reactivity insertion upon ejection greater than 0.3% $\Delta k/k$ at rated power. Inoperable rod worth shall be determined within 4 weeks.

b. A control rod shall be considered inoperable if
   (a) the rod cannot be moved by CRDM, or
   (b) the rod is misaligned from its bank by more than 15 inches, or
   (c) the rod drop time is not met.

c. If a control rod cannot be moved by the drive mechanism, shutdown margin shall be increased by boron addition to compensate for the withdrawn worth of the inoperable rod.

5. CONTROL ROD POSITION INDICATION

If either the power range channel deviation alarm or the rod deviation monitor alarm is not operable, rod positions shall be logged once per shift and after a load change greater than 10% of rated power. If both alarms are inoperable for two hours or more, the nuclear overpower trip shall be reset to 93% of rated power.

6. POWER DISTRIBUTION LIMITS

a. Hot channel factors:

(1) F_Q Limit

The hot channel factors (defined in Bases) must meet the following limits at all times except during low power physics tests:

$$F_Q(Z) \leq ([F_Q]_L/P) \times K(Z), \text{ for } P > 0.5$$

$$F_Q(Z) \leq (2 \times [F_Q]_L) \times K(Z), \text{ for } P \leq 0.5$$

$$F^N_{\Delta H} \leq 1.55\ [1.0 + 0.2\ (1 - P)]$$

Where P is the fraction of rated power at which the core is operating; K(Z) is the function given in Figure 3.2-3, Z is the core height location of F_Q. $[F_Q]_L$ and K(Z) are dependent on the steam generator tube plugging level as follows:

Plugging level	$[F_Q]_L$	Figure Number for K(Z)
$\leq$ 25%	1.93	3.2-3

(2) Augmented Surveillance

If $[F_Q]_p$, as predicted by approved physics calculations, exceeds $[F_Q]_L$ then the power will be limited to a turnon power fraction, P_T, equal to the ratio of $[F_Q]_L$ divided by $[F_Q]_p$, or, for operation at power levels above P_T, augmented surveillance of hot channel factors shall be implemented, except in Base Load operation (Section 3.2.6.a(3)) or Radial Burndown operation (Section 3.2.6.a(4)).

(3) Base Load Operation

1. Base Load operation may be used at power levels between P_T and P_{BL} or P_T and 1.00 (whichever is most limiting). The maximum relative power permitted under Base Load operation, P_{BL}, is equal to the minimum value of the ratio of $[F_Q(Z)]_L/[F_Q(Z)]_{BL}^{Meas}$ where $[F_Q(Z)]_{BL}^{Meas}$ is equal to

$[F_Q(Z)]_{Map}^{Meas}$ x W(Z) x 1.09.

For the purpose of the specification, $[F_Q(Z)]_{Map}^{Meas}$ shall be obtained between the elevations bounded by ± 10% of the active core height. The function W(Z) is determined analytically and accounts for the most perturbed power shapes which can occur under the constraints of Section 3.2.6.a(3)4. W(Z) corresponding to either ± 2% or ± 3% ΔI may be used to infer P_{BL}. The uncertainty factor of 9.0% accounts for manufacturing tolerances, measurement error, rod bow, and any burnup and power dependent peaking factor increases. Base Load operation can be utilized only if Section 3.2.6.a(3)2 or Section 3.2.6.a(3)3 is satisfied.

2. NOTE: For entering Base Load operation with power less than P_T.

Prior to going to Base Load operation, maintain the following conditions for at least 24 hours:

(1) Relative power must be maintained between $P_T/1.05$ and P_T.

(2) ΔI within ±2% or ± 3% ΔI target band. Corresponding W(Z) to have been used to determine P_{BL}.

After 24 hours have elapsed a full core flux map to determine $[F_Q(Z)]_{Map}^{Meas}$ shall be taken unless a valid full core flux map was taken within the time period specified in Section 4.1. P_{BL} is then to be calculated as per Section 3.2.6.a(3)1.

3. NOTE. For entering Base Load operation with power greater than P_T.

Prior to going to Base Load operation and prior to discontinuing augmented surveillance of hot channel factors, maintain the following conditions for at least 24 hours:

(1) Relative power must be maintained between P_T and the power limited by augmented surveillance of hot channel factors.

(2) ΔI within ± 2% or ± 3% I target band. Corresponding W(Z) to have been used to determine P_{BL}.

After 24 hours have elapsed a full core flux map to determine $[F_Q(Z)]^{Meas}_{Map}$ shall be taken unless a valid full core flux map was taken within the time period specified in Section 4.1. P_{BL} is then to be calculated as per Section 3.2.6.a(3)1.

4. If the conditions of Section 3.2.6.a(3)2 or of Section 3.2.6.a(3)3 are satisfied, then Base Load operation may be utilized provided the following is maintained.

   (1) Power between P_T and P_{BL} or P_T and 1.00 (whichever is most limiting).

   (2) ΔI within $\pm$ 2% or $\pm$ 3% ΔI target band. Corresponding W(Z) to have been used to determine P_{BL}.

   (3) Subsequent full core flux maps are taken within the time period specified in Section 4.1.

5. If any of the requirements of Section 3.2.6.a(3)4 are not maintained, then power shall be reduced to less than or equal to P_T, or within 15 minutes augmented surveillance of hot channel factors shall be initiated if the power is above P_T.

(4) Radial Burndown Operation

1. Radial Burndown operation is restricted to use at powers between P_T and P_{RB} or P_T and 1.00 (whichever is most limiting). The maximum relative power permitted under Radial Burndown operation, P_{RB}, is equal to the minimum value of the ratio of $[F_Q(Z)]_L/[F_Q(Z)]^{Meas}_{RB}$

   where $[F_Q(Z)]^{Meas}_{RB} = [F_{xy}(Z)]^{Meas}_{Map} \times F_z(Z) \times 1.09$.

2. A full core flux map to determine $[F_{xy}(Z)]^{Meas}_{Map}$ shall be taken within the time period specified in Section 4.1.

   For the purpose of the specification, $[F_{xy}(Z)]^{Meas}_{Map}$ shall be obtained between the elevations bounded by $\pm$ 10% of the active core height.

3. The function $F_z(Z)$ is determined analytically and accounts for the most perturbed axial power shapes which can occur under axial power distribution control. The uncertainty factor of 9% accounts for manufacturing tolerances, measurement error, rod bow, and any burnup dependent peaking factor increases.

4. Radial Burndown operation may be utilized at powers between P_T and P_{RB} or P_T and 1.00 (whichever is most limiting) provided that the indicated flux difference is within ± 5%ΔI of the target axial offset.

5. If any of the requirements of Section 3.2.6.a.4.4 are not maintained, then the power shall be reduced to less than or equal to P_T or within 15 minutes augmented surveillance of hot channel factors shall be initiated if the power is above P_T.

b. (1) The measurement of total peaking factor, $[F_Q(Z)]^{Meas}_{Map}$, shall be increased by three percent to account for manufacturing tolerances and further increased by five percent to account for measurement error.

(2) The measurement of the enthalpy rise hot channel factor F^N_H, shall be increased by four percent to account for measurement error.

If either measured hot channel factor exceeds its limit specified under Item 6a, the reactor power shall be reduced so as not to exceed a fraction of the rated value equal to the ratio of the F_Q or F^N_H limit to measured value, whichever is less, and the high neutron flux trip setpoint shall be reduced by the same ratio. If subsequent in-core mapping cannot, within a 24 hour period, demonstrate that the hot channel factors are met, the reactor shall be brought to a hot shutdown condition with return to power authorized only for the purpose of physics testing. The reactor may be returned to higher power levels when measurements indicate that hot channel factors are within limits.

c. The reference equilibrium indicated axial flux difference as a function of power level (called the target flux difference) shall be measured at least once per effective full power quarter. If the axial flux difference has not been measured in the last effective full power month, the target flux difference must be updated monthly by linear interpolation using the most recent measured value and the value predicted for the end of the cycle life.

d. Except during physics tests or during excore calibration procedures and as modified by items 6e through 6g below, the indicated axial flux difference shall be maintained within a ± 5% band about the target flux difference (this defines the target band on axial flux difference).

e. If the indicated axial flux difference at a power level greater than 90% of the rated power deviates

HOT CHANNEL FACTOR
NORMALIZED OPERATING ENVELOPE

(for ≤25% steam generator tube plugging and $[F_Q]_L$ = 1.93)

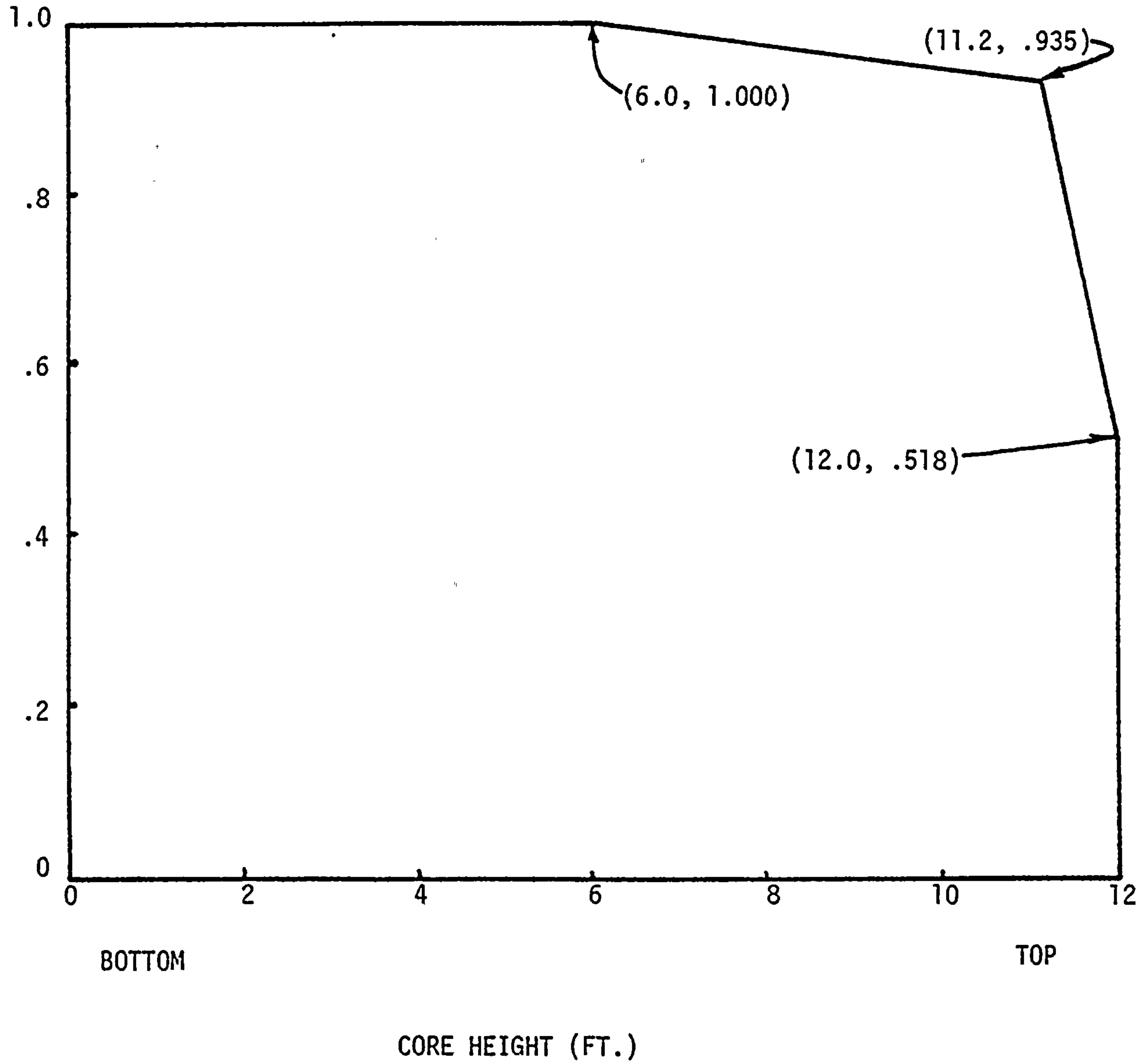

Figure 3.2-3

5/11/81

TABLE 4.1.-1
MINIMUN FREQUENCIES FOR CHECKS, CALIBRATIONS AND
TEST OF INSTRUMENT CHANNELS

	CHANNEL DESCRIPTION	CHECK	CALIBRATE	TEST	REMARKS
1. a.	Nuclear Power Range (Check, Calibrate and Test only applicable above 10% of rated power.)	S(1) M*(4)	D(2) Q*(4)	M(3)	1) Load vs. flux curve 2) Thermal power calculation 3) Signal to ΔT, bistable action (permissive, rod stop, trips) 4) Upper & lower detectors for symmetric offset (+5 to -5%).
b.	Power Distribution Map			M(1) (2) (3)	1) Following initial loading and prior to operation above 75% power. 2) Once per effective full power month. 3) Confirm hot channel factors within limits.
2.	Nuclear Intermediate Range	$S(1)^{+}$	N. A.	P(2)	1) Once/shift up to 50% R.P. 2) Log level; bistable action (permissive, rod stop, trip)
3.	Nuclear Source Range	S(1)	N. A.	P(2)	1) Once/shift when in service. 2) Disable action (alarm, trip)
4.	Reactor Coolant Temperature	S^{+}	R	$B/W(1)^{+}$ $(2)^{+}$	1) Overtemperature Δ T 2) Overpower ΔT
5.	Reactor Coolant Flow	S^{+}	R	M^{+}	
6.	Pressurizer Water Level	S^{+}	R	M^{+}	
7.	Pressurizer Pressure	S^{+}	R	M^{+}	
8.	4 kv Voltage & Frequency	N. A.	R**	R	Reactor protection circuits only
9.	Analog Rod Position	S^{+}	R	M^{+}	With step counters.

Design criteria have been chosen for normal and operating transient events which are consistent with the fuel integrity analyses. These relate to fission gas release, pellet temperature and cladding mechanical properties. Also, the minimum DNBR in the core must not be less than 1.30 in normal operation or in short term transients.

In addition to conditions imposed for normal and operating transient events, the peak linear power density must not exceed the limiting Kw/ft values which result from the large break loss of coolant accident analysis based on the ECCS Acceptance Criteria limit of 2200°F. This is required to meet the initial conditions assumed for loss of coolant accident. To aid in specifying the limits on power distribution, the following hot channel factors are defined.

$F_Q(Z)$, Heat Flux Hot Channel Factor, is defined as the maximum local heat flux on the surface of a fuel rod at core elevation Z divided by the average fuel rod heat flux, allowing for manufacturing tolerances on fuel pellets and rods.

F_Q^E, Engineering Heat Flux Hot Channel Factor, is defined as the allowance on heat flux required for manufacturing tolerances. The engineering factor allows for local variations in enrichment, pellet density and diameter, surface area of fuel rod and eccentricity of the gap between pellet and clad. Combined statistically the net effect is a factor of 1.03 to be applied to fuel rod surface heat flux.

$F_{\Delta H}^N$, Nuclear Enthalpy Rise Hot Channel Factor, is defined as the ratio of the integral of linear power along the rod with the highest integrated power to the average rod power.

It should be noted that $F_{\Delta H}^N$ 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 $F_{\Delta H}^N$.

An upper bound envelope as defined by normalized peaking factor axial dependence of Figure 3.2-3, has been determined to be consistent with the technical specifications on power distribution control as given in Section 3.2.

When an F_Q 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 the specified limit of $F^N_{\Delta H}$, there is an 8 percent allowance for uncertainties which means that normal operation of the core is expected to result in $F^N_{\Delta H} \leq 1.55/1.08$. The logic behind the larger 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_Q, (b) although the operator has a direct influence on F_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 prediction for radial power shape, which may be detected during startup physics tests can be compensated for in F_Q by tighter axial control, but compensation for $F^N_{\Delta H}$ is less readily available. When a measurement of $F^N_{\Delta H}$ is taken, experimental error must be allowed for and 4% is the appropriate allowance for a full core map taken with the movable incore detector flux mapping system.

Measurements of the hot channel factors are required as part of start-up physics tests, at least once each full power month of operation, and whenever abnormal power distribution conditions require a reduction of core power to a level based on measured hot channel factors. The incore map taken following initial loading provides confirmation of the basic nuclear

design bases including proper fuel loading patterns. The periodic monthly incore mapping provides additional assurance that the nuclear design bases remain inviolate and identify operational anomalies which could, otherwise, affect these bases. For normal operation, it is not necessary to measure these quantities. Instead, it has been determined that, provided certain conditions are observed, the hot channel factor limits will be met; these conditions are as follows.

1. Control rods in a single bank move together with no individual rod insertion differing by more than 15 inches from the bank demand position. An indicated misalignment alarm of 12 steps precludes a rod misalignment greater than 15 inches with consideration of maximum instrumentation error.

2. Control rod banks are sequenced with overlapping banks.

3. The full length control bank insertion limits are not violated.

4. Axial power distribution control procedures, which are given in terms of flux difference control and control bank insertion limits are observed. Flux difference refers to the difference in signals between the top and bottom halves of two-section excore neutron detectors. The flux difference is a measure of the axial offset which is defined as the difference in normalized power between the top and bottom halves of the core.

The permitted $F^N_{\Delta H}$ allows radial power shape changes with rod insertion to the insertion limits. It has been determined that provided the above conditions 1 through 4 are observed, these hot channel factors limits are met. In specification 3.2, F_Q is arbitrarily limited for $P \leq 0.5$ (except for low power physics tests).

The procedures for axial power distribution control referred to above are designed to minimize the effects of xenon redistribution on the axial power distribution during load-follow maneuvers. Basically, control of flux difference is required to limit the difference between the current value of

Flux Differences ($\Delta\phi$) and a reference value which corresponds to the full power equilibrium value of Axial Offset (Axial Offset = $\Delta\phi$/fractional power). The reference value of flux difference varies with power level and burnup but expressed as axial offset it varies only with burnup.

The technical specifications on power distribution control assures that the $[F_Q]_L$ upper bound envelope as defined by Figure 3.2-3, is not exceeded and xenon distributions are not developed which at a later time would cause greater local power peaking even though flux difference is then within the limits specified by the procedure.

The target (or reference) value of flux difference is determined as follows. At any time that equilibrium xenon conditions have been established, the indicated flux difference is noted with part length* rods withdrawn from the core and with the full length rod control rod bank more than 190 steps withdrawn (i.e., normal rated power operating position appropriate for the time in life. Control rods are usually withdrawn further as burnup proceeds). This value, divided by the fraction of full power at which the core was operating, is the full power value of the target flux difference. Values for all other core power levels are obtained by multiplying the full power value by the fractional power. Since the indicated equilibrium value was noted, no allowances for excore detector error are necessary and indicated deviations of $\pm$ 5% ΔI are permitted from the indicated reference value. During periods where extensive load following is required, it may be impractical to establish the required core conditions for measuring the target flux difference every rated power month. For this reason, methods are permitted by Item 6c of Section 3.2 for updating the target flux differences. Figure B3.2-1 shows a typical construction of the target flux differences band at BOL and Figure B3.2-2 shows the typical variation of the full power value with burnup.

Strict control of the flux difference (and rod position) is not as necessary during part power operation. This is because xenon distribution control at part power is not as significant as the control at full power and allowance has been made in predicting the heat flux peaking factors for less strict control at part power. Strict control of the flux difference is not possible during certain physics tests or during the required, periodic excore calibra-

*Any reference to part-length rods no longer applies after the part-length rods are removed from the reactor.

tions which require larger flux differences than permitted. Therefore, the specifications on power distribution control are not applied during physics tests or excore calibration. This is acceptable due to the extremely low probability of a significant accident occurring during these operations.

In some instances of rapid plant power reduction automatic rod motion will cause the flux difference to deviate from the target band when the reduced power level is reached. This does not necessarily affect the xenon distribution sufficiently to change the envelope of peaking factors which can be reached on a subsequent return to full power within the target band. However, to simplify the specification, a limitation of one hour in any period of 24 hours is placed on operation outside the band. This ensures that the resulting xenon distributions are not significantly different from those resulting from operation within the target band. The instantaneous consequences of being outside the band, provided rod insertion limits are observed, is not worse than a 10 percent increment in peaking factor for flux differences in the range +14% to -14% (+11% to -11% indicated) increasing by ± 1% for each 2% decrease in rated power. Therefore, while the deviation exists, the power level is limited to 90% of rated power or lower depending on the indicated flux difference.

If, for any reason, flux difference is not controlled within the ± 5% band for as long a period as one hour, then xenon distributions may be significantly changed and operation at 50% of rated power is required to protect against potentially more severe consequences of some accidents.

The analytically determined $[F_Q]_D$ is formulated to generate limiting shapes for all load follow maneuvers consistent with control to a ± 5% band about the target flux difference. For Base Load operation the severity of the shapes that need to be considered is significantly reduced relative to load follow operation. The severity of possible shapes is small due to the restrictions imposed by Sections 3.2.6.a(3)2, 3.2.6.a(3)3 and 3.2.6.a(3)4. To quantify the effect of the limiting transients which could occur during Base Load operation, the function W(Z) is calculated from the following relationship:

$$W(Z) = \left[\text{Max}\left(\frac{F_Q \text{ Base Load Case(s), 150 MWD/T}}{F_Q \text{ ARO, 150 MWD/T}}, \frac{F_Q \text{ Base Load Case(s), 85\% EOL BU}}{F_Q \text{ ARO, 85\% EOL BU}} \right) \right]$$

For Radial Burndown operation the full spectrum of possible shapes consistent with control to a $\pm$ 5% ΔI band needs to be considered in determining power capability. Accordingly, to quantify the effect of the limiting transients which could occur during Radial Burndown operation, the function $F_z(Z)$ is calculated from the following relationship:

$$F_z(Z) = [F_Q(Z)]_{FAC\ Analysis}/[F_{xy}(Z)]_{ARO}$$

As discussed above, the essence of the procedure is to maintain the xenon distribution in the core as close to the equilibrium full power condition as possible. This can be accomplished without part length rods* by using the boron system to position the full length control rods to produce the required indicated flux difference.

For Operating Transient events, the core is protected from overpower and a minimum DNBR of less than 1.30 by an automatic protection system. Compliance with operating procedures is assumed as a precondition for Operating Transients, however, operator error and equipment malfunctions are separately assumed to lead to the cause of the transients considered.

A quadrant tilt power deviation alarm is used to indicate a sudden or unexpected change from the core design radial power distribution. A 2% tilt alarm set point represents minimum practical value consistent with instrumentation error and operating procedures. This asymmetry level is sufficient to detect significant misalignment of control rods which is the most likely cause of radial power asymmetry.

* Any reference to part-length rods no longer applies after the part-length rods are removed from the reactor.

REFERENCES

FSAR - Section 14.3.2

ATTACHMENT 1

As this submittal contains information proprietary to Westinghouse Electric Corporation, it is supported by previously submitted affidavits signed by Westinghouse, the owner of the information. The affidavits set forth the basis on which the information may be withheld from public disclosure by the Commission and address with specificity the considerations listed in paragraph (b)(4) of Section 2.790 of the Commission's regulations.

Accordingly, it is respectfully requested that the information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10CFR Section 2.790 of the commission's regulations. Correspondence with respect to the proprietary aspects of the Application for Withholding or the supporting Westinghouse affidavits should reference CAW-80-13, and should be addressed to R.A. Wiesemann, Manager, Regulatory and Legislative Affairs, Westinghouse Electric Corporation, P. O. Box 355, Pittsburgh, Pennsylvania 15230.

ATTACHMENT 2

Westinghouse Electric Corporation

Water Reactor Divisions

Nuclear Technology Division

Box 355
Pittsburgh Pennsylvania 15230

April 9, 1980
NS-RAW-208

Mr. Darrell Eisenhut, Director
Division of Operating Reactors
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
7920 Norfolk Avenue
Bethesda, Maryland 20014

SUBJECT: Docket Nos. 50-250 and 50-251, Turkey Point Plant, Units No. 3 and 4

REF: Florida Power and Light Company Application for Withholding, Uhrig to Eisenhut, April 1980

Dear Mr. Eisenhut:

The proprietary material for which withholding is being requested by Florida Power and Light Company is of the same technical type as that proprietary material previously submitted by Westinghouse concerning an NRC Staff reload review. The previous application for withholding, AW-76-10, was accompanied by a non-proprietary affidavit signed by the owner of the proprietary information, Westinghouse Electric Corporation. The subject proprietary material is being submitted in support of the Staff's review of the Reload Technical Specification Amendment for FP&L's Turkey Point Station Units 3 and 4.

On March 2, 1977, Westinghouse submitted a proprietary affidavit to supplement the non-proprietary affidavit accompanying application for withholding AW-76-10. Because the Reload Amendment review material associated with Units 3 and 4 is of the same technical type as that associated with the previous reload review, the proprietary affidavit submitted to supplement the previous justification is equally applicable to this material.

Accordingly, this letter authorizes the utilization of the previously furnished affidavits in support of the reload amendment review associated with FP&L's Turkey Point Station Units 3 and 4.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavits should reference CAW-80-13, and should be addressed to the undersigned.

Very truly yours,

Robert A. Wiesemann

Robert A. Wiesemann, Manager
Regulatory & Legislative Affairs

/bek

cc: J. A. Cooke, Esq. (NRC)
R. E. Uhrig (FP&L)