Entergy

Entergy Operations, Inc.
17265 River Road
Killona, LA 70066
Tel 504 739 6310

Barry S. Allen, P.E.
Director, Engineering
Waterford 3

W3F1-2002-0012

January 31, 2002

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

SUBJECT: Waterford Steam Electric Station, Unit 3
Docket No. 50-382
License Amendment Request TSCR NPF-38-241,
Revision to Peak Linear Heat Rate Safety Limit
Technical Specification 2.1.1.2.

REFERENCES:
1. Entergy letter dated July 9 2001, Technical Specification Change Request NPF-38-234, "Replacement of Part-Length Control Element Assemblies.
2. Entergy letter dated September 21, 2001, Technical Specification Change Request, NPF-38-238, "Appendix K Margin Recovery – Power Uprate Request"

Dear Sir or Madam:

Pursuant to 10CFR50.90, Entergy Operations, Inc. (Entergy) hereby requests the following amendment for Waterford Steam Electric Station, Unit 3 (Waterford 3). This submittal requests a change to Technical Specification (TS) Safety Limit 2.1.1.2, "Peak Linear Heat Rate" (PLHR). This change will replace the PLHR Safety Limit with a Peak Fuel Centerline Temperature Safety Limit and update the Index accordingly. The associated TS Bases changes are also being provided to appropriately reflect the proposed new Safety Limit.

It was recently determined that the current Safety Limit does not clearly conform to 10 CFR 50.36(c)(1)(ii)(A). The current PLHR Safety Limit of 21 kW/ft adequately addresses normal steady state operations but may be momentarily exceeded during two anticipated operational occurrences (AOOs). From an accident analysis perspective, this is acceptable per NUREG-0800, "Standard Review Plan" because the fuel centerline melting temperature limit is not exceeded. A change to the Safety Limit is needed to more clearly conform to 10 CFR 50.36. The proposed change will replace the current Peak Linear Heat Rate Safety Limit with a Peak Fuel Centerline Temperature. The proposed approach contained in Attachment 1 has been discussed with the NRC staff.

This License Amendment Request is submitted on an exigent basis. This change is considered exigent since the need to more clearly conform with 10 CFR 50.36 was only recently identified by the NRC staff. Entergy has worked with the staff to expeditiously submit the needed

A001

Technical Specification change. This change has been requested by the NRC staff to support License Amendment Requests (References 1 & 2), which have been requested for the March 2002 refueling outage. Entergy requests approval of the proposed amendment byFebruary 28, 2002. Once approved, the amendment shall be implemented within 30 days.

The proposed change has been evaluated in accordance with 10CFR50.91(a)(1) using criteria in 10CFR50.92(c) and it has been determined that this change involves no significant hazards considerations. The proposed change does not include any new commitments.

If you have any questions or require additional information, please contact D. Bryan Miller at 504-739-6692.

I declare under penalty of perjury that the foregoing is true and correct. Executed on January 31, 2002.

Sincerely,

B.S. Allen
Director, Engineering
Waterford Steam Electric Station, Unit 3

BSA/DBM/cbh

Attachments:
1. Analysis of Proposed Technical Specification Change
2. Proposed Technical Specification Changes (mark-up)
3. Changes to TS Bases pages (mark-up)

cc: E.W. Merschoff, NRC Region IV
N. Kalyanam, NRC-NRR
J. Smith
N.S. Reynolds
NRC Resident Inspectors Office
Louisiana DEQ/Surveillance Division
American Nuclear Insurers

Attachment 1

W3F1-2002-0012

Analysis of Proposed Technical Specification Change Regarding Peak Fuel Centerline Temperature

**Analysis of Proposed Technical Specification Change
Regarding Peak Fuel Centerline Temperature**

1.0 DESCRIPTION

This letter is a request to amend Operating License NPF-38 for Waterford Steam Electric Station, Unit 3 (Waterford 3).

The proposed change will replace the Peak Linear Heat Rate (PLHR) Safety Limit, Technical Specification 2.1.1.2, with a Peak Fuel Centerline Temperature Safety Limit. This change is necessary to more clearly conform with 10 CFR 50.36(c)(1)(ii)(A), which requires that Limiting Safety System Settings prevent a Safety Limit from being exceeded during normal operations and Anticipated Operational Occurrences (AOOs).

2.0 PROPOSED CHANGE

Replace Technical Specification (TS) Safety Limit (SL) 2.1.1.2, "Peak Linear Heat Rate" with a new "Peak Fuel Centerline Temperature" Safety Limit.

Revise TS Index page III to reflect the new SL.

Attachment 2 contains the marked-up TS pages reflecting the proposed changes.

The Bases for TS 2.1.1 and 2.2.1 are being revised accordingly to reflect the new Peak Fuel Centerline Temperature Safety Limit and provide a reference to the approved Topical Report for determining the new Safety Limit. The Bases for TS 3/4.2.7, "Axial Shape Index" will also be revised to reference the new Safety Limit. Attachment 3 contains the marked-up TS Bases pages reflecting the proposed changes. The Bases pages are provided for information only.

This change deviates from NUREG-1432[1] in that it proposes to replace the PLHR Safety Limit with the Peak Fuel Centerline Temperature Safety Limit. This deviation from NUREG-1432 is necessary to ensure this SL adequately address both AOOs and normal operation. Note, however, that the change is consistent with the standard improved Technical Specifications for the Westinghouse and Babcock and Wilcox plants (see Section 6.0, Precedence).

3.0 BACKGROUND

In preparation for the Spring 2002 refueling outage, Entergy submitted License Amendment Requests (TAC# MB2971[2] & MB2379[3]) to increase rated thermal power by 1.5% (Appendix K Margin Recovery) and replace the part-length control element assemblies with full length control element assemblies. During the review of the Waterford 3 Appendix K Margin Recovery Power Uprate request, the NRC staff recognized that the PLHR SL of 21 kW/ft would be exceeded for an AOO. In accordance with 10 CFR 50.36(c)(1)(ii)(A), Limiting Safety System Settings must

---

[1] NUREG-1432, "Standard Technical Specifications, Combustion Engineering Plants," Revision 2
[2] Entergy letter dated September 21, 2001, Technical Specification Change Request, NPF-38-238, "Appendix K Margin Recovery – Power Uprate Request"
[3] Entergy letter dated July 9 2001, Technical Specification Change Request NPF-38-234, "Replacement of Part-Length Control Element Assemblies"

be chosen such that automatic action will prevent a SL from being exceeded. This is applicable during normal operations and AOOs. Therefore conformance with 10 CFR 50.36 was not clearly demonstrated.

While the current steady state limit of 21 kW/ft is momentarily exceeded during the two AOOs; the peak fuel centerline temperature does not exceed the melting point. The AOOs are the Control Element Assembly Withdrawal events from subcritical and low power conditions. The analysis results, including the linear heat rate greater than 21 kW/ft, for these events has been previously reviewed in accordance with the Standard Review Plan[4] (SRP) and found to be acceptable by the NRC staff. This review and acceptance by the staff is documented in the original Waterford 3 Safety Evaluation Report[5] and the Safety Evaluation Report for the Waterford 3 Cycle 2 Reload Analysis Report[6].

4.0 TECHNICAL ANALYSIS

The intent of the PLHR SL is to prevent the fuel centerline temperature from reaching the melting point, which conservatively assures there will be no breach in cladding integrity. The current 21 kW/ft limit was chosen because it is the highest steady state linear heat rate at which the fuel can operate without causing the centerline temperature to reach the melting point. This limit adequately addresses steady state operation (normal operation). However, during two short duration AOOs at Waterford 3, PLHR exceeds 21 kW/ft. Due to the short duration of these AOOs, the peak fuel centerline temperature does not exceed the melting point of the fuel. A more appropriate SL would be one that addresses both normal operation and AOOs such as peak fuel centerline temperature.

In accordance with 10 CFR 50, Appendix A, "General Design Criteria" (GDC) 10, "Reactor Design," and 20, "Protection Systems Functions," the acceptance criteria for normal operation and AOOs is that the Specified Acceptable Fuel Design Limits (SAFDLs) not be exceeded. The SAFDL of interest, in this case, is the Peak Fuel Centerline Temperature limit. This SAFDL is discussed in detail in SRP Section 4.2[7], which states:

> *(II)(A)(2)(e) "Overheating of Fuel Pellets: It has also been traditional practice to assume that failure will occur if centerline melting takes place. ... For normal operation and anticipated operational occurrences, centerline melting is not permitted. ... The centerline melting criterion was established to assure that axial or radial relocation of molten fuel would neither allow molten fuel to come into contact with the cladding nor produce local hot spots. The assumption that centerline melting results in fuel failure is conservative."*

Waterford 3 complies with GDC 10 and 20 as discussed in Final Safety Analysis Report (FSAR) Sections 3.1.6 and 3.1.16. Additionally, FSAR Section 4.4.1, lists the SAFDLs utilized for the design of the Waterford 3 reactor. FSAR Section 4.4.1.3, states:

---

[4] NUREG-0800, "Standard Review Plan," Section 15.4.1, "Uncontrolled Control Rod Assembly Withdrawal From A Subcritical or Low Power Startup Condition," Rev. 2, July 1981
[5] NUREG-0787, "Safety Evaluation Report related to the operation of Waterford Steam Electric Station, Unit No. 3," July 1981
[6] NRC letter dated January 16, 1987, "Reload Analysis Report for Cycle 2 at Waterford 3"
[7] NUREG-0800, Standard Review Plan, Section 4.2, "Fuel System Design," Rev. 2, July 1981

"The peak temperature of the fuel shall be less than the melting point ... during steady-state operation and anticipated operation and anticipated operational occurrences."

Therefore, a more appropriate SL would be one that is based upon the peak fuel centerline temperature. A peak fuel centerline temperature SL would address both normal operation and AOOs. A peak fuel centerline temperature SL would be consistent with 10 CFR 50 Appendix A, the SRP, the Waterford 3 licensing basis, and 10 CFR 50.36.

The melting point of the fuel is dependent on fuel burnup and the amount and type of burnable poison used in the fuel. The design melting point of new fuel with no burnable poison is 5080 °F. The melting point is adjusted downward from this temperature depending on the amount of burnup and amount and type of burnable poison in the fuel. The adjustment for burnup of 58 °F per 10,000 MWD/MTU is consistent with standard TSs as discussed in Section 6.0 of this attachment. The 58 °F per 10,000 MWD/MTU was accepted by the NRC staff in Topical Report CEN-386-P-A[8]. The burnable poison adjustments are determined in accordance with CENPD-382-P-A[9]. The adjustment for the erbium burnable poison is considered to be proprietary information and therefore can not be included in the TS.

The mode of applicability and actions required if the limit was exceeded would be the same as they are for the current PLHR SL. CENPD-382-P-A will be appropriately referenced in the TS Bases for the SL.

Therefore, a peak fuel centerline temperature SL of less than 5080 °F (decreasing by 58 °F per 10,0000 MWD/MTU for burnup and adjusting for burnable poisons per CENPD-382-P-A) is more appropriate then the current PLHR SL. The peak fuel centerline temperature SL will:

- address both normal operations and AOOs,
- be consistent with 10 CFR 50 Appendix A criteria,
- be consistent with SAFDLs,
- be consistent with SRP acceptance criteria,
- be consistent with the Waterford 3 licensing basis,
- be determined using NRC approved methodologies, and
- clearly conform to 10 CFR 50.36(c)(1)(ii)(A).

5.0 REGULATORY ANALYSIS

5.1 Applicable Regulatory Requirements/Criteria

The proposed changes have been evaluated to determine whether applicable regulations and requirements continue to be met.

---

[8] CEN-386-P-A, "Verification of the Acceptability of a 1-Pin Burnup Limit of 60 MWD/kgU for Combustion Engineering 16x16 PWR Fuel," August 1992

[9] Topical Report, CENDP-382-P-A, "Methodology for Core Designs Containing Erbium Burnable Absorbers," Revision 0, August 1993

The proposed change is already consistent with the Waterford 3 FSAR and the FSAR will only require a change to indicate that the Safety Limit for fuel temperature is fuel centerline melt and not linear heat rate.

Entergy has determined that the proposed changes do not require any exemptions or relief from regulatory requirements, other than the TS, and do not affect conformance with any GDC differently than described in the FSAR. The approval of this change will clearly establish conformance with 10 CFR 50.36.

5.2 No Significant Hazards Consideration

The proposed change will revise the Waterford 3 Technical Specifications to replace the Peak Linear Heat Rate Safety Limit, Technical Specification 2.1.1.2, with a Peak Fuel Centerline Temperature Safety Limit. The value of the new Safety Limit will be the melting point of the fuel (5080 °F (decreasing by 58 °F per 10,0000 MWD/MTU for burnup and adjusting for burnable poisons per CENPD-382-P-A). This change is necessary to more clearly conform with 10 CFR 50.36(c)(1)(ii)(A), which requires that Limiting Safety System Settings prevent a Safety Limit from being exceeded during normal operations and Anticipated Operational Occurrences (AOOs.)

Entergy Operations, Inc. has evaluated whether or not a significant hazards consideration is involved with the proposed amendment by focusing on the three standards set forth in 10 CFR 50.92, "Issuance of amendment," as discussed below:

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

   Response: No.

   The proposed change does not require any physical change to any plant systems, structures, or components nor does it require any change in systems or plant operations. The proposed change does not result in any change to safety analysis methods or results. The change to establish the peak fuel centerline temperature as the Safety Limit is consistent with the Waterford 3 licensing basis for ensuring that the fuel design limits are met. Operations and analysis will continue to be in accordance with the Waterford 3 licensing basis. The peak fuel centerline temperature is the basis for protecting the fuel and is consistent with safety analysis.

   Therefore, the proposed change does not involve a significant increase in the probability or consequences of an accident previously evaluated.

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

   Response: No.

   The Waterford 3 FSAR Chapter 15 accident analysis for AOOs where the peak linear heat rate may exceed the existing Safety Limit of 21 kW/ft is the CEA Withdrawal at subcritical and low power conditions. The analysis for these AOOs indicates that the

peak fuel centerline temperature is not exceeded. The existing safety analysis, which is unchanged, does not affect any accident initiators that would create a new accident.

Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. Does the proposed change involve a significant reduction in a margin of safety?

Response: No.

The proposed change does not result in any change to safety analysis methods or results. Therefore, by changing the Safety Limit from peak linear heat rate to peak fuel centerline temperature the margin as established in the Waterford 3 Technical Specifications and FSAR are unchanged.

Therefore, the proposed change does not involve a significant reduction in a margin of safety.

Based on the above, Entergy concludes that the proposed amendment(s) present no significant hazards consideration under the standards set forth in 10 CFR 50.92(c), and, accordingly, a finding of "no significant hazards consideration" is justified.

5.3 Environmental Considerations

The proposed amendment does not involve (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluent that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed amendment meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed amendment.

6.0 PRECEDENCE

The "Peak Fuel Centerline Temperature Safety Limit" proposed for Waterford 3 is consistent with the "Peak Fuel Centerline Temperature" and "Maximum Local Fuel Pin Centerline Temperature" Safety Limits contained in the Standard Technical Specifications (STS) for Westinghouse[10] and Babcock & Wilcox[11] (B&W) plants, respectively. The STS for Westinghouse and B&W contain a formula for decreasing the melting point as a function of burnup. The proposed SL for Waterford 3 does not contain the same formula but instead states that the limit is "decreasing by 58 °F per 10,0000 MWD/MTU for burnup and adjusting for burnable poisons per CENPD-382-P-A." This is acceptable because the portion of the adjustment formula accounting for burnable poison is proprietary and can not be placed in the TS. CENPD-382-P-A is an approved NRC methodology.

[10] NUREG-1431, Standard Technical Specifications Westinghouse Plants, Revision 2
[11] NUREG-1430, Standard Technical Specifications Babcock and Wilcox Plants, Revision 2

Attachment 2

W3F1-2002-0012

Proposed Technical Specification Changes (mark-up)

INDEX

SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

BASES

2.0 SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

2.1 SAFETY LIMITS

2.1.1 REACTOR CORE

DNBR

2.1.1.1 The DNBR of the reactor core shall be maintained greater than or equal to 1.26.

APPLICABILITY: MODES 1 and 2.

ACTION:

Whenever the DNBR of the reactor has decreased to less than 1.26, be in HOT STANDBY within 1 hour, and comply with the requirements of Specification 6.7.1.

PEAK LINEAR HEAT RATE

2.1.1.2 The peak linear heat rate (adjusted for fuel rod dynamics) of the fuel shall be maintained less than or equal to 21.0 kW/ft.

APPLICABILITY: MODES 1 and 2.

ACTION:

Whenever the peak linear heat rate (adjusted for fuel rod dynamics) of the fuel has exceeded 21.0 kW/ft, be in HOT STANDBY within 1 hour, and comply with the requirements of Specification 6.7.1.

Replace with insert

REACTOR COOLANT SYSTEM PRESSURE

2.1.2 The Reactor Coolant System pressure shall not exceed 2750 psia.

APPLICABILITY: MODES 1, 2, 3, 4, and 5.

ACTION:

MODES 1 and 2

Whenever the Reactor Coolant System pressure has exceeded 2750 psia, be in HOT STANDBY with the Reactor Coolant System pressure within its limit within 1 hour, and comply with the requirements of Specification 6.7.1.

MODES 3, 4, and 5

Whenever the Reactor Coolant System pressure has exceeded 2750 psia, reduce the Reactor Coolant System pressure to within its limit within 5 minutes, and comply with the requirements of Specification 6.7.1.

TS 2.1.1.2 Insert

PEAK FUEL CENTERLINE TEMPERATURE

2.1.1.2 The peak fuel centerline temperature shall be maintained less than 5080 °F (decreasing by 58 °F per 10,000 MWD/MTU for burnup and adjusting for burnable poisons per CENPD-382-P-A.)

APPLICABILITY: MODES 1 and 2.

ACTION:

Whenever the peak fuel centerline temperature has equaled or exceeded 5080 °F (decreasing by 58 °F per 10,000 MWD/MTU for burnup and adjusting for burnable poisons per CENPD-382-P-A), be in HOT STANDBY within 1 hour, and comply with the requirements of Specification 6.7.1.

Attachment 3

W3F1-2002-0012

Changes to Technical Specification Bases Pages (Mark-up)

2.1 and 2.2 SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

BASES

2.1.1 REACTOR CORE

The restrictions of these safety limits prevent overheating of the fuel cladding and possible cladding perforation which would result in the release of fission products to the reactor coolant. Overheating of the fuel cladding is prevented by (1) restricting fuel operation to within the nucleate boiling regime where the heat transfer coefficient is large and the cladding surface temperature is slightly above the coolant saturation temperature, and (2) maintaining the dynamically adjusted peak linear heat rate of the fuel at or less than 21.0 kW/ft which will not cause fuel centerline melting in any fuel rod.

Replace with Bases Insert A.

First, by operating within the nucleate boiling regime of heat transfer, the heat transfer coefficient is large enough so that the maximum clad surface temperature is only slightly greater than the coolant saturation temperature. The upper boundary of the nucleate boiling regime is termed "departure from nucleate boiling" (DNB). At this point, there is a sharp reduction of the heat transfer coefficient, which would result in higher cladding temperatures and the possibility of cladding failure.

Correlations predict DNB and the location of DNB for axially uniform and non-uniform heat flux distributions. The local DNB ratio (DNBR), defined as the ratio of the predicted DNB heat flux at a particular core location to the actual heat flux at that location, is indicative of the margin to DNB. The minimum value of DNBR during normal operational occurrences is limited to 1.26 for the CE-1 correlation and is established as a Safety Limit. This value is based on a statistical combination of uncertainties. It includes uncertainties in the CHF correlation, allowances for rod bow and hot channel factors (related to fuel manufacturing variations) and allowances for other hot channel calculative uncertainties.

Second, operation with a peak linear heat rate below that which would cause fuel centerline melting maintains fuel rod and cladding integrity. Above this peak linear heat rate level (i.e., with some melting in the center), fuel rod integrity would be maintained only if the design and operating conditions are appropriate throughout the life of the fuel rods. Volume changes which accompany the solid to liquid phase change are significant and require accommodation. Another consideration involves the redistribution of the fuel which depends on the extent of the melting and the physical state of the fuel rod at the time of melting. Because of the above factors, the steady state value of the peak linear heat rate which would not cause fuel centerline melting is established as a Safety Limit. To account for fuel rod dynamics (lags), the directly indicated linear heat rate is dynamically adjusted.

Bases Insert B

Limiting safety system settings for the Low DNBR, High Local Power Density, High Logarithmic Power Level, Low Pressurizer Pressure and High Linear Power Level trips, and limiting conditions for operation on DNBR and kW/ft margin are specified such that there is a high degree of confidence that the specified acceptable fuel design limits are not exceeded during normal operation and design basis anticipated operational occurrences.

Bases Insert A

maintaining the peak fuel centerline temperature below the melting point.

Bases Insert B

The design melting point of new fuel with no burnable poison is 5080 °F. The melting point is adjusted downward from this temperature depending on the amount of burnup and amount and type of burnable poison in the fuel. The 58 °F per 10,000 MWD/MTU adjustment for burnup was accepted by the NRC in Topical Report CEN-386-P-A, "Verification of the Acceptability of a 1-Pin Burnup Limit of 60 MWD/kgU for Combustion Engineering 16x16 PWR Fuel," August 1992. Adjustments for burnable poisons are established based on NRC approved Topical Report CENPD-382-P-A, "Methodology for Core Designs Containing Erbium Burnable Absorbers," August 1993.

A steady state peak linear heat rate of 21 kW/ft has been established as the Limiting Safety System Setting to prevent fuel centerline melting during normal steady state operation. Following design basis anticipated operational occurrences, the transient linear heat rate may exceed 21 kW/ft provided the fuel centerline melt temperature is not exceeded.

SAFETY LIMITS AND LIMITING SAFETY SYSTEM SETTINGS

BASES

Local Power Density - High (Continued)

The local power density (LPD), the trip variable, calculated by the CPC incorporates uncertainties and dynamic compensation routines. These uncertainties and dynamic compensation routines ensure that a reactor trip occurs when the actual core peak LPD is sufficiently less than the fuel design limit such that the increase in actual core peak LPD after the trip will not result in a violation of the peak LPD Safety Limit. CPC uncertainties related to peak LPD are the same types used for DNBR calculation. Dynamic compensation for peak LPD is provided for the effects of core fuel centerline temperature delays (relative to changes in power density), sensor time delays, and protection system equipment time delays.

fuel centerline melt

DNBR - Low

The DNBR - Low trip is provided to prevent the DNBR in the limiting coolant channel in the core from exceeding the fuel design limit in the event of anticipated operational occurrences. The DNBR - Low trip incorporates a low pressurizer pressure floor of 1860 psia. At this pressure a DNBR - Low trip will automatically occur. This low pressure trip also provides protection against steam generator tube rupture events. The DNBR is calculated in the CPC utilizing the following information:

a. Nuclear flux power and axial power distribution from the excore neutron flux monitoring system;

b. Reactor Coolant System pressure from pressurizer pressure measurement;

c. Differential temperature (Delta T) power from reactor coolant temperature and coolant flow measurements;

d. Radial peaking factors from the position measurement for the CEAs;

e. Reactor coolant mass flow rate from reactor coolant pump speed;

f. Core inlet temperature from reactor coolant cold leg temperature measurements.

The DNBR, the trip variable, calculated by the CPC incorporates various uncertainties and dynamic compensation routines to assure a trip is initiated prior to violation of fuel design limits. These uncertainties and dynamic compensation routines ensure that a reactor trip occurs when the actual core DNBR is sufficiently greater than the fuel design limit such that the decrease

POWER DISTRIBUTION LIMITS

BASES

DNBR MARGIN (Continued)

A DNBR penalty factor has been included in the COLSS and CPC DNBR calculations to accommodate the effects of rod bow. The amount of rod bow in each assembly is dependent upon the average burnup experienced by that assembly. Fuel assemblies that incur higher average burnup will experience a greater magnitude of rod bow. Conversely, lower burnup assemblies will experience less rod bow. In design calculations, the penalty for each batch required to compensate for rod bow is determined from a batch's maximum average assembly burnup applied to the batch's maximum integrated planar-radial power peak. A single net penalty for COLSS and CPC is then determined from the penalties associated with each batch, accounting for the offsetting margins due to the lower radial power peaks in the higher burnup batches.

3/4.2.5 RCS FLOW RATE

This specification is provided to ensure that the actual RCS total flow rate is maintained at or above the minimum value used in the LOCA safety analyses, and that the DNBR is maintained within the safety limit for Anticipated Operational Occurrences (AOO).

3/4.2.6 REACTOR COOLANT COLD LEG TEMPERATURE

This specification is provided to ensure that the actual value of reactor coolant cold leg temperature is maintained within the range of values used in the safety analyses, with adjustment for instrument accuracy of ±2°F, and that the peak linear heat generation rate and the moderator temperature coefficient effects are validated.

3/4.2.7 AXIAL SHAPE INDEX

This specification is provided to ensure that the actual value of AXIAL SHAPE INDEX is maintained within the range of values used in the safety analyses, to ensure that the peak linear heat rate and DNBR remain within the safety limits for Anticipated Operational Occurrences (AOO).

peak fuel centerline temperature

3/4.2.8 PRESSURIZER PRESSURE

This specification is provided to ensure that the actual value of pressurizer pressure is maintained within the range of values used in the safety analyses. The inputs to CPCs and COLSS are the most limiting. The values are adjusted for an instrument accuracy of ± 25 psi. The sensitive events are SGTR, LOCA, FWLB and loss of condenser vacuum to initial high pressure, and MSLB to initial low pressure.