Attachment A

Proposed Revised Technical Specifications Pages for D.C. Cook Unit 1.

HEAT FLUX HOT CHANNEL FACTOR-$F_Q(Z)$

LIMITING CONDITION FOR OPERATION

3.2.2 $F_Q(Z,\ell)$ shall be limited by the following relationships:

Westinghouse Fuel	Exxon Nuclear Co. Fuel	
$F_Q(Z,\ell) \leq \frac{2.10}{P}\,[K(Z)]$	$F_Q(Z,\ell) \leq [\frac{F_Q^L(E_\ell)}{P}]\,[K(Z)]$	$P > 0.5$
$F_Q(Z,\ell) \leq [4.20]\,[K(Z)]$	$F_Q(Z,\ell) \leq 2\,[F_Q^L(E_\ell)\,K(Z)]$	$P \leq 0.5$

where $P = \frac{\text{THERMAL POWER}}{\text{RATED THERMAL POWER}}$

$F_Q^L(E_\ell)$ is the exposure dependent F_Q limit for rod ℓ and is defined in Figure 3.2-4 for Exxon Nuclear Co. fuel and in Figure 3.2-5 for Westinghouse fuel. E_ℓ is the maximum pellet exposure in rod ℓ. K(Z) is the function obtained from Figure 3.2-3 for Westinghouse fuel and Figure 3.2-2 for Exxon Nuclear Co. fuel. F_Q is defined as the $F_Q(Z,\ell)$ with the smallest margin or the greatest excess of the limit.

APPLICABILITY: MODE 1

ACTION:

With F_Q exceeding its limit:

a. Comply with either of the following ACTIONS:

1. Reduce THERMAL POWER at least 1% for each 1% F_Q exceeds the limit within 15 minutes and similarly reduce the Power Range Neutron Flux-High Trip Setpoints within the next 4 hours; POWER OPERATION may proceed for up to a total of 72 hours; subsequent POWER OPERATION may proceed provided the Overpower ΔT Trip Setpoints have been reduced at least 1% for each 1% F_Q exceeds the limit. The Overpower ΔT Trip Setpoint reduction shall be performed with the reactor in at least HOT STANDBY.

LIMITING CONDITION FOR OPERATION (Continued)

2. Reduce THERMAL POWER as necessary to meet the limits of Specification 3.2.6 using the APDMS with the latest incore map and updated $\bar{R}$.

b. Identify and correct the cause of the out of limit condition prior to increasing THERMAL POWER; THERMAL POWER may then be increased provided F_Q is demonstrated through incore mapping to be within its limit.

SURVEILLANCE REQUIREMENTS

4.2.2.1 The provisions of Specification 4.0.4 are not applicable.

4.2.2.2 $F_Q(Z,\ell)$ shall be determined to be within its limit by:

a. Using the movable incore detectors to obtain a power distribution map at any THERMAL POWER greater than 5% of RATED THERMAL POWER.

b. Increasing the measured $F_Q(Z,\ell)$ component of the power distribution map by 3% to account for manufacturing tolerances and further increasing the value by 5% to account for measurement uncertainties. This product is defined as $F_Q^M(Z)$.

c. Satisfying the following relationships at the time of the target flux determination.

Westinghouse Fuel	Exxon Nuclear Co. Fuel	
$F_Q^M(Z) \leq \left[\frac{2.10}{P \times E_p(Z)}\right] \frac{K(Z)}{V(Z)}$	$F_Q^M(Z) \leq \left[\frac{F_Q^L(Z)}{P \times E_p(Z)}\right] \frac{K(Z)}{V(Z)}$	$P > 0.5$
$F_Q^M(Z) \leq \left[\frac{4.20}{E_p(Z)}\right] \frac{K(Z)}{V(Z)}$	$F_Q^M(Z) \leq \left[\frac{2\ F_Q^L(Z)}{E_p(Z)}\right] \frac{K(Z)}{V(Z)}$	$P \leq 0.5$

SURVEILLANCE REQUIREMENTS (Continued)

where

$F_Q^M(Z) = F_Q(Z,\ell)$ at ℓ for which

$\frac{F_Q(Z,\ell)}{T(E_\ell)}$ is a maximum

$F_Q^L(Z) = F_Q^L(E_\ell)$ at ℓ for which

$\frac{F_Q(Z,\ell)}{T(E_\ell)}$ is a maximum

$F_Q^M(Z)$ and $F_Q^L(Z)$ are functions of core height, Z, and correspond at each Z to the rod ℓ for which $\frac{F_Q(Z,\ell)}{T(E_\ell)}$ is a maximum at that Z

V(Z) is a cycle dependent function and is provided in the Peaking Factor Limit Report. K(Z) is defined in Figure 3.2-2 for Exxon Nuclear Company fuel and in Figure 3.2-3 for Westinghouse fuel. $T(E_\ell)$ is defined in Figures 3.2-4 and 3.2-5. $E_p(Z)$ is an uncertainty factor to account for the reduction in the $F_Q^L(E_\ell)$ curve due to accumulation of exposure prior to the next flux map.

Westinghouse Fuel	Exxon Nuclear Co. Fuel	
$E_p(Z) = 1.0$	$E_p(Z) = 1.0$	$0.0 \leq E\ell \leq 17.62$
$E_p(Z) = 1.0$	$E_p(Z) = 1.0 + [.0040 \times F_Q^M(Z)]$	$17.62 < E\ell \leq 34.5$
$E_p(Z) = 1.0$	$E_p(Z) = 1.0 + [.0093 \times F_Q^M(Z)]$	$34.5 < E\ell \leq 42.2$
	$E_p(Z) = 1.0 + [.0060 \times F_Q^M(Z)]$	$42.2 < E\ell \leq 48.0$

2. Comply with the requirements of Specification 3.2.2 for $F_Q(Z,\ell)$ exceeding its limit by the maximum percent calculated with the following expressions with V(Z) corresponding to the target band and $P \geq 0.5$:

$$\left[\left[\text{max. over } Z \text{ of } \frac{F_Q^M(Z) \times V(Z) \times E_p(Z)}{\frac{F_L^Q(E_\ell)}{P} \times [K(Z)]}\right] - 1\right] \times 100$$

Exxon Nuclear Co Fuel

$$\left[\left[\text{max. over } Z \text{ of } \frac{F_Q^M(Z) \times V(Z) \times E_p(Z)}{\frac{2.10}{P} \times [K(Z)]}\right] - 1\right] \times 100$$

WESTINGHOUSE FUEL

g. The limits specified in 4.2.2.2.c and 4.2.2.2.f above are not applicable in the following core plane regions:

1. Lower core region 0 to 10% inclusive.

2. Upper core region 90% to 100% inclusive.

4.2.2.3 When $F_Q(Z,\ell)$ is measured for reasons other than meeting the requirements of Specification 4.2.2.2, an overall measured $F_Q(Z,\ell)$ shall be obtained from a power distribution map and increased by 3% to account for manufacturing tolerances and further increased by 5% to account for measurement uncertainty.

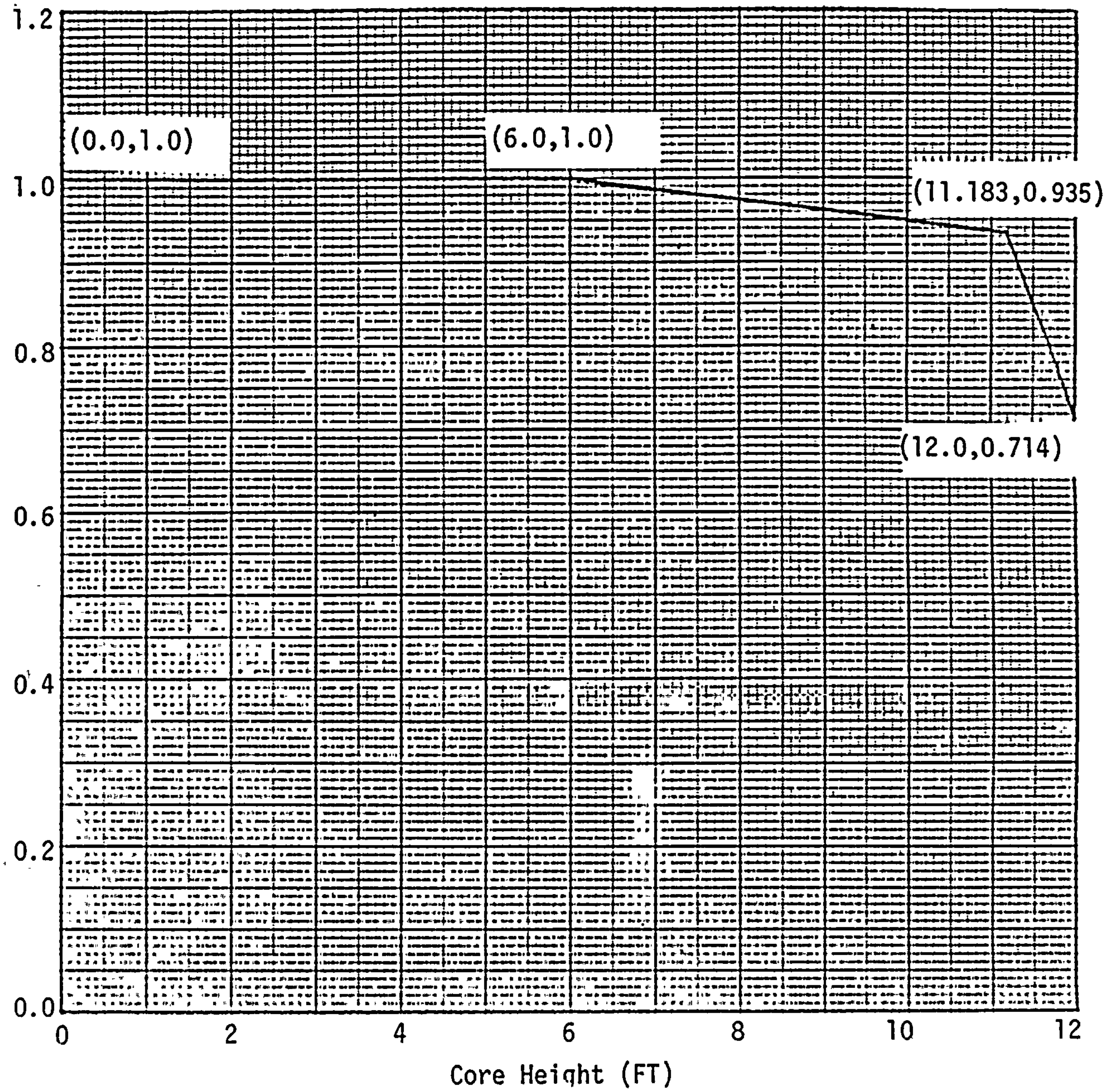

FIGURE 3.2-3 K(Z) - Normalized $F_Q(Z)$ As A Function of Core Height For Westinghouse Fuel

LIMITING CONDITION FOR OPERATION

3.2.6 The axial power distribution shall be limited by the following relationship:

Westinghouse Fuel

$$[F_j(Z)]_s = \frac{[2.10]\,[K(Z)]}{(\overline{R_j})(P_L)(1.03)(1+\sigma_j)(1.07)F_p}$$

Exxon Nuclear Co. Fuel

$$[F_j(Z)]_s = \frac{[2.04]\,[K(Z)]}{(\overline{R_j})(P_L)(1.03)(1+\sigma_j)(1.07)F_p}$$

where:

a. $F_j(Z)$ is the normalized axial power distribution from thimble j at core elevation Z.

b. P_L is the fraction of RATED THERMAL POWER.

c. $K(Z)$ is the function obtained for a given core height location from Figure 3.2-2 for Exxon Nuclear Company fuel and from Figure 3.2-3 for Westinghouse fuel.

d. $\overline{R}_j$, for thimble j, is determined from at least $n=6$ in-core flux maps covering the full configuration of permissible rod patterns at 100% or APL (whichever is less) of RATED THERMAL POWER in accordance with:

$$\overline{R_j} = \frac{1}{n}\sum_{i=1}^{n} R_{ij}$$

where:

$$R_{ij} = \frac{F_{Qi\ell}^{Meas}/T(E\ell)}{[F_{ij}(Z)]_{Max}}$$

R_{ij} and its associated σ_i may be calculated on a full core or a limiting fuel batch basis as defined on page B 3/4 3-3 of basis.

Westinghouse Fuel	ENC Fuel	
$F_p = 1.0$	$F_p = 1.0$	$0.0 \leq E\ell \leq 17.62$
$F_p = 1.0$	$F_p = 1.0 + [.0015 \times W]$	$17.62 < E\ell \leq 34.5$
$F_p = 1.0$	$F_p = 1.0 + [.0033 \times W]$	$34.5 < E\ell \leq 42.2$
	$F_p = 1.0 + [.0020 \times W]$	$42.2 < E\ell \leq 48.0$

where W is the number of effective full power weeks (rounded up to the next highest integer) since the last full core flux map.

APPLICABILITY: Mode 1 above the minimum percent of RATED THERMAL POWER indicated by the relationships.*

$$APL = \text{min over } Z \text{ of } \frac{2.10 \times K(Z)}{F_Q(Z,\ell) \times V(Z)} \times 100\ \% \qquad \text{Westinghouse Fuel}$$

$$APL = \text{min over } Z \text{ of } \frac{F_Q^L(E_\ell) \times K(Z)}{F_Q(Z,\ell) \times V(Z) \times \bar{F}_p(Z)} \times 100\ \% \qquad \text{Exxon Nuclear Co. Fuel}$$

where $F_Q(Z,\ell)$ is the measured $F_Q(Z,\ell)$, including a 3% manufacturing tolerance uncertainty and a 5% measurement uncertainty, at the time of target flux determination from a power distribution map using the movable incore detectors. V(Z) is the function given in the Peaking Factor Limit Report. The above limit is not applicable in the following core plane regions.

1. Lower core region 0% to 10% inclusive.
2. Upper core region 90% to 100% inclusive.

*The APDMS may be out of service when surveillance for determining power distribution maps is being performed.

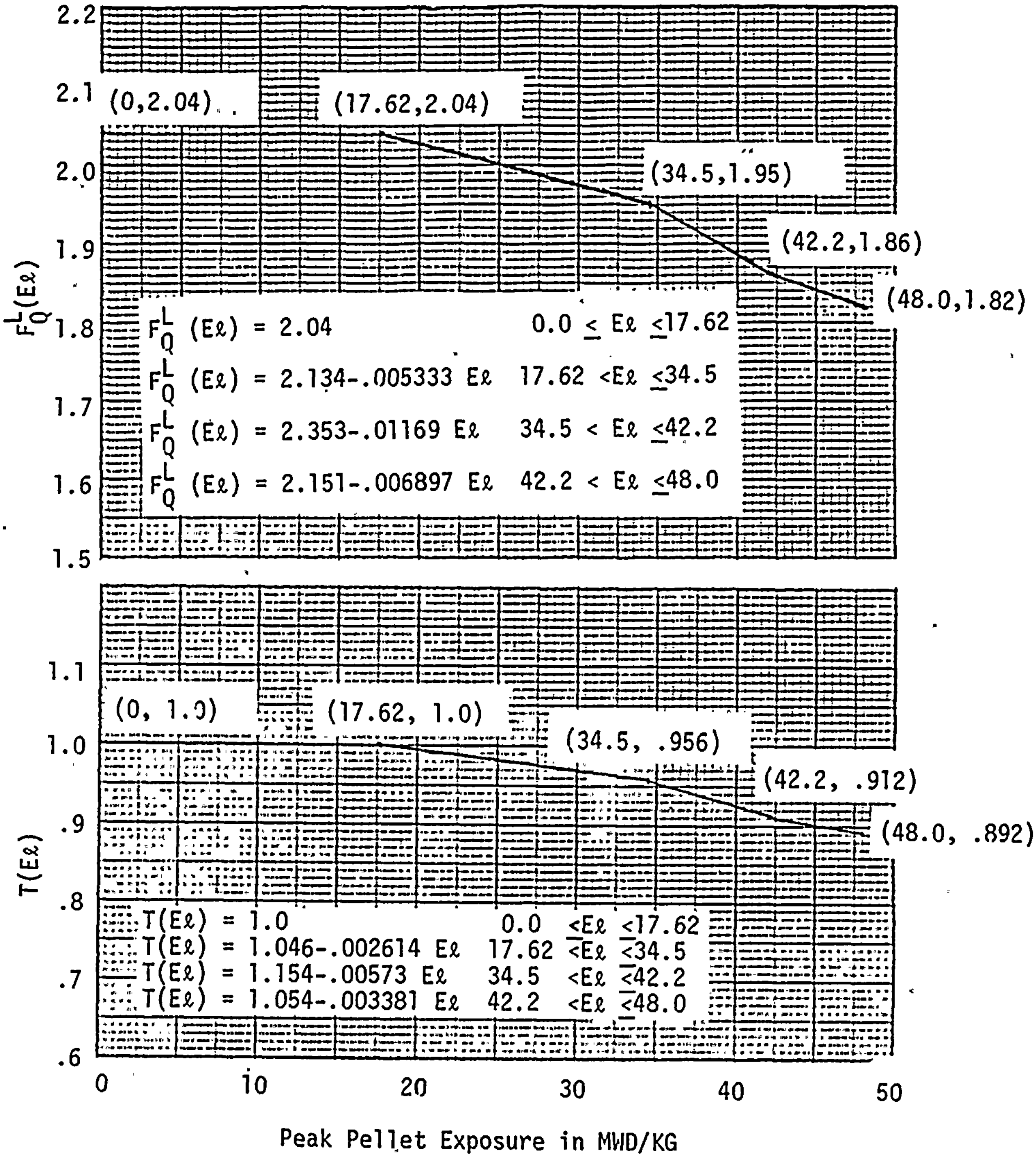

FIGURE 3.2-4

Exposure Dependent F_Q Limit, $F_Q^L(E\ell)$, and Normalized Limit $T(E\ell)$ as a function of Peak Pellet Burnup for Exxon Nuclear Company Fuel

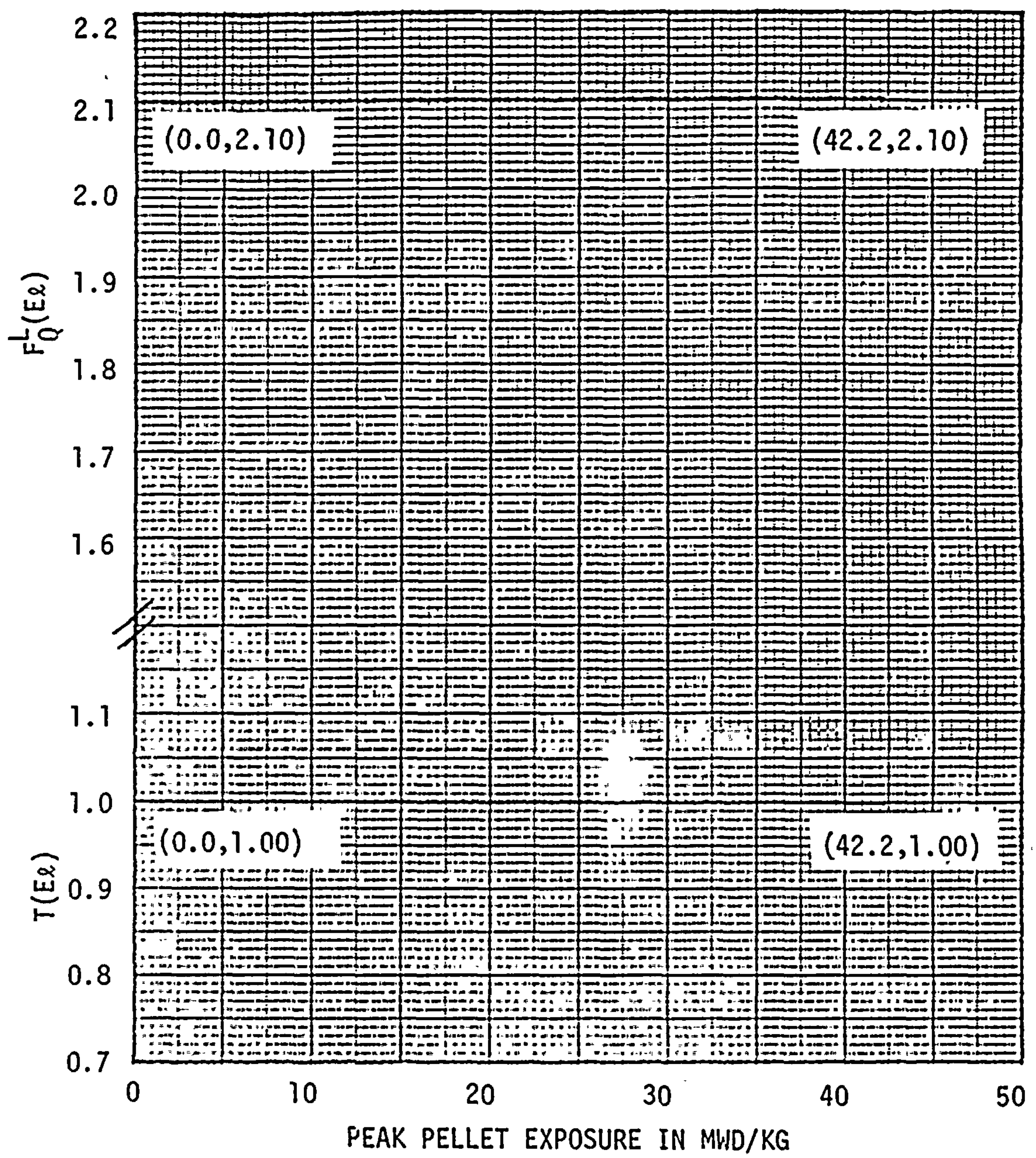

FIGURE 3.2-5

Exposure Dependent F_Q Limit, $F_Q^L(E\ell)$, and Normalized Limit $T(E\ell)$ as a Function of Peak Pellet Burnup for Westinghouse Fuel

Attachment B

Environmental and 10 CFR 50.92 justifications for those Technical Specifications changes (enclosed in Attachment A) associated with the extension of the peak pellet burnup allowed in fuel supplied by Exxon Nuclear Company.

The justification for an increase in the allowed peak pellet burnup in fuel supplied by Exxon Nuclear Company (ENC) from 42,200 MWD/MTU (42.2 MWD/KG) to 48,000 MWD/MTU (48.0 MWD/KG) is based on analyses performed on the mechanical design, LOCA-ECCS analysis, and review of significant hazards and environmental considerations.

Mechanical design analyses for extended burnup to 48,000 MWD/MTU (48.0 MWD/KG) were performed. The results of these analyses are presented in XN-NF-84-25(P), April, 1984. XN-NF-84-25(P), April, 1984, states that all current ENC design criteria are satisfied. These criteria are repeated below:

- The maximum end-of-life (EOL) steady-state cladding strain was determined to be negative, thus meeting the 1.0% design limit.

- The cladding stress and strain during power ramps, calculated under different overpower conditions, do not exceed the design stress corrosion cracking threshold or the 1.0% strain limit.

- The cladding fatigue usage factor of 0.20 is within the 0.67 design limit.

- The end-of-life fuel rod internal pressure is less than the system pressure.

- The cladding diameter reduction due to uniform creepdown plus creep ovality after fuel densification is less than the minimum initial pellet/clad gap. This criterion prevents the formation of fuel column gaps.

- The maximum calculated EOL thickness of the oxide corrosion layer is less than 0.0007 inch, and the maximum calculated concentration of hydrogen in the cladding is 80 ppm. These values are within the design limits of 0.002 inch and 300 ppm, respectively.

- An evaluation of the fuel assembly growth and the fuel rod growth indicates that the fuel assembly design provides adequate clearances at the design burnup.

Data on the performance of similar ENC fuel at high burnups can be found in XN-NF-82-06, "Qualification of Exxon Nuclear Fuel for Extended Burnup", June, 1982. Lead assemblies at H.B. Robinson have been burned to assembly average exposures of approximately 48,000 MWD/MTU (48.0 MWD/KG).

A LOCA/ECCS analysis was performed to extend the peak pellet exposure from 42,200 MWD/MTU (42.2 MWD/KG) to 48,000 MWD/MTU (48.0 MWD/KG). The results of these analyses are presented in XN-NF-83-61, August, 1983, which extends the analyses presented in XN-NF-81-07, February, 1981. The end-of-life calculated peak cladding temperature (PCT) is 1736°F, occurring 262 seconds into the accident at a location 9.25 feet from the bottom of the active core. Assuming a 42°F increase in PCT from an earlier sensitivity study for a conservative estimate of maximum LPSI flow, the PCT will be 1778°F. The analysis of the limiting break for the D.C. Cook Unit 1 reactor with the ENC WREM-IIA and selected EXEM/PWR ECCS evaluation models shows that the reactor can operate at allowed total peaking F_Q^T of 1.82 and $F_{\Delta H}$ of 1.55 at a peak pellet burnup of 48,000 MWD/MTU (48.0 MWD/KG) and continue to meet the 10 CFR 50.46 criteria with analyses performed in conformance to 10 CFR 50 Appendix K requirements.

In a December, 1982 memo from L.G. Hulman, Chief NRC-Accident Evaluation Branch, to Carl Berlinger, Chief, NRC-Core Performance Branch, L.G. Hulman suggested that the Accident Evaluation Branch need not be involved in reload analysis as long as batch average burnup levels do not exceed 38,000 MWD/MTU (38.0 MWD/KG) at discharge. The fuel supplied by Exxon Nuclear Company which is currently in Donald C. Cook Nuclear Plant Unit 1 Cycle 8 is in Region 8 and Region 9. The fuel in Region 8 which will be discharged at the end of Cycle 8 has a design batch average burnup of 32,600 MWD/MTU (32.6 MWD/KG). The remaining Region 8 fuel will be completely discharged at the end of Cycle 9 with a design average burnup of 33,007 MWD/MTU (33.007 MWD/KG) for that batch. The fuel in Region 9 will be completely discharged at the end of Cycle 9 with a design batch average burnup of 34,061 MWD/MTU (34.061 MWD/KG). Reactor coolant system activity data for Unit 1 Cycle 8 indicates that some fuel assemblies are leaking, which will result in some design changes for Unit 1 Cycle 9, with minor effects on the design batch average burnups at discharge. Therefore, the fuel supplied by Exxon Nuclear Company will not exceed 38,000 MWD/MTU (38.0 MWD/KG) batch average burnups at discharge, even though the peak pellet burnup may be up to 48,000 MWD/MTU (48.0 MWD/KG).

On the basis of the above evaluations, we believe that the Technical Specifications changes associated with extending the peak pellet burnup from 42,200 MWD/MTU (42.2 MWD/KG) to 48,000 MWD/MTU (48.0 MWD/KG) do not constitute a significant hazards consideration under 10 CFR 50.92. We have further concluded that the extended burnup will not adversely affect the environment since it will not result in radiological consequences greater than those previously analyzed.

Attachment C

Reasons for the increase in F_Q for fuel supplied by Westinghouse.

The justification for an increase in the F_Q allowed in fuel supplied by Westinghouse to 2.10 is based on a large break analysis which was performed with the December 1981 version of the Evaluation Model modified to incorporate the BART computer code. The analysis specific to Donald C. Cook Nuclear Plant, Unit 1 is included as Attachment D to this letter.

The most limiting single failure when offsite power is unavailable for D.C. Cook Unit 1 is analyzed with maximum safeguards because the current Appendix K models give more limiting results assuming the maximum possible ECCS flow delivery. In that case, maximum safeguards which assume minimum injection line resistances, enhanced ECCS pump performance, and no single failure, result in the highest amount of flow delivered to the RCS. Westinghouse ECCS analyses currently performed for some other Westinghouse plants assume minimum safeguards because that assumption is more limiting for those plants than the maximum safeguards assumption.

Based on previous LOCA sensitivity studies, the limiting large break was found to be the double ended cold leg guillotine (DECLG). Therefore, only the DECLG break is considered in the large break ECCS performance analysis. Calculations were performed for a range of Moody break discharge coefficients. Current LOCA analysis for the D.C. Cook Unit 1 has demonstrated that maximum safeguards assumptions result in the highest peak clad temperature. Therefore, the worst break for D.C. Cook (C_D = 0.6) was re-analyzed, assuming maximum safeguards.

The results of the analyses presented in Attachment D show that 1) the maximum clad temperature calculated for a large break is 2163°F, 2) the maximum local metal-water reaction is 9.65 percent, and 3) the total core metal-water reaction is less than 0.3 percent. The clad temperature transient is terminated at a time when the core geometry is still amenable to cooling. As a result, the core temperature will continue to drop and the ability to remove decay heat generated in the fuel for an extended period of time will be provided. These calculations were performed at 102% of the Design Thermal Power of 3411 MWT and a peaking factor of 2.10.

On the basis of the above evaluations, where the only differences from previously analyzed results are the change in the power level from 3250 MWt to 3411 MWt and an increased peaking factor F_Q^T from 1.97 to 2.10, which is based upon a change in the methods used to perform the analysis; and since the results of such analysis are within the guidelines specified in 10 CFR 50.46, we conclude that the change will not involve a significant hazards considerations as defined by 10 CFR 50.92. Also since the accidents analyzed will not result in an increase in the radiological source term, we believe this change will not have an adverse effect to the environment.