~ ratio of the individual fuel pin power to the core average pin power integrated over the total core height, including tilt. |

## 3.2 POWER DISTRIBUTION LIMITS

### 3.2.2 ~~Radial Peaking Factors~~ TOTAL RADIAL PEAKING FACTOR ($F_R^T$)

LCO 3.2.2 ~~The Assembly Radial Peaking Factor, $F_R^A$, and Total Radial Peaking Factor,~~ $F_R^T$~~,~~ shall be within the limits specified in the COLR.

APPLICABILITY: MODE 1 with THERMAL POWER > 25% RTP.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. ~~One or more Radial Peaking Factors~~ $F_R^T$ not within limits specified in the COLR. | A.1 Restore ~~Radial Peaking Factor(s)~~ $F_R^T$ to within limits. | 6 hours |
| B. Required Action and associated Completion Time not met. | B.1 Reduce THERMAL POWER to ≤ 25% RTP. | 4 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.2.2.1 | Verify ~~$F_R^A$ and~~ $F_R^T$ ~~are~~ is within limits specified in the COLR. | Prior to operation > 50% RTP after each fuel loading<br><br>AND<br><br>31 EFPD thereafter |

## 3.2 POWER DISTRIBUTION LIMITS

### 3.2.3 QUADRANT POWER TILT ($T_q$)

LCO 3.2.3 $T_q$ shall be ≤ 0.05.

APPLICABILITY: MODE 1 with THERMAL POWER > 25% RTP.

ACTIONS

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. $T_q$ > 0.05. | A.1 ~~Verify $F_R^A$ and $F_R^T$ are~~ $F_R^T$ is within the limits of LCO 3.2.2, "~~Radial Peaking Factors~~ TOTAL RADIAL PEAKING FACTOR". | 2 hours<br><br>AND<br><br>Once per 8 hours thereafter |
| B. $T_q$ > 0.10. | B.1 Reduce THERMAL POWER to < 50% RTP. | 4 hours |
| C. Required Action and associated Completion Time not met.<br><br>OR<br><br>$T_q$ > 0.15. | C.1 Reduce THERMAL POWER to ≤ 25% RTP. | 4 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | FREQUENCY |
|---|---|
| SR 3.2.3.1 Verify $T_q$ is ≤ 0.05. | 12 hours |

ENCLOSURE
ATTACHMENT 3

CONSUMERS ENERGY COMPANY
PALISADES PLANT
DOCKET 50-255

TECHNICAL SPECIFICATIONS CHANGE REQUEST
DELETION OF ASSEMBLY RADIAL PEAKING FACTOR LIMIT

FOR INFORMATION
EXISTING TECHNICAL SPECIFICATIONS BASES PAGES
MARKED TO SHOW EXPECTED CHANGES

14 Pages

BASES

APPLICABLE SAFETY ANALYSES (continued)

The prediction of DNB is a function of several measured parameters. The following trip functions and LCOs, limit these measured parameters to protect the Palisades reactor from approaching conditions that could lead to DNB:

| Parameter | Protection |
|---|---|
| Core Flow Rate | Low PCS Flow Trip |
| Core Power | Variable High Power Trip |
| PCS Pressure/Core Power | TM/LP Trip |
| Core Inlet Temperature | $T_{inlet}$ LCO |
| Axial Shape Index (ASI) | ASI LCO |
| Assembly Power | Incore Power Monitoring (LHR and ~~Radial Peaking Factor~~ $F_R^T$ LCOs) |

The RPS setpoints, LCO 3.3.1, "Reactor Protective System (RPS) Instrumentation," in combination with all the LCOs, are designed to prevent any anticipated combination of transient conditions for PCS temperature, pressure, and THERMAL POWER level that would result in a Departure from Nucleate Boiling Ratio (DNBR) of less than the DNBR limit and preclude the existence of flow instabilities.

The SL represents a design requirement for establishing the protection system trip setpoints identified previously. LCO 3.2.1, "Linear Heat Rate (LHR)," and LCO 3.2.2, "~~Radial Peaking Factors~~ TOTAL RADIAL PEAKING FACTOR," or the assumed initial conditions of the safety analyses (as indicated in the FSAR, Ref. 2) provide more restrictive limits to ensure that the SLs are not exceeded.

SAFETY LIMITS

SL 2.1.1.1 and SL 2.1.1.2 ensure that the minimum DNBR is not less than the safety analyses limit and that fuel centerline temperature remains below melting.

The minimum value of the DNBR during normal operation and design basis AOOs is limited to the following DNB correlation safety limit:

| Correlation | Safety Limit |
|---|---|
| XNB | 1.17 |
| ANFP | 1.154 |
| HTP | 1.141 |

The fuel centerline melt LHR value assumed in the safety analysis is 21 kw/ft. Operation ≤ 21 kw/ft maintains the dynamically adjusted peak LHR and ensures that fuel centerline melt will not occur during normal operating conditions or design AOOs.

BASES

ACTIONS (continued)

B.1

When the control rod deviation alarm is inoperable, performing SR 3.1.4.1, once within 15 minutes of movement of any control rod, ensures improper control rod alignments are identified before unacceptable flux distributions occur. The specified Completion Times take into account other information continuously available to the operator in the control room, so that during control rod movement, deviations can be detected, and the protection provided by the control rod and deviation circuit is not required.

C.1 and C.2

Condition C addresses the situation where one rod in a group is misaligned, ie. there is more than 8" between that rod and any other rod in its group, but all remaining rods in that group are within 8 inches of each other.

A full-length control rod may become misaligned, yet remain trippable. In this condition, the control rod can still perform its required function of adding negative reactivity should a reactor trip be necessary.

Regulating rod alignment can be restored by either aligning the misaligned rod(s) to within 8 inches of all other rods in its group or, aligning the misaligned rod's group to within 8 inches of the misaligned rod if allowed by the rod group insertion limits. Shutdown rod alignment can be restored by aligning the misaligned rod to within 8 inches of all other rods in its group.

If one control rod is misaligned by > 8 inches continued operation in MODES 1 and 2 may continue, provided, within 2 hours the TOTAL RADIAL PEAKING FACTOR has ~~peaking factors have~~ been verified acceptable in accordance with SR 3.2.2.1, or the power is reduced to ≤ 75% RTP.

Xenon redistribution in the core starts to occur as soon as a rod becomes misaligned. Reducing THERMAL POWER to ≤ 75% RTP ensures acceptable power distributions are maintained.

## B 3.1 REACTIVITY CONTROL SYSTEMS

### B 3.1.6 Regulating Rod Group Position Limits

BASES

BACKGROUND

The insertion limits of the regulating rod groups are initial assumptions in all safety analyses that assume full-length rod insertion upon reactor trip. The insertion limits directly affect core power distributions, assumptions of available SDM, and initial reactivity insertion rate. The applicable criteria for these reactivity and power distribution design requirements are contained in the Palisades Nuclear Plant design criteria (Ref. 1), and 10 CFR 50.46, "Acceptance Criteria for Emergency Core Cooling Systems for Light Water Nuclear Power Reactors" (Ref. 2).

Limits on regulating rod group insertion have been established, and all regulating rod group positions are monitored and controlled during power operation to ensure that the power distribution and reactivity limits defined by the design power peaking, ejected rod worth, reactivity insertion rate, and SDM limits are preserved.

The regulating rod groups operate with a predetermined amount of position overlap, in order to approximate a linear relation between rod worth and rod position (integral rod worth). The regulating rod groups are withdrawn and operate in a predetermined sequence. The group sequence and overlap limits are specified in the COLR.

The regulating rods are used for precise reactivity control of the reactor. The positions of the regulating rods are manually controlled. They are capable of changing reactivity very quickly (compared to borating or diluting).

The power density at any point in the core must be limited to maintain specified acceptable fuel design limits, including limits that preserve the criteria specified in 10 CFR 50.46 (Ref. 2). Together, LCO 3.1.6; LCO 3.2.3, "QUADRANT POWER TILT ($T_q$)"; and LCO 3.2.4, "AXIAL SHAPE INDEX (ASI)," provide limits on control component operation and on monitored process variables to ensure the core operates within the linear heat rate (LCO 3.2.1, "Linear Heat Rate (LHR)") and ~~radial peaking factor~~ $F_R^T$ ~~and $F_R^*$~~ (LCO 3.2.2, "~~Radial Peaking Factors~~ TOTAL RADIAL PEAKING FACTOR ($F_R^T$)") limits in the COLR.

BASES

BACKGROUND (continued)

Operation within the LHR limits given in the COLR prevents power peaks that would exceed the Loss Of Coolant Accident (LOCA) limits derived by the Emergency Core Cooling System analysis. Operation within the ~~$F_R^A$ and~~ $F_R^T$ limits given in the COLR prevents Departure from Nucleate Boiling (DNB) during a loss of forced reactor coolant flow accident. In addition to the LHR, $F_R^A$, and $F_R^T$ limits, certain reactivity limits are preserved by regulating rod insertion limits. The regulating rod group insertion limits also restrict the ejected rod worth to the values assumed in the safety analysis and preserve the minimum required SDM in MODES 1 and 2.

The ejected rod case is limited to the reactivity worth for the highest worth rod ejected from the PDIL limit, thus limiting the maximum possible reactivity excursion.

The establishment of limiting safety system settings and LCOs requires that the expected long and short term behavior of $F_R^T$ ~~the radial peaking factors~~ be determined. The long term behavior relates to the variation of the steady state $F_R^T$ ~~radial peaking factors~~ with core burnup and is affected by the amount of rod insertion assumed, the portion of a burnup cycle over which such insertion is assumed, and the expected power level variation throughout the cycle. The short term behavior relates to transient perturbations to the steady state radial peaks, due to radial xenon redistribution. The magnitudes of such perturbations depend upon the expected use of the rods during anticipated power reductions and load maneuvering. Analyses are performed, based on the expected mode of operation of the Nuclear Steam Supply System (base loaded, maneuvering, etc.). The PDIL curve stated in the COLR dictates the acceptable regulating rod group positioning for anticipated power maneuvers and transient mitigation within the limits. The PDIL limitations stated in the COLR reflect the assumptions made in the safety analyses. This ensures that the $F_R^T$ limits are ~~radial peaking is~~ not violated during power level maneuvering or transient mitigation.

The regulating rod group insertion and alignment limits are process variables that together characterize and control the three dimensional power distribution of the reactor core. Additionally, the regulating rod group insertion limits control the reactivity that could be added in the event of a control rod ejection accident, and the shutdown and regulating bank insertion limits ensure the required SDM is maintained.

BASES

APPLICABLE SAFETY ANALYSES (continued)

The SDM requirement is ensured by limiting the regulating and shutdown rod group insertion limits, so that the allowable inserted worth of the rods is such that sufficient reactivity is available to shut down the reactor to hot zero power. SDM assumes the maximum worth rod remains fully withdrawn upon trip (Ref. 4).

The most limiting SDM requirements for Mode 1 and 2 conditions at Beginning of Cycle (BOC) are determined by the requirements of several transients, e.g., Loss of Flow, etc. However, the most limiting SDM requirements for MODES 1 and 2 at End of Cycle (EOC) come from just one transient, Main Steam Line Break (MSLB). The requirements of the MSLB event at EOC for the full power and no load conditions are significantly larger than those of any other event at that time in cycle and, also, considerably larger than the most limiting requirements at BOC.

Although the most limiting SDM requirements at EOC are much larger than those at BOC, the available SDMs obtained via tripping the full-length control rods are substantially larger due to the much lower boron concentration at EOC. To verify that adequate SDMs are available throughout the cycle to satisfy the changing requirements, calculations are performed at both BOC and EOC. It has been determined that calculations at these two times in cycle are sufficient since the difference between available SDMs and the limiting SDM requirements are the smallest at these times in cycle. The measurement of full-length control rod bank worth performed as part of the Startup Testing Program demonstrates that the core has the expected shutdown capability. Consequently, adherence to LCO 3.1.5, "Shutdown and Part-Length Rod Group Insertion Limits," and LCO 3.1.6 provides assurance that the available SDM at any time in cycle will exceed the limiting SDM requirements at that time in cycle.

Operation at the insertion limits or ASI limits may approach the maximum allowable linear heat generation rate or peaking factor, with the allowed $T_q$ present. Operation at the insertion limit may also indicate the maximum ejected rod worth could be equal to the limiting value in fuel cycles that have sufficiently high ejected rod worth.

The regulating and shutdown rod insertion limits ensure that safety analyses assumptions for reactivity insertion rate, SDM, ejected rod worth, and ~~power distribution~~ peaking factors are preserved.

The regulating rod group position limits satisfy Criterion 2 of 10 CFR 50.36(c)(2).

BASES

BACKGROUND (continued)

The limits on LHR, Assembly Radial Peaking Factor ($F_R^*$), Total Radial Peaking Factor TOTAL RADIAL PEAKING FACTOR ($F_R^T$), QUADRANT POWER TILT ($T_q$), and AXIAL SHAPE INDEX (ASI), which are obtained directly from the core reload analysis, ensure compliance with the safety limits on LHR and Departure from Nucleate Boiling Ratio (DNBR).

Either of the two core power distribution monitoring systems, the Incore Alarm portion of the Incore Monitoring System or the Excore Monitoring System, provides adequate monitoring of the core power distribution and is capable of verifying that the LHR is within its limits. The Incore Alarm System performs this function by continuously monitoring the local power at many points throughout the core and comparing the measurements to predetermined setpoints above which the limit on LHR could be exceeded. The Excore Monitoring System performs this function by providing comparison of the measured core ASI with predetermined ASI limits based on incore measurements. An Excore Monitoring System Allowable Power Level (APL), which may be less than RATED THERMAL POWER, and an additional restriction on $T_q$, are applied when using the Excore Monitoring System to ensure that the ASI limits adequately restrict the LHR to less than the limiting values.

In conjunction with the use of the Excore Monitoring System for monitoring LHR and in establishing ASI limits, the following assumptions are made:

a. The control rod insertion limits of LCO 3.1.5, "Shutdown and Part-Length Rod Group Insertion Limits," and LCO 3.1.6, "Regulating Rod Group Position Limits," are satisfied;

b. The additional $T_q$ restriction of SR 3.2.1.6 is satisfied; and

c. Radial Peaking Factors, $F_R^*$ and $F_R^T$, does do not exceed the limits of LCO 3.2.2.

The limitations on the Radial Peaking Factors TOTAL RADIAL PEAKING FACTOR provided in the COLR ensure that the assumptions used in the analysis for establishing the LHR limits and Limiting Safety System Settings (LSSS) remain valid during operation at the various allowable control rod group insertion limits.

BASES

BACKGROUND (continued)

The Incore Monitoring System continuously provides a direct indication of the core power distribution. It also provides alarms that have been established for the individual incore detector segments, ensuring that the peak LHRs are maintained within the limits specified in the COLR. The setpoints for these alarms include tolerances, set in conservative directions, for:

a. A measurement calculational uncertainty factor (as identified in the COLR);

b. An engineering uncertainty factor of 1.03; and

c. A THERMAL POWER measurement uncertainty factor of 1.02.

The measurement uncertainties associated with LHR, $F_R^*$ and $F_R^T$ are based on a statistical analysis performed on power distribution benchmarking results. The COLR includes the applicable measurement uncertainties for fresh and depleted incore detector usage. The engineering and THERMAL POWER uncertainties are incorporated in the power distribution calculation performed by the fuel vendor.

The excore power distribution monitoring system consists of Power Range Channels 5 through 8. The power range channels monitor neutron flux from 0 to 125 percent full power. They are arranged symmetrically around the reactor core to provide information on the radial and axial flux distributions.

The power range detector assembly consists of two uncompensated ion chambers for each channel. One detector extends axially along the lower half of the core while the other, which is located directly above it, monitors flux from the upper half of the core. The DC current signal from each of the ion chambers is fed directly to the control room drawer assembly without pre-amplification. Each excore detector supplies data to a Thermal Margin Monitor (TMM). Each TMM uses these excore signals to calculate Axial Shape Index (ASI) on a continuous basis.

ASI can be defined as the compensated ratio of power developed in the upper and lower sections of the core. The TMM takes the excore detector signals and develops a power ratio (YE) that describes the distribution of neutron flux developed in the core by the formula:

$$\mathbf{YE = (L - U)/(L + U)}$$

Where L is the lower excore segment flux, and U is the upper excore segment flux.

BASES

APPLICABLE SAFETY ANALYSES (continued)

Fuel cladding failure during a LOCA is limited by restricting the maximum linear heat generation rate so that the peak cladding temperature does not exceed 2200°F (Ref. 4). High peak cladding temperatures are assumed to cause severe cladding failure by oxidation due to a Zircaloy water reaction.

The LCOs governing LHR, ASI, and the Primary Coolant System Operation ensure that these criteria are met as long as the core is operated within the LHR, ASI, ~~$F_R^*$~~, $F_R^T$, and $T_q$ limits. The latter are process variables that characterize the three dimensional power distribution of the reactor core. Operation within the limits for these variables ensures that their actual values are within the ranges used in the accident analyses.

Fuel cladding damage does not necessarily occur while the plant is operating at conditions outside the limits of these LCOs during normal operation. Fuel cladding damage could result, however, if an accident occurs from initial conditions outside the limits of these LCOs. The potential for fuel cladding damage exists because changes in the power distribution can cause increased power peaking and can correspondingly increase local LHR.

The Incore Monitoring System provides for monitoring of LHR, $F_R^T$ ~~radial peaking factors~~, and QUADRANT POWER TILT to ensure that fuel design conditions and safety analysis assumptions are maintained. The Incore Monitoring System is also utilized to determine the target AXIAL OFFSET (AO) and to determine the Allowable Power Level (APL) when using the excore detectors.

The Excore Monitoring System provides for monitoring of ASI and QUADRANT POWER TILT to ensure that fuel design conditions and safety analysis assumptions are maintained.

LHR satisfies Criterion 2 of 10 CFR 50.36(c)(2).

LCO

The power distribution LCO limits are based on correlations between power peaking and certain measured variables used as inputs to the LHR and DNBR operating limits. The power distribution LCO limits, except $T_q$, are provided in the COLR. The limitation on the LHR in the peak power fuel rod at the peak power elevation Z ensures that, in the event of a LOCA, the peak temperature of the fuel cladding does not exceed 2200°F.

B 3.2 POWER DISTRIBUTION LIMITS

B 3.2.2 TOTAL RADIAL PEAKING FACTOR ($F_R^T$) ~~Radial Peaking Factors~~

BASES

| | |
|---|---|
| BACKGROUND | The Background section of Bases B 3.2.1, "Linear Hear Rate," is applicable to these Bases. |
| APPLICABLE SAFETY ANALYSES | The Applicable Safety Analyses section of Bases B 3.2.1 is applicable to these Bases.<br><br>The ~~Power Radial Factors satisfy~~ TOTAL RADIAL PEAKING FACTOR satisfies Criterion 2 of 10 CFR 50.36(c)(2). |
| LCO | The power distribution LCO limits are based on correlations between power peaking and certain measured variables used as inputs to the LHR and DNBR operating limits. The power distribution LCO limits, except $T_q$, are provided in the COLR.<br><br>The limitations on ~~$F_R^*$ and~~ $F_R^T$ are provided to ensure that assumptions used in the analysis for establishing DNB margin, LHR limit and the thermal margin/low pressure and variable high power trip setpoints remain valid during operation. Data from the incore detectors are used for determining $F_R^T$ ~~the measured radial peaking factors~~. |
| APPLICABILITY | In MODE 1 with THERMAL POWER > 25% RTP, power distribution must be maintained within the limits assumed in the accident analyses to ensure that fuel damage does not result following an AOO. In MODE 1 with THERMAL POWER ≤ 25% RTP, and in other MODES, this LCO does not apply because there is not sufficient THERMAL POWER to require a limit on the core power distribution, and because ample thermal margin exists to ensure that the fuel integrity is not jeopardized and safety analysis assumptions remain valid. |

BASES

ACTIONS

A.1

If one or more Radial Peaking Factors exceed their $F_R^T$ exceeds its limits, $F_R^T$ they must be restored to within the their limits as identified in the COLR within 6 hours. Restoration may be either by correcting the source of the peaking or by a conservative reduction in THERMAL POWER. The THERMAL POWER typically necessary to achieve restoration is typically identified by the equation:

$$P = [1 - 3.33 ((F_R/F_L) - 1)] (RTP)$$

Where $F_R$ is the measured value of either $F_R^*$ or $F_R^T$; and $F_L$ is the corresponding limit provided in the COLR. Operating at or below this power level, P, is typically sufficient to restore $F_R^T$ the Radial Peaking Factors to within limits. If the reduced power reductions does not restore $F_R^T$ the Radial Peaking Factor(s) to within limits within 6 hours, further power reduction is necessary. If such power reductions are insufficient to restore the peaking to within limits, Condition B is applicable.

Six hours to restore $F_R^T$ the Radial Peaking Factor(s) to within their limit(s) is reasonable and ensures that the core does not continue to operate in this condition for an extended period. The 6 hour Completion Time also allows the operator sufficient time for evaluating core conditions and for initiating proper corrective actions.

B.1

If the Required Action and associated Completion Time are not met, THERMAL POWER must be reduced to ≤ 25% RTP. This reduced power level ensures that the core is operating within its thermal limits and places the core in a conservative condition. The allowed Completion Time of 4 hours is reasonable, based on operating experience, to reach ≤ 25% RTP from full power conditions in an orderly manner and without challenging plant systems.

BASES

SURVEILLANCE REQUIREMENTS

SR 3.2.2.1

The periodic Surveillance to determine the calculated $F_R^*$ and $F_R^T$ ensures that $F_R^T$ the Radial Peaking Factors remains within the range assumed in the analysis throughout the fuel cycle. Determining $F_R^T$ the measured Radial Peaking Factors using the incore detectors after each fuel loading prior to the reactor exceeding 50% RTP ensures that the core is properly loaded.

Performance of the Surveillance every 31 Effective Full Power Days (EFPD) ensures that unacceptable changes in $F_R^T$ the Radial Peaking Factors are promptly detected.

REFERENCES

None

BASES

ACTIONS

A.1

If the measured $T_q$ is > 0.05, $T_q$ must be restored within 2 hours or ~~$F_R^*$ and~~ $F_R^T$ must be determined to be within the limits of LCO 3.2.2, and determined to be within these limits every 8 hours thereafter, as long as $T_q$ is out of limits. Two hours is sufficient time to allow the operator to reposition control rods, and significant radial xenon redistribution cannot occur within this time. The 8 hour Completion Time ensures changes in ~~$F_R^*$ and~~ $F_R^T$ can be identified before the limits of LCO 3.2.2 are exceeded.

As stated in SR 3.0.2, the 25% extension allowed by SR 3.0.2 may be applied to Required Actions whose Completion Time is stated as "once per . . ." however, the 25% extension does not apply to the initial performance of a Required Action with a periodic Completion Time that requires performance on a "once per. . ." basis. The 25% extension applies to each performance of the Required Action after the initial performance. Therefore, while Required Action 3.2.3 A.1 must be initially performed within 2 hours without any SR 3.0.2 extension, subsequent performances at the "Once per 8 hours" interval may utilize the 25% SR 3.0.2 extension.

B.1

With the measured $T_q$ > 0.10, power must be reduced to < 50% RTP within 4 hours, ~~and $F_R^*$~~ and $F_R^T$ must be within ~~their~~ specified limits to ensure that acceptable flux peaking factors are maintained as required by Condition A (which continues to be applicable). Based on operating experience, 4 hours is sufficient time for evaluation of these factors. If ~~$F_R^*$ and~~ $F_R^T$ is ~~are~~ within limits, operation may proceed while attempts are made to restore $T_q$ to within its limit. If the tilt is generated due to a control rod misalignment, continued operation at < 50% RTP allows for realignment; if the cause is other than control rod misalignment, continued operation may be necessary to discover the cause of the tilt. Reducing THERMAL POWER to < 50% RTP, and the more frequent measurement of $F_R^T$ ~~peaking factors~~ required by ACTION A.1, provide conservative protection from potential increased peaking due to xenon redistribution.