Enclosure 2 to the Letter from C. W. Giesler

to H. R. Denton

Dated November 30, 1984

Proposed Amendment 64 to the KNPP Technical Specifications

Affected Pages

Applicability

Applies to the limits on core fission power distributions and to the limits on control rod operations.

Objective

To ensure 1) core subcriticality after reactor trip, 2) acceptable core power distribution during power operation in order to maintain fuel integrity in normal operation transients associated with faults of moderate frequency, supplemented by automatic protection and by administrative procedures, and to maintain the design basis initial conditions for limiting faults, and 3) limited potential reactivity insertions caused by hypothetical control rod ejection.

Specification

a. Shutdown Reactivity

When the reactor is subcritical prior to reactor startup, the hot shutdown margin shall be at least that shown in Figure TS 3.10-1. Shutdown margin as used here is defined as the amount by which the reactor core would be subcritical at hot shutdown conditions if all control rods were tripped, assuming that the highest worth control rod remained fully withdrawn, and assuming no changes in xenon, boron, or part length rod position.

b. Power Distribution Limits

1. At all times, except during low power physics tests, the hot channel factors defined in the basis must meet the following limits:

A. $F_Q^N(Z)$ Limits:

(i) Westinghouse Electric Corporation Fuel

$F_Q^N(Z) \times 1.03 \times 1.05 \leq (2.14)/P \times K(Z)$ for $P > .5$

$F_Q^N(Z) \times 1.03 \times 1.05 \leq (4.28) \times K(Z)$ for $P \leq .5$ 64

(ii) Exxon Nuclear Company Fuel

$F_Q^N(Z) \times 1.03 \times 1.05 \leq (2.28)/P \times K(Z)$ for $P \geq .5$

$F_Q^N(Z) \times 1.03 \times 1.05 \leq (4.56) \times K(Z)$ for $P \leq .5$

where:

P is the fraction of full power at which the core is operating

K(Z) is the function given in Figure TS 3.10-2

Z is the core height location for the FQ of interest

B. $F_{\Delta H}^{N}$ Limits

(i) For Exxon Nuclear Company fuel and Westinghouse Electric Corporation fuel with burnup less than 24,000 MWD/MTU

$F_{\Delta H}^{N} \times 1.04 \leq 1.55\ (1 + 0.2(1 - P))$ 64

(ii) For Westinghouse Electric Corporation fuel with burnup exceeding 24,000 MWD/MTU.

$F_{\Delta H}^{N} \times 1.04 \leq 1.52\ (1 + 0.2(1 - P))$

where:

P is the fraction of full power at which the core is operating

2. If, for any measured hot channel factor, the relationships specified in 3.10.b.1 are not true, reactor power shall be reduced by a fractional amount of the design power to a value for which the relationships are true, and the high neutron flux trip setpoint shall be reduced by the same fractional amount. If subsequent incore mapping cannot, within a 24 hour period, demonstrate that the hot channel factors are met, the overpower ΔT and overtemperature ΔT trip setpoints shall be similarly reduced.

3. Following initial loading and at regular effective full power monthly intervals thereafter, power distribution maps using the movable detection system shall be made to confirm that the hot channel factor limits of specification 3.10.b.1 are satisfied.

4. The measured F_Q^{EQ} (Z) hot channel factors under equilibrium conditions shall satisfy the following relationship for the central axial 80% of the core:

A. Westinghouse Electric Corporation Fuel

$F_Q^{EQ}(Z) \times 1.03 \times 1.05 \times V(Z) \leq (2.14)/P \times K(Z)$

B. Exxon Nuclear Company Fuel 64

$F_Q^{EQ}(Z) \times 1.03 \times 1.05 \times V(Z) \leq (2.28)/P \times K(Z)$

where:

P is the fraction of full power at which the core is operating

V(Z) is defined in Figure TS 3.10-6. 64

$F_Q^{EQ}(Z)$ is a measured FQ distribution obtained during the target flux determination

5. Power distribution maps using the movable detector system shall be made to confirm the relationship of specification 3.10.b.4 according to the following schedules with allowances for a 25% grace period:

   A. During the target flux difference determination or once per effective full power monthly interval whichever occurs first.

   B. Upon achieving equilibrium conditions after reaching a thermal power level more than 10% higher than the power level at which the last power distribution measurement was performed in accordance with 3.10.b.5.A above.

   C. If a power distribution map indicates an increase in peak pin power, $F_{\Delta H}^{N}$, of 2% or more, due to exposure, when compared to the last power distribution map either of the following actions shall be taken:

      i. $F_Q^{EQ}(Z)$ shall be increased by an additional 2% for comparison to the relationship specified in 3.10.b.4 OR

      ii. $F_Q^{EQ}(Z)$ shall be measured by power distribution maps using the incore movable detector system at least once every 7 effective full power days until a power distribution map indicates that the peak pin power, $F_{\Delta H}^{N}$, is not increasing with exposure when compared to the last power distribution map.

6. If, for a measured F_Q^{EQ}, the relationships of 3.10.b.4 are not satisfied and the relationships of 3.10.b.1 are satisfied, within 12 hours take one of the following actions:

An upper bound envelope for F_Q^N defined by specification 3.10.b.1 has been determined from extensive analyses considering all operating maveuvers consistent with the technical specifications on power distribution control as given in Section 3.10. The results of the loss of coolant accident analyses based on this upper bound envelope indicate that peak clad temperatures remain below the 2200°F limit.

The $F_Q^N(Z)$ limits of specification 3.10.b.1.A include consideration of enhanced fission gas release at high burnup, off-gassing (release of absorbed gases), and other effects in fuel supplied by Exxon Nuclear Company. The result of these analyses show that no additional burnup dependent penalty need be applied for Exxon fuel (7). 64

When a F_Q^N measurement is taken, both experimental error and manufacturing tolerance must be allowed for. Five percent is the appropriate allowance for a full core map taken with the movable incore detector flux mapping system and three percent is the appropriate allowance for manufacturing tolerance.

In specification 3.10.b.1 and 3.10.b.4 F_Q^N is arbitrarily limited for $P \leq 0.5$ (except for low power physics tests).

$F_{\Delta H}^N$, Nuclear Enthalpy Rise Hot Channel Factor

$F_{\Delta H}^N$, Nuclear Enthalpy Rise Hot Channel Factor, is defined as the ratio of the integral of linear power along the rod on which minimum DNBR occurs to the average rod power.

It should be noted that $F^N_{\Delta H}$ is based on an integral and is used as such in the DNB calculations. Local heat fluxes are obtained by using hot channel and adjacent channel explicit power shapes which take into account variations in horizontal (x-y) power shapes throughout the core. Thus the horizontal power shape at the point of maximum heat flux is not necessarily directly related to $F^N_{\Delta H}$.

In the specified limit of $F^N_{\Delta H}$ there is an 8% allowance for design protection uncertaintie which means that normal operation of the core is expected to result in $F^N_{\Delta H} \leq 1.55/1.08$. When a measurement of $F^N_{\Delta H}$ is taken, experimental error must be allowed for and 4% is the appropriate allowance, as specified in 3.10.b.1. The logic behind the larger design uncertainty in this case is that (a) normal perturbations in the radial power shape (e.g. rod misalignment) affect $F^N_{\Delta H}$, in most cases without necessarily affecting F^N_Q, (b) the operator has a direct influence on F^N_Q through movement of rods, and can limit it to the desired value, he has no direct control over $F^N_{\Delta H}$ and (c) an error in the predictions for radial power shape, which may be detected during startup physics tests can be compensated for in F^N_Q by tighter axial control, but compensation for $F^N_{\Delta H}$ is less readily available. 6

The use of $F^N_{\Delta H}$ in specification 3.10.b.5 is to monitor "upburn" which is defined as an increase in $F^N_{\Delta H}$ with exposure. Since this is not to be confused with observed changes in peak power resulting from such phenomena as xenon redistribution, control rod movement, power level changes, or changes in the number of instrumented thimbles recorded, an allowance of 2% is used to account for such changes.

Rod Bow Effects

No penalty for rod bow effects need be included in specification 3.10.b.1 for Exxon Nuclear Company fuel rod burnups to 49,000 MWD/MTU (8). Westinghouse Electric Company fuel requires a burnup dependent penalty be incorporated through a decrease in the $F^N_{\Delta H}$ limit of 2% for 0-15,000 MWD/MTU fuel burnup, 4% for 15000-24000 MWD/MTU fuel burnup, and 6% for greater than 24000 MWD/MTU fuel burnup. These penalties are counter-balanced by credits for increased Reactor Coolant flow and lower Core inlet temperature. The Reactor Coolant System flow has been determined to exceed design flow by greater than 8%. Since the flow channel protective trips are set on a percentage of full flow, significant margin to DNB is provided. One half of the additional flow is taken as a DNB credit to offset 2% of the $F^N_{\Delta H}$ penalty. The existence of 4% additional reactor coolant flow will be verified after each refueling at power prior to exceeding 95% power. If the reactor coolant flow measured per loop averages less than 92560 gpm, the $F^N_{\Delta H}$ limit shall be reduced at the rate of 1% for every 1.8% of reactor coolant design flow (89000 gpm design flow rate) for fuel with greater than 15000 MWD/MTU burnup. Uncertainties in reactor coolant flow have already been accounted for in the flow channel protective trips for design flow. The assumed T_{inlet} for DNB analysis was 540°F while the normal T_{inlet} at 100% power is approximately 532°F. The reduction of maximum allowed T_{inlet} at 100% power to 536°F as addressed in specification 3.10.k provides an additional 2% credit to offset the rod bow penalty. The combination of the penalties and offsets results in a required 2% reduction of allowed $F^N_{\Delta H}$ for high burnup fuel, (assembly burnups > 24000 MWD/MTU). The permitted relaxation in $F^N_{\Delta H}$ allows radial power shape changes with rod insertion to the insertion limits.

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(5) Letter from E. R. Mathews, (WPSC), to D. G. Eisenhut, (NRC), dated January 8, 1980, submitting information on Clad Swelling and Fuel Blockage Models.

(6) Letter from E. R. Mathews, (WPSC), to A. Schwencer, (NRC), dated December 14, 1979, submitting the ECCS Re-analysis properly accounting for the zirconium/water reaction.

(7) M. S. Stricker, "Kewaunee High Burnup Safety Analysis: Limiting Break LOCA and Radiological Consequences", XN-NF-84-31 Rev. 1, Exxon Nuclear Company, October 1984.

(8) N. E. Hoppe, "Mechanical Design Report Supplement for Kewaunee High Burnup (49GWD/MTU) Fuel Assemblies", XN-NF-84-28(P), Exxon Nuclear Company, July 1984. 64

(9) XN-NF-77-57 Exxon Nuclear Power Distribution Control for Pressurized Water Reactor, Phase II, January, 1978.

Westinghouse Fuel K(z) Coordinates	Exxon Nuclear Fuel K(z) Coordinates
P1 (6,1.0) P2 (10.99, 0.932) P3 (12, 0.467)	P1 (6, 1.0) P2 (10.84, 0.938) P3 (12, 0.438)
Normalized to 2.14	Normalized to 2.28

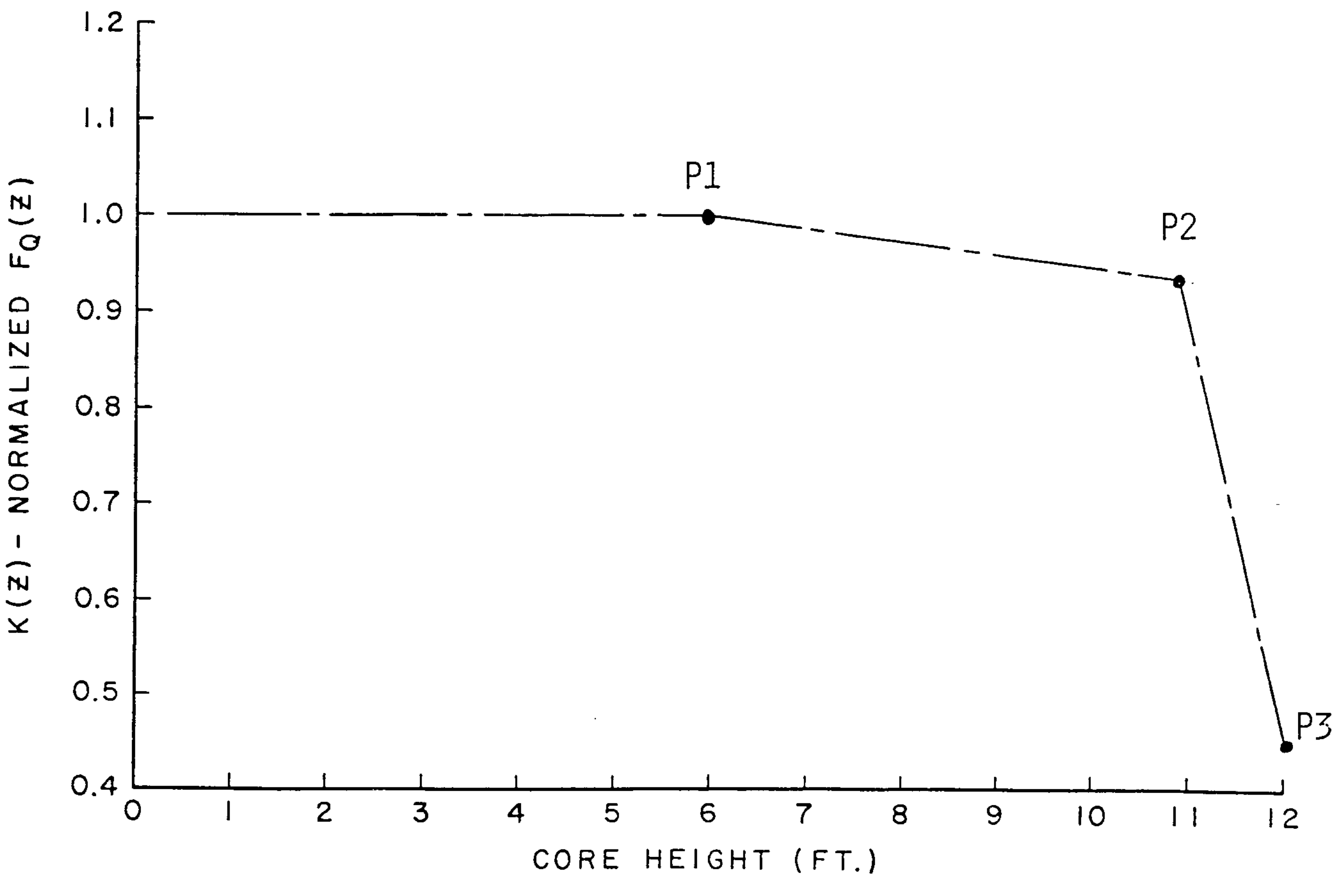
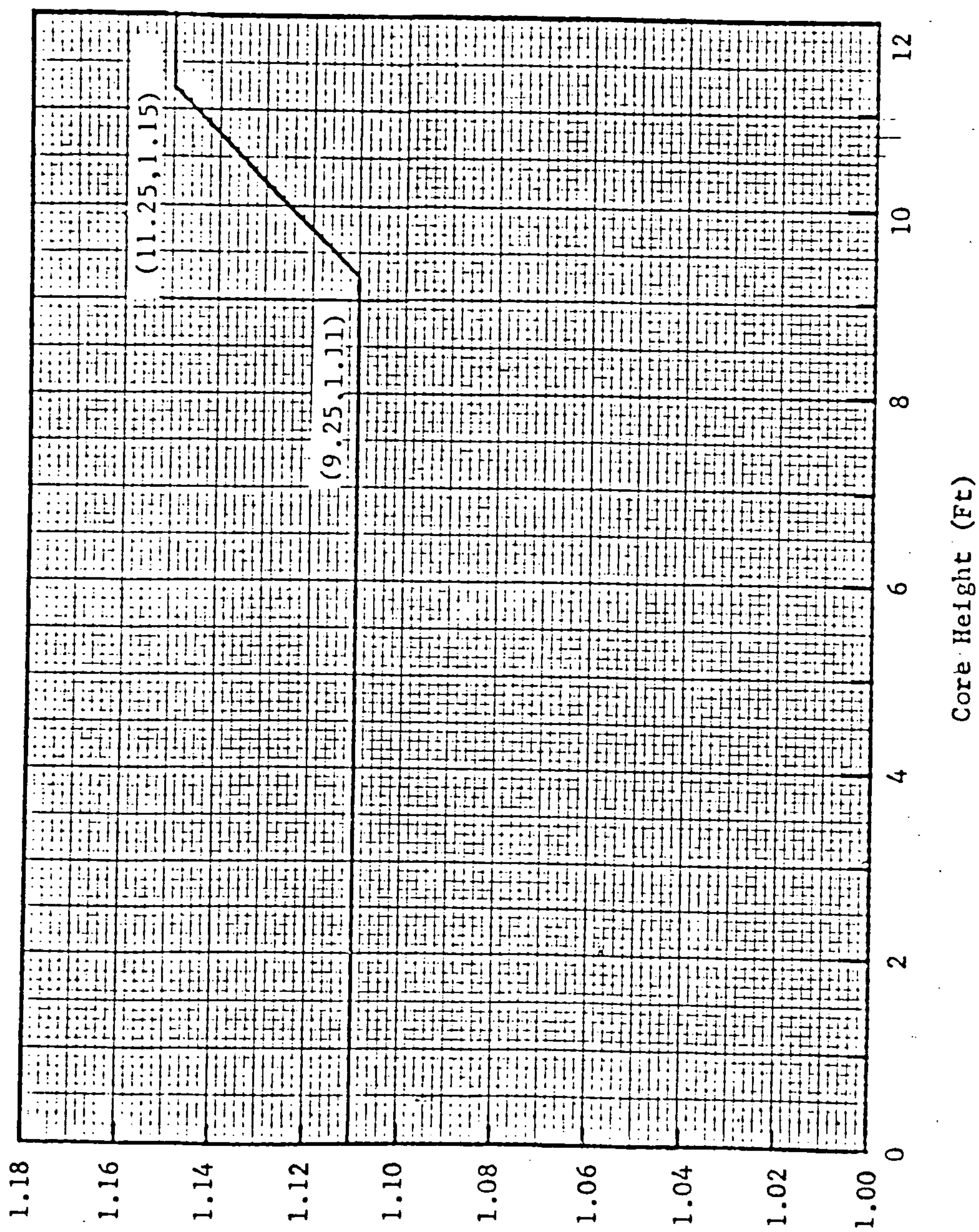


FIGURE TS 3.10-2 HOT CHANNEL FACTOR NORMALIZED OPERATING ENVELOPE



V(Z) as a Function of Core Height

Figure 3.10-6

Enclosure 3 to the letter from C. W. Giesler

to H. R. Denton

Dated November 30, 1984

Affidavit for Withholding

A F F I D A V I T

STATE OF WASHINGTON)
ss.
COUNTY OF BENTON

I, Garrett J. Busselman, being duly sworn, hereby say and depose:

1. I am Manager, Fuel Design, for Exxon Nuclear Company, Inc. ("ENC"), and as such I am authorized to execute this Affidavit.

2. I am familiar with ENC's detailed document control system and policies which govern the protection and control of information.

3. I am familiar with the document XN-NF-84-28(P), Revision 1, entitled "Mechanical Design Report Supplement for Kewaunee High Burnup (49 GWD/MTU) Fuel Assemblies," referred to as "Document." Information contained in this Document has been classified by ENC as proprietary in accordance with the control system and policies established by ENC for the control and protection of information.

4. The document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by ENC and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in the Document as proprietary and confidential.

5. The Document has been made available to the U.S. Nuclear Regulatory Commission in confidence, with the request that the information contained in the Document will not be disclosed or divulged.

6. The Document contains information which is vital to a competitive advantage of ENC and would be helpful to competitors of ENC when conpeting with ENC.

7. The information contained in the Document is considered to be proprietary by ENC because it reveals certain distinguishing aspects of the mechanical design methodology which secure competitive advantage to ENC for fuel design optimization and marketability, and includes information utilized by ENC in its business which affords ENC an oppurtunity to obtain a competitive advantage over its competitors who do not or may not know or use the information contained in the Document.

8. The disclosure of the proprietary information contained in the Document to a competitor would permit the competitor to reduce its expenditure of money and manpower and to improve its competitive position by giving it extremely valuable insights into the mechanical design methodology and would result in substantial harm to the competitive position of ENC.

9. The Document contains proprietary information which is held in confidence by ENC and is not available in public sources.

10. In accordance with ENC's policies governing the protection and control of information, proprietary information contained in the Document has been made available, on a limited basis, to others outside ENC only as required and under suitable agreement providing for non-disclosure and limited use of the information.

11. ENC policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

12. This Document provides information which reveals the mechanical design methodology developed by ENC over the past several years. ENC has invested millions of dollars and many man-years of effort in developing the mechanical design methodology revealed in the Document. Assuming a competitor had available the same background data and incentives as ENC, the competitor might, at a minimum, develop the information for the same expenditure of manpower and money as ENC.

13. Based on my experience in the industry, I do not believe that the background data and incentives of ENC's competitors are sufficiently similar to the corresponding background data and incentives of ENC to reasonably expect such competitors would be in a position to duplicate ENC's proprietary information contained in the Document.

THAT the statements made hereinabove are, to the best of my knowledge, information, and belief, truthful and complete.

FURTHER AFFIANT SAYETH NOT.

Garrett J. Davidson

SWORN TO AND SUBSCRIBED
before me this 12th day of
September, 1984.

Charles W. Lund
NOTARY PUBLIC