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JOHN R. McGAHA, JR.
Vice President
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September 12, 1994

U. S. Nuclear Regulatory Commission
Mail Station P1-37
Washington, DC. 20555

Attention: Document Control Desk

Subject: River Bend Station - Unit 1
Docket No. 50-458
License No. NPF-47
License Amendment Request (LAR 94-10) - Change to Technical Specification 3/4.2.2, APRM Setpoints

File Nos.: G9.5, G9.42

RBF1-94-0039
RBG-40868

Recently, Entergy Operations, Incorporated (EOI) identified a condition as part of the review of NRC Generic Letter 94–02, "Long-Term Solutions and Upgrade of Interim Operating Recommendations for Thermal-Hydraulic Instabilities in Boiling Water Reactors", which requires a change to Technical Specification 3/4.2.2, "APRM Setpoints", in order to be able to operate > 35% rated thermal power (RTP).

RBS is implementing the BWR Owners' Group (BWROG) recommendations of NRC Generic Letter 94–02, concerning the improved BWR stability Interim Corrective Actions (ICAs). The BWROG guidelines include changes to the required administrative operating domain restrictions defined by the BWROG ICA stability regions. RBS has revised the Controlled Entry (CE) region of the Power-Flow Map in plant procedure Abnormal Operating Procedure AOP-0024, "Core Thermal Hydraulic Instability High Power/Low Core Flow/Flux Oscillations," where entry into or operation within this region requires administrative stability controls. Implementation of these administrative stability controls during reactor startup, requires core power distributions with higher power peaking.

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Linear Heat Generation Rate (LHGR) protection for off–rated operations (< 100% RTP) is provided by the APRM setpoint T–factor, an operating control on total power peaking at off–rated conditions. The limitation on power distributions enforced by APRM setpoints T–factor results in low total peaking and therefore relatively flat axial power shapes. For reactor operating conditions with high peaking, the required action (APRM gains or trip setpoint adjustment) to achieve compliance with APRM setpoints T–factor is such that continued power increases through control rod withdrawal are not possible.

The flat axial power distributions imposed by the APRM setpoints T–factor requirements result in reduced stability margin. Under these conditions the required stability controls (AOP-0024) can not be met. Furthermore, power distributions necessary to meet the stability controls during reactor startup before recirculation pump upshift will lead to APRM gains or trip setpoint adjustments. Under these conditions reactor startup cannot be continued, as a result of a control rod block signal.

The proposed resolution to the conflict between complying with the requirements of APRM setpoints T–factor and the stability controls is to develop a new definition of APRM setpoints T–factor. The modified APRM setpoints T–factor provides additional operating margin to achieve power distributions which ensure compliance with stability controls, without compromising LHGR protection at off–rated operations.

RBS is currently evaluating schedule for startup from a plant scram occurring September 8, 1994. If conditions warrant a startup schedule within the next 14 days, RBS will amend this request to have it considered for emergency action per 10CFR50.91. To enable operation >35% RTP, EOI requests this change be reviewed and approved under the provisions of 10CFR50.91(a)(6).

EOI believes this request meets the requirements for exigent action per 10CFR50.91(a)(6) as follows:

- RBS is unable to achieve power distributions which ensure compliance with stability controls, without Technical Specification relief for APRM setpoints adjustment. Without this relief RBS will be unable to increase power output up to the licensed power level while maintaining required stability controls.

Based on the detailed discussion provided in the Attachment 1, the proposed change to APRM setpoints T–factor does not result in undue risks to the health and safety of the

public. This request has been reviewed and approved by the RBS Facility Review Committee and the Nuclear Review Board in accordance with Technical Specifications.

If you have further questions regarding this request, please contact me or my staff.

Sincerely,

John R. McGaha
Vice President–Operations

attachments

cc: NRC Resident Inspector
P. O. Box 1051
St. Francisville, LA 70775

Mr. Raymond Azua
U. S. Nuclear Regulatory Commission
M/S OWFN 13–H–15
Washington, DC 20555

Department of Environmental Quality
Radiation Protection Division
P. O. Box 82135
Baton Rouge, LA 70884–2135
Attn: Administrator

BEFORE THE

UNITEI STATES NUCLEAR REGULATORY COMMISSION

LICENSE NO. NPF-47

DOCKET NO. 50-458

IN THE MATTER OF

GULF STATES UTILITIES COMPANY

CAJUN ELECTRIC POWER COOPERATIVE AND

ENTERGY OPERATIONS, INC.

AFFIRMATION

I, John R. McGaha, state that I am Vice President-Operations of Entergy Operations, Inc., at River Bend Station; that on behalf of Entergy Operations, Inc., I am authorized by Entergy Operations, Inc. to sign and file with the Nuclear Regulatory Commission, this License Amendment Request #94-09 for the River Bend Station; that I signed this License Amendment Request as Vice President-Operations at River Bend Station of Entergy Operations, Inc.; and that the statements made and the matters set forth therein are true and correct to the best of my knowledge, information, and belief.

John R. McGaha

John R. McGaha

STATE OF LOUISIANA
WEST FELICIANA PARISH

SUBSCRIBED AND SWORN TO before me, a Notary Public, in and for the County and State above named, this 12TH day of SEPTEMBER, 1994.

(SEAL)

Notary Public

My commission expires: 1/1/97

ATTACHMENT 1
PROPOSED
ENTERGY OPERATIONS, INC.
DOCKET 50-458/LICENSE NO. NPF-47

APRM SETPOINTS
(94-10)

LICENSING DOCUMENT INVOLVED: **Technical Specifications**

ITEM: **3/4.2.2, Pages B 2-1, 3/4 2-7, and 3/4 2-7a**

REASON FOR REQUEST:

Linear Heat Generation Rate (LHGR) protection for off–rated operations is provided by the APRM setpoints adjustment, which requires the Core Maximum Fraction of the Limiting Power Density (CMFLPD) to be less than or equal to the Fraction of Rated Thermal Power (FRTP). For CMFLPD greater than FRTP, the APRM flow–biased scram and control rod block trip setpoints are setdown by the factor T=FRTP/CMFLPD, to limit the initial power condition permitted and the severity of events associated with power increases. The limitation on CMFLPD necessary to provide acceptable APRM setpoints T-factor, results in low total peaking and therefore relatively flat axial power shapes. For reactor conditions with high peaking, the required APRM adjustment can be such that continued power increases through control rod withdrawal are not possible. When such a condition is encountered during reactor startup prior to recirculation pump upshift, the reactor power increases necessary to clear the feedwater flow interlocks for the recirculation pumps may be prevented by a control rod block signal. Therefore, the reactor recirculation pumps cannot be shifted to high speed, and the reactor startup cannot continue.

In compliance with NRC Generic Letter 94–02, RBS is implementing the BWROG recommendations concerning the improved BWR stability Interim Corrective Actions (ICAs). The BWROG recommendations include changes to the required administrative operating domain restrictions defined by the BWROG ICA stability regions. RBS has revised the Controlled Entry (CE) region of the Power-Flow Map in plant procedure AOP-0024, "Core Thermal Hydraulic Instability High Power/Low Core Flow/Flux Oscillations", where entry into or operation within the region requires administrative operating controls on core–average boiling boundary. Core–average boiling boundary is the axial elevation of the transition from sub–cooled to saturated fluid conditions on a core–average basis, and is a function of the core–average axial power shape, the core power and flow, and the core inlet subcooling.

The BWROG guidelines for the implementation of the core-average boiling boundary control require that a boiling boundary of 4.0 feet be maintained for entry into and operation in the CE region, to provide a high degree of stability margin. The core–average boiling boundary controls are implemented as an administrative operating limit, FCBB (fraction of core boiling boundary), such that FCBB is ≤ 1 for a core–average boiling boundary of 4.0 feet or higher.

To meet the FCBB controls during reactor startup, core–average axial power distributions which deposit a relatively high fraction of power into the lower third of the core must be avoided. Such power distributions are associated with higher peaking at higher elevations in the core. However, minimizing APRM setpoints T–factor so that APRM trip setdown is not necessary requires relatively flat core–average axial power distributions. These flat axial power distributions result in a low core–average boiling boundary, which is associated with increased susceptibility to instability. Therefore, the requirements of APRM setpoints T–factor result in reduced stability margin. Under these conditions FCBB stability control is not possible. Furthermore, power distributions necessary for FCBB control during reactor startup before recirculation pump upshift lead to APRM trip setdowns that result in a control rod block. Under these conditions reactor startup cannot be continued.

The proposed resolution to the conflict between complying with the requirements of APRM setpoints T–factor and the FCBB stability control is to develop a new definition of APRM setpoints T–factor. The modified APRM setpoints T–factor provides additional operating margin to achieve power distributions which allow FCBB stability control, without compromising LHGR protection at off–rated operations.

ANALYTICAL AND DESIGN BASES:

Background

The operability of the APRMs and their setpoints is an initial condition of safety analyses that assume control rod insertion upon reactor scram. Applicable GDCs are GDC 10, "Reactor Design"; GDC 13, "Instrumentation and Control"; GDC 20, "Protection System Functions"; and GDC 29, "Protection against Anticipated Operation Occurrences". Technical Specification 3/4.2.2, "APRM Setpoints", is provided to require the APRM gain or APRM-flow biased scram and control rod block setpoints be adjusted when operating under conditions of high power peaking to maintain acceptable margin to the fuel thermal-mechanical limit.

The condition of high power peaking is determined by the ratio of the actual power peaking to the limiting power peaking at Rated Thermal Power (RTP). This ratio is

presented as a APRM setpoints T-factor (T). At any off-rated power conditions T is equal to the Fraction of Rated Thermal Power (FRTP) divided by the Core Maximum Fraction of Limiting Power Density (CMFLPD). FRTP is the measured thermal power divided by the RTP. CMFLPD is the limiting linear heat generation rate (LHGR) divided by the rated LHGR limit. High power peaking exists when:

$$\frac{FRTP}{CMFLPD} \leq 1$$

As power is reduced with the design power distribution maintained, CMFLPD is reduced in proportion to the reduction in power. However, if power peaking increases above the design value, the CMFLPD is not reduced in proportion to the reduction in power. Under these conditions, the APRM gain is adjusted upward or the APRM flow biased scram and rod-block trip setpoints are reduced accordingly. When the reactor is operating with peaking less than the design value, it is not necessary to modify the APRM gain or flow biased scram trip setpoints. Adjusting the APRM gain or setpoints is equivalent to maintaining CMFLPD less than or equal to FRTP.

The nominal APRM setpoints position the scram above the upper bound of the normal power/flow operating region that has been considered in the licensing basis safety analysis. The setpoints are flow biased with a slope that approximates the upper flow control line, such that an approximately constant margin is maintained between the flow biased trip setpoint and the upper operating boundary for core flows in excess of about 45% of rated core flow. In the range of infrequent operations below 45% of rated core flow, the margin to scram or control rod blocks is reduced because of the nonlinear core flow versus drive flow relationship. The nominal APRM setpoints are applied to conditions characterized by a power distribution with low peaking. However, at off-rated conditions, control rod patterns can be established that significantly reduce the margin to thermal limits with a highly-peaked power distribution. Therefore, the flow biased APRM scram and rod-block trip setpoints may be setdown during operation when the combination of thermal power and CMFLPD indicates highly-peaked power distributions, to assure adequate margin to fuel thermal limits.

The normal setting of the APRM flow-biased scram and rod-block trip setpoints, with an example of the RBS startup path, is shown in Figure 1.

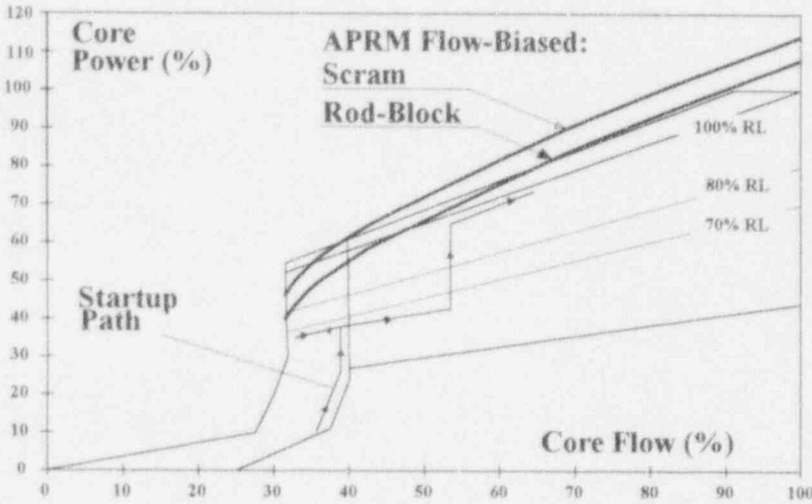

Figure 1: APRM Flow-Biased Normal Trip Setting

The APRM gain or trip setpoint adjustments, performed when operating with highly peaked power distributions, ensure acceptable margins to the fuel thermal-mechanical limit. This provides very conservative protection for LHGR performance at off-rated conditions since plant-specific off-rated LHGR operating limits are not provided.

Figure 2 illustrates the APRM flow-biased scram and rod-block trip setpoint setdown as an example with a T of approximately 0.7, along with the example startup path. The resulting domain available for operations, in this example, can be seen to be considerably reduced and the normal startup path will not be viable. During startup, reactor power is increased to clear the feedwater flow interlocks for recirculation pump upshift. Once the interlocks are cleared the recirculation loop flow control valves are closed, one at a time, to the minimum position and flow approaches minimum forced circulation conditions. Once the flow control valve (FCV) is closed for minimum flow the recirculation pump is shifted to high speed. Power ascension continues subsequent to upshift of both pumps.

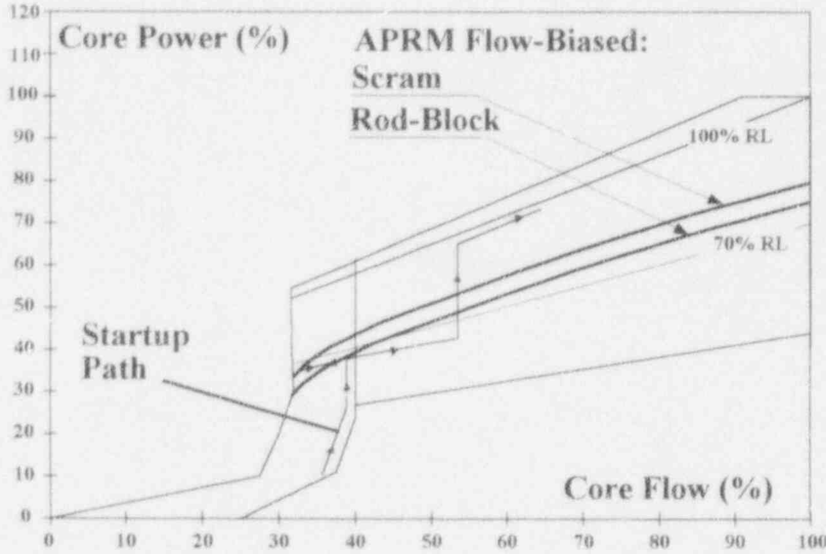

Figure 2: APRM Flow-Biased Setdown Trip Setting

For the example startup, with T of approximately 0.7, the APRM trip setpoints are setdown such that a control block trip signal is received at the power level necessary for recirculation pump upshift. Additionally, closure of the FCVs to the minimum position approaches the APRM scram trip setpoint. Under these conditions, recirculation pump upshift and continued power ascension is not possible.

Protection of thermal limits other than the LHGR is accomplished by specific limits that are independent of the APRM setpoints T-factor. These are the power- and flow-dependent MCPR Operating Limits which provide protection from fuel dryout and the rated MAPLHGR limit which provides protection from excessive peak clad temperature for the DBA LOCA.

Justification

Operational and analytical data for RBS, supplemented by similar data for Grand Gulf Nuclear Station Unit One (GGNS–1), were evaluated to determine the required operational margin to maintain compliance with the FCBB stability control over a range of expected operational conditions. A modified APRM setpoints T–factor definition was developed to permit power distributions that allow compliance with the FCBB core stability control, thereby ensuring adequate stability margin. The modified APRM setpoints T–factor revises the definition of the power–to–peaking ratio T, applied for APRM gains or trip setpoints adjustment for values of T less than one:

$$T = \frac{3 \cdot FRTP + 1}{4 \cdot CMFLPD} \quad \text{for } CMFLPD \leq 0.6 \cdot FRTP + 0.4$$

As in the current Technical Specifications definition of APRM setpoints T–factor, the APRM flow–biased scram and control rod block trip setpoints or the APRM gains are adjusted by a factor of T for values of T less than one. An additional constraint is placed on the definition of T, however, in the modified APRM setpoints T–factor definition. Above a peaking upper bound T reverts to the current Technical Specifications definition of T to require APRM gains or trip setpoints adjustment by the current Technical Specifications requirements:

$$T = \frac{FRTP}{CMFLPD} \quad \text{for } CMFLPD > 0.6 \cdot FRTP + 0.4$$

The modified APRM setpoints T–factor definition for T greater than or equal to one envelopes the expected range of reactor operating conditions for which FCBB compliance is required. Power and peaking values which require APRM gains or trip setpoints adjustment provide an adequate operating margin for possible variations during the fuel cycle or unanticipated operating conditions. The peaking upper bound defines the extent of operations to meet stability control requirements and is not expected to be exceeded.

The modified APRM setpoints T–factor definition accommodates higher power peaking, and therefore higher LHGR values, to support the required stability controls for ensuring adequate stability margin. However, due to the conservatism of the current Technical Specifications definition of APRM setpoints T–factor, adequate LHGR protection is maintained by the modified APRM setpoints T–factor definition.

APRM setpoints T–factor provides off–rated LHGR protection by requiring an APRM gains or trip setpoints adjustment, which limits the initial power permitted and the severity of events associated with power increases for high power peaking conditions with values of T less than one.

The original and modified APRM setpoints T–factors are shown in Figure 3. The original APRM setpoints T–factor requires APRM gains or trip setpoints adjustment for CMFLPD values exceeding the line defined by the original APRM setpoints T-factor equal to one. The modified APRM setpoints T-factor imposes the same requirement if the modified APRM setpoints T-factor is equal to one. The definition of the modified APRM setpoints T–factor, which provides for greater operational margin to comply with the required stability controls, can potentially result in higher peaking and, therefore, higher off–rated LHGR values.

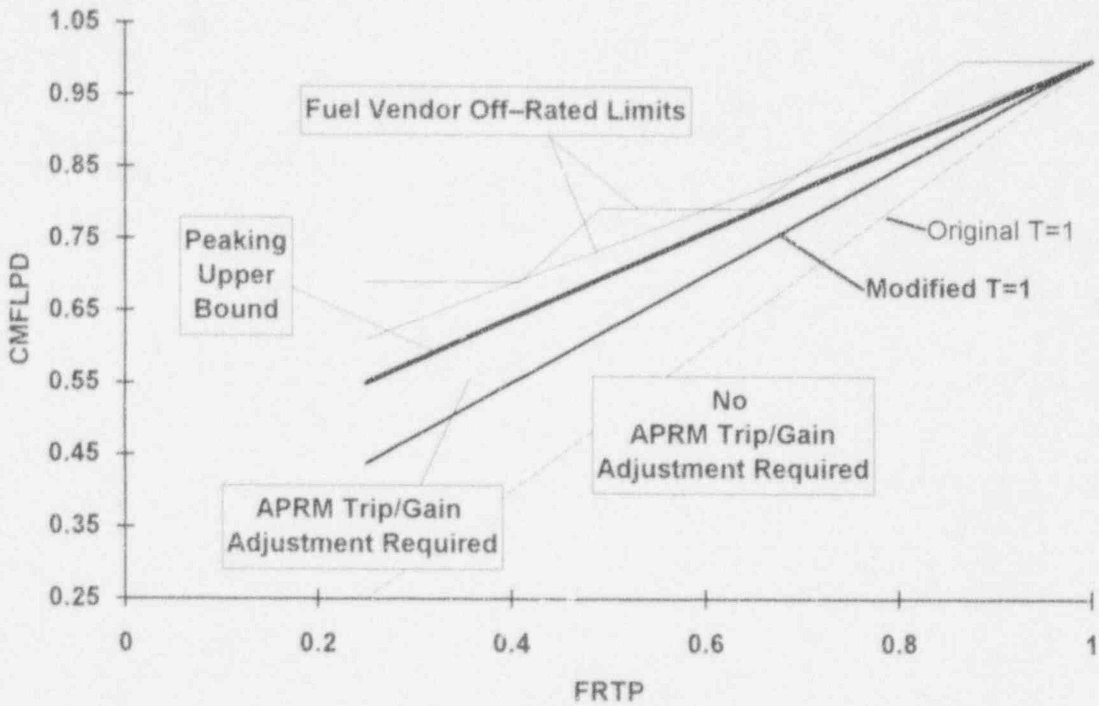

Figure 3: Confirmation of Modified T–Factor LHGR Protection

The LHGR protection provided by the modified APRM setpoints T–factor definition is confirmed by comparing the modified APRM setpoints T–factor definition to power– and flow–dependent limits for LHGR protection established by the fuel vendor based on a database of analyses of limiting transients (AECM–86/0129), as illustrated in Figure 3. The off–rated LHGR limits address all limiting anticipated operational occurrences at off–rated conditions. These limits are applicable to RBS since the basis of the limits is an analytical data base of analyses of the limiting transients for determination of LHGR margin and are confirmed conservative for application to a BWR/6 of similar plant and fuel design as RBS.

A significant margin to the LHGR limit exists without APRM gains or trip setpoints adjustment. LHGR protection for reactor operation with APRM gains or trip setpoints adjustment, up to and including the peaking upper bound, is confirmed by the fuel vendor off-rated LHGR limits. The additional constraint on the modified APRM setpoints T–factor definition, that for high peaking the definition of T revert to the current Technical Specifications definition, ensures that the peaking upper bound is not exceeded. Operation in this region is not possible given the low value of T calculated with the current Technical Specifications definition and the requirements enforced by the APRM gains or trip setpoints adjustment. Because the peaking upper bound enforces a

power–dependent restriction on the maximum value of CMFLPD to be less than the fuel vendor off–rated LHGR limits, CMFLPD margin to safety is not affected.

Operational and analytical experience at another BWR/6, has demonstrated, for peaking performance equivalent to that of RBS, that large margin to plant–specific off–rated LHGR limits is available. This experience includes compliance with the FCBB core stability control, which demonstrates that power distributions allowing FCBB compliance are compatible with large margins to LHGR limits.

PROPOSED CHANGES:

The following change to Technical Specification 3/4.2.2 is proposed:

$$T = \frac{3 \times FRTP + 1}{4 \times CMFLPD} \quad \text{provided} \quad CMFLPD \leq 0.6 \times FRTP + 0.4, \text{ otherwise}$$

$$T = \frac{FRTP}{CMFLPD}$$

T is applicable only if it is less than or equal to 1.0

FRTP is the FRACTION OF RATED THERMAL POWER and CMFLPD is the CORE MAXIMUM FRACTION OF LIMITING POWER DENSITY.

NO SIGNIFICANT HAZARDS CONSIDERATION:

1. The request does not involve a significant increase in the probability or consequences of an accident previously evaluated.

   This change only redefines the APRM setpoints T-factor. The modified APRM setpoints T-factor does not change or affect operator required actions in relation to the APRM setpoints T-factor and is only applied at different power peaking for given reactor power. Therefore, this change only affects the precursors to events that can be initiated as a result of different power peaking. The only event affected is the formation of coupled thermal-hydraulic and neutronic oscillations (reactor stability). Since the modified APRM setpoints T-factor allows power distributions which permits the application of stability controls to increase stability margin, the probability for initiation of reactor instability is significantly reduced. Therefore, this change does not inv lve a significant increase in the probability of any event previously evaluated.

The consequence of a reactor instability event is minimized since the initial reactor conditions are associated with very stable power distributions. These stable conditions are established using stability controls which are permitted with the modified APRM setpoints T-factor. Since the initial reactor conditions are very stable, the severity of a postulated reactor instability event is significantly diminished. In addition, the modified APRM setpoints T-factor is confirmed to provide adequate LHGR protection at off-rated conditions for other anticipated events. Protection of other thermal limits for all previously analyzed events is accomplished by specific limits that are independent of the APRM setpoints T-factor. These are the power and flow dependent MCPR Operating Limits which provide protection from fuel dryout and the rated MAPLHGR limit which provides protection of the peak clad temperature for the DBA LOCA. Therefore, the proposed change does not involve a significant increase in the consequences of any event previously evaluated.

The proposed change in APRM setpoints T-factor permits implementation of appropriate reactor stability controls and maintain adequate off-rated LHGR margin for all operating conditions. This change, therefore, does not involve a significant increase in the probability and consequences of any event previously evaluated.

2. The request does not create the possibility of occurrence of a new or different kind of accident from any accident previously evaluated.

This change only redefines the APRM setpoints T-factor. The proposed changes do not involve any new modes of operation or any plant modifications. The ability to implement reactor stability controls do not result in any new precursors to an accident. Therefore, the proposed changes do not create the possibility of a new or different type of accident from any accident previously analyzed.

3. The request does not involve a significant reduction in a margin of safety.

The change in the APRM setpoints T-factor definition allows the implementation of reactor stability controls during reactor operation at off-rated conditions which significantly improve the reactor stability performance. This is accomplished by achieving very stable power distributions outside the stability excluded region. Since the initial reactor conditions are very stable, the severity of a postulated reactor instability event is significantly diminished.

The modified APRM setpoints T-factor accommodates higher power peaking to support the required stability controls. The modified APRM setpoints T-factor has

been confirmed to provide adequate LHGR protection. Operation with higher peaking without APRM gains or flow bias trip setpoints adjustment does not involve a reduction in a margin of safety because the higher power peaking resulting from the APRM setpoints T-factor modification are below applicable LHGR limits. For power peaking conditions that result in APRM setpoints T-factor less than one, an adjustment to the APRM gains or trip setpoints is made to provide additional LHGR protection. Additionally, an upper bound is placed on power peaking by the modified APRM setpoints T-factor definition. Therefore, the modified APRM setpoint T-factor does not involve a reduction in a margin of safety because the higher power peaking resulting from the APRM setpoints T-factor modification is below applicable LHGR limits.

Protection of other thermal limits for all previously analyzed events is accomplished by specific limits that are independent of the T-factor. These are the power and flow dependent MCPR Operating Limits which provide protection from fuel dryout and the rated MAPLHGR limit which provides protection of the peak clad temperature for the DBA LOCA. The proposed changes does not result in an increase in core damage frequency. Therefore, the proposed change does not involve a significant reduction in the margin of safety evaluated.

ENVIRONMENTAL IMPACT CONSIDERATION:

EOI has reviewed this Request against the criteria of 10CFR51.22 for environmental considerations. The request does not affect any system discharging radwaste to the environment or monitoring any such discharge. Also, the request does not adversely affect any system designed to monitor or isolate gaseous radioactive effluents to the environment. Therefore, the request; does not involve a significant hazards consideration, does not significantly increase the types or quantity of effluent that may be released offsite, and does not significantly increase individual or cumulative occupational radiation exposures. Based on the foregoing, EOI concludes that the proposed change meets the criteria given in 10CFR51.22 (c)(9) for a categorical exclusion from the requirement for an Environmental Impact Statement.