ATTACHMENT 3

PROPOSED TECHNICAL SPECIFICATIONS

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SURVEILLANCE REQUIREMENTS

4.2.2.1 If $[F_Q]^P$ as predicted by approved physics calculations is greater than $[F_Q]^L$ and P is greater than P_T* as defined in 4.2.2.2, $F_Q(Z)$ shall be evaluated by MIDS (Specification 4.2.2.2), BASE LOAD (Specification 4.2.2.3) or RADIAL BURNDOWN (Specification 4.2.2.4) to determine if F_Q is within its limit $[F_Q]^P$ = Predicted F_Q).

If $[F_Q]^P$, is less than $[F_Q]^L$ or P is less than P_T, $F_Q(Z)$ shall be evaluated to determine if $F_Q(Z)$ is within its limit as follows:

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

b. Increasing the measured $F_Q(Z)$ 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.

INSERT A

Verifying that the requirements of Specification 3.2.2 are satisfied.

c. $F_Q^M(Z) \leq F_Q^L(Z)$

Where $F_Q^M(Z)$ is the measured $F_Q(Z)$ increased by the allowance for manufacturing tolerances and measurement uncertainty and $F_Q^L(Z)$ is the F_Q limit defined in 3.2.2.

d. Measuring $F_Q^M(Z)$ according to the following schedule:

1. Prior to exceeding 75% of RATED THERMAL POWER,** after refueling,

2. At least once per 31 Effective Full Power Days.

e. With the relationship specified in Specification 4.2.2.1.c above not being satisfied:

1) Calculate the percent $F_Q^M(Z)$ exceeds its limit by the following expression:

$$\left[\left[\frac{F_Q^M(Z)}{[F_Q]^L \times K(Z)/P}\right] - 1\right] \times 100 \text{ for } P \geq 0.5$$

$$\left[\left[\frac{F_Q^M(Z)}{[F_Q]^L \times K(Z)/0.5}\right] - 1\right] \times 100 \text{ for } P < 0.5$$

*P_T = Reactor power level at which predicted F_Q would exceed its limit.

**During power escalation at the beginning of each cycle, power level may be increased until a power level for extended operation has been achieved and power distribution map obtained.

INSERT A

c) After 24 hours have elapsed, take a full core flux map to determine $F_Q^M(Z)$ unless a valid full core flux map was taken within the time period specified in 4.2.2.1d.

d) Calculate P_{BL} per 4.2.2.3b.

b. Base Load operation is permitted provided:

1. THERMAL POWER is maintained between P_T and P_{BL} or between P_T and 100% (whichever is most limiting).

2. AFD (Delta-I) is maintained within a ± 2% or ± 3% target band.

3. Full core flux maps are taken at least once per 31 effective Full Power Days.

P_{BL} and P_T are defined as:

$$P_{BL} = \frac{[F_Q]^L \times K(Z)}{F_Q^M(Z) \times W(Z)_{BL} \times \sout{1.09}}$$ ← U_{BL}

$$P_T = [F_Q]^L/[F_Q]^P$$

where: $F_Q^M(Z)$ is the measured $F_Q(Z)$ with no allowance for manufacturing tolerances or measurement uncertainty. For the purpose of this Specification $[F_Q^M(Z)]$ shall be obtained between elevations bounded by 10% and 90% of the active core height. $[F_Q]^L$ is the F_Q limit. K(Z) is given in Figure 3.2-2. $W(Z)_{BL}$ is the cycle dependent function that accounts for limited power distribution transients encountered during base load operation.

The function is given in the Peaking Factor Limit Report as per Specification 6.9.1.6. ~~The 9% uncertainty factor accounts for manufacturing tolerance, measurement error, rod bow and any burnup and power dependent peaking factor increases~~. INSERT D

c. During Base Load operation, if the THERMAL POWER is decreased below P_T, then the conditions of 4.2.2.3.a shall be satisfied before re-entering Base Load operation.

d. If any of the conditions of 4.2.2.3b are not maintained, reduce THERMAL POWER to less than or equal to P_T, or, within 15 minutes initiate the Augmented Surveillance (MIDS) requirements of 4.2.2.2.

4.2.2.4 RADIAL BURNDOWN

Operation is permitted at powers above P_T if the following Radial Burndown conditions are satisfied:

a. 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 $[F_Q^L(Z)]/[F_Q(Z)]_{RB}$ Meas.

   where: $[F_Q(Z)]_{RB}$ Meas. = $[F_{xy}(Z)]_{Map}$ Meas. x $F_z(Z)$ x ~~1.09~~ U_{RB} and $[F_Q^L(Z)]$ is equal to $[F_Q^L]$ x K(Z).

b. A full core flux map to determine $[F_{xy}(Z)]_{Map}$ Meas. shall be taken within the time period specified in Section 4.2.2.1d.2. For the purpose of the specification, $[F_{xy}(Z)]_{Map}$ Meas. shall be obtained between the elevations bounded by 10% and 90% of the active core height.

c. The function $F_z(Z)$, provided in the Peaking Factor Limit Report (6.9.1.6), 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.~~ INSERT E

d. 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 AFD (Delta-I) is within ± 5% of the target axial offset.

e. If the requirements of Section 4.2.2.4d 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.

4.2.2.5 When $F_Q(Z)$ is measured for reasons other than meeting the requirements of Specifications 4.2.2.1, 4.2.2.2, 4.2.2.3 or 4.2.2.4 an overall measured $F_Q(Z)$ 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.

INSERT A (HERE)

U/RS

INSERT (E)

INSERT A (HERE)

SURVEILLANCE REQUIREMENTS

4.2.3.1 The provisions of Specification 4.0.4 are not applicable.

4.2.3.2 When a measurement of $F^N_{\Delta H}$ is taken, the measured $F^N_{\Delta H}$ shall be increased by 4% to account for measurement error.

INSERT B

4.2.3.3 This corrected $F^N_{\Delta H}$ shall be determined to be within its limit through incore flux mapping:

a. Prior to operation above 75% of RATED THERMAL POWER after each fuel loading, and

b. At least once per 31 Effective Full Power Days.

INSTRUMENTATION

MOVABLE INCORE DETECTORS

LIMITING CONDITION FOR OPERATION

3.3.3.2 The Movable Incore Detection System shall be OPERABLE with:

a. At least 16 detector thimbles when used for recalibration and check of the Excore Neutron Flux Detection System and monitoring the QUANDRANT POWER TILT RATIO*, and at least 38 detector thimbles when used for monitoring $F^N_{\Delta H}$, $F_Q(Z)$ and $F_{xy}(Z)$. **

b. A minimum of two detector thimbles per core quadrant, and INSERT C

c. Sufficient movable detectors, drive, and readout equipment to map these thimbles.

APPLICABILITY: When the Movable Incore Detection System is used for:

a. Recalibration of the Excore Neutron Flux Detection System, or

b. Monitoring the QUADRANT POWER TILT RATIO*, or

c. Measurement of $F^N_{\Delta H}$, $F_Q(Z)$ and $F_{xy}(Z)$.

ACTION:

With the Movable Incore Detection System inoperable, do not use the system for the above applicable monitoring or calibration functions. The provisions of Specification 3.0.3 are not applicable.

SURVEILLANCE REQUIREMENTS

4.3.3.2 The Movable Incore Detection System shall be demonstrated OPERABLE at least once per 24 hours by normalizing each detector output when required for:

a. Recalibration of the Excore Neutron Flux Detection System, or

b. Monitoring the QUADRANT POWER TILT RATIO*, or

c. Measurement of $F^N_{\Delta H}$, $F_Q(Z)$ and $F_{xy}(Z)$.

*Exception to the 16 detector thimble requirement of monitoring the QUADRANT POWER TILT RATIO is acceptable when performing Specification 4.2.4.2 using two sets of four symmetric thimbles.

** The minimum number of operable detector thimbles is 25 (Unit 3 Cycle 13 only).

3/4.2.2 and 3/4.2.3 HEAT FLUX HOT CHANNEL FACTOR AND NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR

The limits on heat flux hot channel factor and nuclear enthalpy rise hot channel factor ensure that: (1) the design limits on peak local power density and minimum DNBR are not exceeded and (2) in the event of a LOCA the peak fuel clad temperature will not exceed the 2200°F ECCS acceptance criteria limit. The LOCA peak fuel clad temperature limit may be sensitive to the number of steam generator tubes plugged. The current limit is valid for tube plugging levels up to 5%.

$F_Q(Z)$, 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.

$F^N_{\Delta H}$ 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.

Each of these is measurable but will normally only be determined periodically as specified in Specifications 4.2.2 and 4.2.3. This periodic surveillance is sufficient to ensure that the limits are maintained provided:

a. Control rods in a single group move together with no individual rod insertion differing by more than ± 12 steps, indicated, from the group demand position;

b. Control rod groups are sequenced with overlapping groups as described in Specification 3.1.3.6;

c. The control rod insertion limits of Specifications 3.1.3.5 and 3.1.3.6 are maintained; and

d. The axial power distribution, expressed in terms of AXIAL FLUX DIFFERENCE, is maintained within the limits.

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. These uncertainties only apply if the map is taken for purposes other than the determination of P_{BL} and P_{RB}.

$F^N_{\Delta H}$ will be maintained within its limits provided Conditions a. through d. above are maintained.

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 $F^N_{\Delta H} \leq 1.62/1.08$. The logic behind the larger uncertainty in this

* For Unit 3 Cycle 13, this uncertainty was increased to accommodate a reduced number of operable detector thimbles.

HEAT FLUX HOT CHANNEL FACTOR AND NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR (Continued)

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 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, bu 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.

The following are independent augmented surveillance methods used to ensure peaking factors are acceptable for continued operation above Threshold Power, P_T:

Base Load - This method uses the following equation to determine peaking factors:

$$F_{QBL} = F_Q(Z) \text{ measured} \times 1.09^* \times W(Z)_{BL}$$

where: $W(Z)_{BL}$ = accounts for power shapes;
1.09* = accounts for uncertainty;
$F_Q(Z)$ = measured data;
F_{QBL} = Base load peaking factor.

The analytically determined $[F_Q]^P$ 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 4.2.2.3. To quantify the effect of the limiting transients which could occur during Base Load operation, the function $W(Z)_{BL}$ is calculated from the following relationship:

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

Radial Burndown - This method uses the following equation to determine peaking factors.

* For Unit 3 Cycle 13, this uncertainty was increased to accommodate a reduced number of operable detector thimbles.

HEAT FLUX HOT CHANNEL FACTOR AND NUCLEAR ENTHALPY RISE HOT CHANNEL FACTOR (Continued)

$$F_Q(Z)_{R.B.} = F_{xy}(Z)_{measured} \times F_z(Z) \times 1.09^*$$

where: 1.09* = accounts for uncertainty

$F_Z(Z)$ = accounts for axial power shapes

$F_{xy}(Z)_{measured}$ = ratio of peak power density to average power density at elevation(Z)

$F_Q(Z)_{R.B.}$ = Radial Burndown Peaking Factor.

For Radial Burndown operation the full spectrum of possible shapes consistent with control to a ±5% Delta-I 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:

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

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 by using the boron system to position the full length control rods to produce the require indicated flux difference.

Above the power level of P_T, additional flux shape monitoring is required. In order to assure that the total power peaking factor, F_Q, is maintained at or below the limiting value, the movable incore instrumentation will be utilized. Thimbles are selected initially during startup physics tests so that the measurements are representative of the peak core power density. By limiting the core average axial power distribution, the total power peaking factor F_Q can be limited since all other components remain relatively; fixed. The remaining part of the total power peaking factor can be derived from incore measurements, i.e., an effective radial peaking factor $\bar{R}$, can be determined as the ratio of the total peaking factor resulting from a full core flux map and the axial peaking factor in a selected thimble.

The limiting value of $[F_j(Z)]_s$ is derived as follows:

$$[F_j(Z)]_s = \frac{[F_Q]^L \times [K(Z)]}{P_L \bar{R}_j (1 + \sigma_j)(1.03)(1.07)}$$

Where:

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

* For Unit 3 Cycle 13, this uncertainty was increased to accommodate a reduced number of operable detector thimbles.

4. In Unit 5 Cycle 13, this uncertainty was increased to accommodate a reduced number of operable detector thimbles.

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For Unit 3 Cycle 13, when the number of operable movable detector thimbles (T) is less than 75% (38) of the total, the 5% Fq measurement uncertainty shall be increased to [5 + 4(3-T/12.5)]% where T (the number of operable detector thimbles), must be greater than or equal to 50% (25) of the total number of thimbles.

[illegible]

INSERT B

For Unit 3 Cycle 13, when the number of operable movable detector thimbles (T) is less than 75% (38) of the total, the 4% FΔH measurement uncertainty shall be increased to [4 + 2(3-T/12.5)]% where T (the number of operable detector thimbles), must be greater than or equal to 50% (25) of the total number of thimbles.

[illegible]

INSERT C

For Unit 3 Cycle 13, a minimum of three (3) detector thimbles per quadrant whenever the number of operable detector thimbles is less than 38 where two sets of quadrants are defined: 1) quadrants formed by the vertical and horizontal axes of the core and 2) quadrants formed by the two diagonals of the core. These quadrants are defined such that the instrument locations along the axes dividing the quadrants are included in each of those adjacent quadrants as whole thimbles.

[illegible]

[illegible]

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U_{BL} is defined as the Base Load uncertainty factor that accounts for: manufacturing tolerance, measurement error, rod bow and any burnup and power dependent peaking factor increases. With at least 75% (38) of the detector thimbles operable, U_{BL} is 9%. For Unit 3 Cycle 13, when the number of operable movable detector thimbles (T) is less than 75% (38) of the total, U_{BL} uncertainty shall be increased to:

$$[9 + 4(3-T/12.5)]\%$$

where T (the number of operable detector thimbles), must be greater than or equal to 50% (25) of the total number of thimbles.

INSERT E

U_{RB} is defined as the Radial Burndown uncertainty factor that accounts for: manufacturing tolerance, measurement error, rod bow and any burnup and power dependent peaking factor increases. With at least 75% (38) of the detector thimbles operable, U_{RB} is 9%. For Unit 3 Cycle 13, when the number of operable movable detector thimbles (T) is less than 75% (38) of the total, U_{RB} uncertainty shall be increased to:

$$[9 + 4(3-T/12.5)]\%$$

where T (the number of operable detector thimbles), must be greater than or equal to 50% (25) of the total number of thimbles.

ATTACHMENT 4

ANALYSIS OF POWER PEAKING UNCERTAINTIES FOR TURKEY POINT UNIT 3 CYCLE 13

[illegible]

1.0 INTRODUCTION

In 1987, Westinghouse performed a generic thimble reduction study for Turkey Point Units 3 and 4 [reference 4.1 (also contained in Appendix A of this Attachment)]. In response to FPL questions, Westinghouse also provided an update to the thimble deletion study in 1988 [reference 4.2 (also contained in Appendix B of this Attachment)]. In order to ensure that these analyses are applicable for Unit 3 Cycle 13, FPL performed a calculation [reference 4.3]. This calculation is based on calculations and operational data for Turkey Point Unit 3 Cycle 13 through March 1993.

2.0 GENERIC THIMBLE DELETION STUDY

2.1 Peaking Factor Uncertainties

Several studies have been performed with peaking factor measurement uncertainties when less than full complement of instrumentation thimbles are used in the core. These studies were used as the basis for determining the magnitude of the uncertainty to be applied to measured peaking factors for the Turkey Point Units. Flux maps from three different three-loop reactors were used to determine the peaking factor uncertainties. These other three-loop reactors all have INCORE thimble patterns identical to the Turkey Point units. From these reactors, a total of 7 flux maps were taken to perform the study. Five (5) separate random thimble reduction cases (down to 50% of the thimbles) were performed for each map, for a total of 35 reduced thimble maps. The measured peaking factors in the reduced thimble maps were compared to the reference maps. Differences were calculated in terms of percentage change in Fq, $F\Delta H$, and Fxy and relative difference in Axial Offset and Quadrant Power Tilt using the following formulas:

$$\% \text{ Error} = (1 - FTD/Fref) * 100$$

$$\text{Error} = Fref - FTD$$

where FTD is the parameter of interest from the deletion map, and Fref is the parameter from the reference map with all available thimbles.

This data is compiled in Table 2.1. The mean and standard deviation of the five deletion cases were then calculated (see Table 2.2) , as were the mean and standard deviation for all reload maps combined (35 cases). After all of these data were obtained, a 95% confidence level / 95% probability one-sided upper tolerance limit was constructed to quantify

the thimble deletion uncertainty component using the following formula:

$$TDUC = Xbar + K\delta$$

where TDUC is the thimble deletion uncertainty component for the parameter of interest, Xbar is the mean error for all 35 cases, δ is the standard deviation for all 35 cases, and K is the one sided 95% confidence level / 95% probability tolerance limit.

For 34 degrees of freedom (35 - 1), the K value is 2.176. Using this data, the uncertainty for the parameter of interest was combined with the statistical independent measurement uncertainties provided in the Technical Specifications using the following formula:

$$UNC = 1. + Xbar + \{(TSUNC-1)^2 + TDUC^2\}^{1/2}$$

where UNC it the combined uncertainty, and TSUNC is the Technical Specifications uncertainty for each of the parameters.

Note: Negative biases (Xbar) (negative meaning the deletion maps gave more conservative measurements) were assumed to be zero for conservatism.

The resulting uncertainties for peaking factor with only 50% of thimbles operable are:

Peaking Factor Uncertainties
for Deletion to 50% of Thimbles

	TSUNC	TDUC	UNC Combined	Conservative	Increase
$F\Delta H$	1.04	0.0118	1.043	1.05	.01
Fq	1.05	0.0146	1.057	1.07	.02
Fxy	1.05	0.0178	1.054	1.07	.02

The "combined" column is the statistically combined total uncertainty for the respective peaking factor. The "conservative" column is the combined uncertainties rounded up. The "increase" column is the difference between the "conservative" column and the Technical Specifications (TSUNC) column.

[illegible]

As an additional conservatism, the peaking factor uncertainties due to the reduction of thimbles were doubled. Therefore, the peaking factor uncertainties become:

Peaking Factor Uncertainties for Deletion to 50% of Thimbles

FΔH	**1.06**
Fq	**1.09**
Fxy	**1.09**

These peaking factor uncertainties are then applied to measurements using a ramp function as follows:

FΔH measurement uncertainty = 4% + 2.0*(3 - T/12.5)
Fq measurement uncertainty = 5% + 4.0*(3 - T/12.5)

where T is the number of operable incore detector thimbles remaining and must be between 25 and 37 inclusive. For cases with greater than 37 thimbles, the standard Technical Specifications uncertainties apply.

2.2 Random Deletion Applicability

The peaking factor measurement uncertainty analysis described above makes the assumption that thimbles were randomly deleted from the core. If thimbles are somehow systematically deleted from the core then the above calculated uncertainties will not apply. To help ensure that thimbles deletion is random, a restriction is placed on the number of thimbles that must remain operable in each quadrant. For example, if 50% of the thimbles are removed from the core, it was shown that greater than 97% of the time at least three (3) thimbles will be remaining in each quadrant of the core. This number was obtained by using a computer simulation that randomly deleted 50% of the thimbles. The core quadrant were divided in two sets: 1) quadrants formed by the vertical and horizontal axes of the core and 2) quadrants formed by the two diagonals of the core. In summary, when 50% of the thimbles remain after a random deletion, at least three (3) thimbles should be left in each of the eight quadrants. If less than three thimbles are left in any quadrant, then the thimbles removal is probably not a random process and the peaking factor uncertainties calculated previously will no longer apply.

2.3 Axial Offset and Quadrant Power Tilt Variations

The variation in the measured axial offset and core quadrant tilts were calculated using the following formula:

$$\text{Variation} = \text{Xbar} +/- K\delta/(35)^{1/2}$$

The value of 35 corresponds to the total population. The variation in the axial offset is -0.0007% +/- 0.0739% while the variation in core tilt is -0.1797 +/- 0.2637%. Conservatively, the Axial Offset variation was rounded up to 0.08%. As can be seen, deleting down to as few as 50% (25) of the thimbles has little or no effect on the measured axial offset or core tilt when compared to the reference case.

TABLE 2.1

Flux Map Results for Three-Loop Cores

Map	Fxy	FDH	FQ	Axial Offset	Quad Tilt	Min. FQ Mar	Percent Differences Fxy	Percent Differences FDH	Percent Differences FQ	Relative Differences A.O.	Relative Differences Tilt	Relative Differences FQ Mar
Ref 1	1.4020	1.3909	1.6695	-1.517	0.98	21.959						
Del A	1.4080	1.3937	1.6763	-1.626	-0.90	21.767	-0.4280	-0.2013	-0.4073	0.109	1.88	0.192
Del B	1.4079	1.3938	1.6724	-1.384	1.23	21.709	-0.4208	-0.2085	-0.1737	-0.133	-0.27	0.250
Del C	1.4565	1.4375	1.7194	-1.329	-0.76	19.315	-3.8873	-3.3503	-2.9889	-0.188	1.72	2.644
Del D	1.4292	1.3936	1.6810	-1.621	1.02	21.640	-1.9401	-0.1941	-0.6888	0.104	-0.06	0.319
Del E	1.4247	1.4118	1.6884	-1.812	1.07	20.940	-1.6191	-1.5026	-1.1321	0.295	-0.11	1.019
Ref 2	1.4268	1.4251	1.6449	-3.144	0.72	23.319						
Del A	1.4430	1.4228	1.6652	-3.600	0.99	22.375	-1.1354	0.1614	-1.2341	0.456	-0.27	0.944
Del B	1.4549	1.4275	1.6744	-3.109	0.98	21.945	-1.9694	-0.1684	-1.7934	-0.035	-0.26	1.374
Del C	1.4302	1.4333	1.6449	-2.972	0.62	23.322	-0.2383	-0.5754	0.0000	-0.172	0.10	-0.003
Del D	1.4204	1.4275	1.6426	-3.408	0.68	23.429	0.4486	-0.1684	0.1398	0.264	0.04	-0.110
Del E	1.4411	1.4370	1.6611	-3.291	0.70	22.564	-1.0022	-0.8350	-0.9848	0.147	0.02	0.755
Ref 3	1.4336	1.4233	1.6442	-3.729	0.53	23.354						
Del A	1.4532	1.4262	1.6802	-3.739	0.68	22.607	-1.3672	-0.2038	-0.9731	0.010	-0.15	0.747
Del B	1.4453	1.4327	1.6813	-3.819	0.98	22.556	-0.8161	-0.6604	-1.0400	0.090	-0.43	0.798
Del C	1.4479	1.4254	1.6593	-3.989	0.51	22.648	-0.9975	-0.1475	-0.9184	0.260	0.02	0.706
Del D	1.4378	1.4260	1.6505	-3.690	0.74	23.062	-0.2930	-0.1897	-0.3832	-0.039	-0.21	0.292
Del E	1.4374	1.4232	1.6497	-3.769	0.73	23.095	-0.2651	0.0070	-0.3345	0.040	-0.20	0.259
Ref 1	1.4706	1.3995	1.6391	-0.915	-0.28	23.589						
Del A	1.4490	1.4087	1.6160	-0.842	-0.99	24.667	1.4688	-0.6574	1.4093	-0.273	0.71	-1.078
Del B	1.4980	1.4090	1.6705	-0.895	-0.52	22.127	-1.8632	-0.6788	-1.9157	-0.020	0.24	1.462
Del C	1.4653	1.4003	1.6294	-0.768	-0.67		0.3604	-0.0572	0.5918	-0.147	0.39	
Del D	1.5093	1.4264	1.6840	-1.009	-0.63	21.499	-2.6316	-1.9221	-2.7393	0.094	0.35	2.090
Del E	1.4600	1.4010	1.6310	-0.932	0.38	23.966	0.7208	-0.1072	0.4942	0.017	-0.64	-0.377
Ref 2	1.4657	1.4163	1.6474	-0.865	0.40	20.178						
Del A	1.4956	1.4173	1.6675	-0.783	0.30	19.201	-2.0400	-0.0706	-1.2201	-0.082	0.10	0.977
Del B	1.4909	1.4228	1.6771	-0.954	0.94	18.739	-1.7193	-0.4589	-1.8028	0.089	-0.54	1.439
Del C	1.4617	1.4239	1.6402	-0.713	0.81	20.526	0.2729	-0.5366	0.4371	-0.152	-0.41	-0.348
Del D	1.4674	1.4212	1.6475	-0.947	0.69	20.173	-0.1160	-0.3460	-0.0061	0.082	-0.29	0.005
Del E	1.4772	1.4157	1.6618	-1.098	0.53	19.478	-0.7846	0.0424	-0.8741	0.233	-0.13	0.700
Ref 1	1.3800	1.3910	1.6677	-7.822	-0.42	21.582						
Del A	1.3827	1.3875	1.6636	-7.288	0.41	21.776	-0.1957	0.2516	0.2458	-0.536	-0.83	-0.194
Del B	1.3892	1.3926	1.6692	-7.638	0.75	21.510	-0.6667	-0.1150	-0.0899	-0.184	-1.17	0.072
Del C	1.3789	1.3885	1.6648	-7.666	-0.73	21.720	0.0797	0.1797	0.1739	-0.156	0.31	-0.138
Del D	1.3929	1.3901	1.6818	-8.103	-0.45	20.920	-0.9348	0.0647	-0.8455	0.281	0.03	0.662
Del E	1.3928	1.4002	1.6784	-7.847	0.65	21.079	-0.9275	-0.6614	-0.6416	0.025	-1.07	0.503
Ref 2	1.3882	1.3790	1.5734	-3.389	-0.46	26.018						
Del A	1.3896	1.3786	1.5703	-3.112	0.57	26.162	-0.2453	0.0290	0.1970	-0.277	-1.03	-0.144
Del B	1.4383	1.3784	1.5785	-3.333	0.91	25.097	-3.7585	0.0435	-0.3241	-0.056	-1.37	0.921
Del C	1.4221	1.3817	1.5726	-3.177	1.0094	25.096	-2.5898	-0.1958	0.0508	-0.212	-1.40	0.922
Del D	1.3754	1.3821	1.5731	-3.259	1.0082	26.030	0.7791	-0.2248	0.0191	-0.130	-1.28	-0.012
Del E	1.3819	1.3869	1.5737	-3.560	0.9960	26.001	0.3102	0.8774	-0.0191	0.171	-0.06	0.017

TABLE 2.2

Statistical Results for All Deletion Maps

Fxy X(%)	Fxy S(%)	FDH X(%)	FDH S(%)	FQ X(%)	FQ S(%)	Axial Offset X(%)	Axial Offset S(%)	Quad Tilt X(%)	Quad Tilt S(%)	Min FQ Margin X(%)	Min FQ Margin S(%)
-1.6591	1.4225	-1.0914	1.3828	-1.0782	1.1262	0.0374	0.1973	0.6280	1.0647	0.8848	1.0387
-0.7794	0.9210	-0.3172	0.3899	-0.7745	0.8261	0.1320	0.2484	-0.0740	0.1769	0.5920	0.6342
-0.7478	0.4718	-0.2389	0.2501	-0.7298	0.3418	0.0722	0.1150	-0.1940	0.1610	0.5604	0.2624
-0.3890	1.7640	-0.6845	0.7515	-0.4319	1.7903	-0.0858	0.1449	0.2100	0.5063	0.5243	1.4956
-0.8774	0.9985	-0.2740	0.2499	-0.6932	0.9071	0.0340	0.1525	-0.2540	0.2491	0.5546	0.7243
-0.5290	0.4539	-0.0561	0.3658	-0.2315	0.4892	-0.1140	0.3000	-0.5460	0.6725	0.1810	0.3838
-1.1009	1.9709	0.1059	0.4487	-0.0153	0.1911	-0.1008	0.1733	-1.0280	0.5603	0.3408	0.5336
-0.8889	1.2174	-0.3652	0.7117	-0.5649	0.9298	-0.0007	0.2009	-0.1787	0.7170	0.5186	0.7422

3.0 Applicability to Unit 3 Cycle 13

To ensure that the generic analysis was applicable to Unit 3 Cycle 13, a calculation was performed (reference 4.3). Four flux maps from Cycle 13 were chosen. These maps are the only 100% power flux maps available (#4, 5, 6 & 7) for the current cycle. Four subsets were generated for each flux map by randomly deleting 50% of the available traces. The deletion patterns for the 4 flux maps are presented in Table 3.1. Note that the calibration thimbles are identified by double asterisk, and were not allowed to be deleted. Also, after the 50% of random thimble deletion was established (note that this is more conservative that just deleting 50% of the total number of thimbles), thimbles in the core flats were also deleted from processing. This was performed since these locations contain part length Hafnium absorbers and their treatment by the INCORE computer code yields unrealistic peaking factors at adjacent assemblies. This is caused by the incore constant deck in INCORE that extends from the core midplane to the lower portion of the fuel assembly (nodes 31 to 56) which contains an average predicted reaction rate over the specified region. In this region, the fuel assemblies in the flats contain approximately 36 inches of hafnium absorber and approximately 24 inches of un-poisoned fuel. The significant change in axial reaction rates combined with the average reaction rate from the incore constant deck yields large percentage differences. The treatment by INCORE then yields an unrealistic value for peaking factor (Fq). A total subset of 16 flux maps with 25 (50%) or less thimbles were processed through the INCORE computer code.

Using the same equations as presented in section 2.0, the mean error and the standard deviation for the peaking factors and Axial Offset were generated. Table 3.2 presents the results. Note that K for 15 degrees of freedom (16-1) was obtained from Reference 4.4 to be 2.566. Using this number, the total peaking factor uncertainties after combining them with the current Technical Specifications uncertainty components are 1.0489 and 1.0605 for $F\Delta H$ and Fq, respectively. Also, the axial offset variation calculated in Table 3.1 is rounded up to 0.08% which is identical to the one calculated in section 2.0.

Since these uncertainties are lower than those obtained in section 2.0 and the axial offset variations are identical to that calculated in section 2.0, it is concluded that the original analyses are applicable to Unit 3 Cycle 13.

TABLE 3.1

Calculation of Available Thimbles for Flux Map Number 4							
			Case 1	Case 2	Case 3	Case 4	
Item	Thimble Number	Thimble ID	Del =Y	Del =Y	Del =Y	Del =Y	
========	========	========	========	========	========	========	========
1	1	M-3		Y	Y		
2	3	F-4	Y		Y	Y	
3	5	F-8**					
4	7	B-5**					
5	8	H-6	Y	Y	Y	Y	
6	9	J-3		Y		Y	
7	10	D-3			Y		
8	11	L-9		Y	Y		
9	12	B-10	Y		Y		
10	13	L-4	Y		Y		
11	14	F-13	Y	Y	Y		
12	15	F-6			Y	Y	
13	16	J-12	Y	Y			
14	17	B-7	Y		Y		
15	18	H-1	Y	Y	Y	Y	
16	19	G-9			Y		
17	20	G-7	Y	Y		Y	
18	21	F-11		Y	Y	Y	
19	23	J-10		Y			
20	24	J-5		Y		Y	
21	25	B-8	Y	Y	Y		
22	26	N-10	Y	Y		Y	
23	27	C-12	Y			Y	
24	29	D-7	Y				
25	30	L-14		Y		Y	
26	32	F-9		Y		Y	
27	33	N-7	Y		Y		
28	34	A-9	Y	Y	Y	Y	
29	35	N-12	Y			Y	
30	37	H-4			Y		
31	39	D-5	Y	Y		Y	
32	40	L-6	Y		Y	Y	
33	42	G-14		Y		Y	
34	43	H-13**					
35	45	H-3			Y	Y	
36	46	N-8	Y	Y		Y	
37	48	L-11		Y			
38	49	E-5			Y		
39	50	L-5	Y				
** Represent Calibration Thimble							

[illegible]

TABLE 3.1

Calculation of Available Thimbles for Flux Map Number 5									
					Case 1	Case 2	Case 3	Case 4	
Item	Thimble Number		Thimble ID		Del =Y	Del =Y	Del =Y	Del =Y	
========	========	========	========	========	========	========	========	================	
1	1		M-3				Y	Y	
2	3		F-4			Y	Y	Y	
3	5		F-8**						
4	7		B-5		Y				
5	8		H-6			Y	Y	Y	
6	9		J-3			Y		Y	
7	10		D-3		Y	Y		Y	
8	11		L-9		Y		Y	Y	
9	12		B-10		Y		Y		
10	13		L-4			Y			
11	14		F-13		Y		Y	Y	
12	15		F-6		Y		Y	Y	
13	16		J-12		Y		Y	Y	
14	17		B-7		Y		Y	Y	
15	18		H-1		Y	Y	Y	Y	
16	19		G-9			Y	Y		
17	20		G-7			Y	Y		
18	21		F-11 **						
19	23		J-10				Y	Y	
20	24		J-5**						
21	25		B-8		Y	Y	Y		
22	26		N-10		Y	Y		Y	
23	27		C-12			Y	Y		
24	28		J-7		Y	Y			
25	29		D-7		Y	Y		Y	
26	30		L-14				Y		
27	32		F-9		Y	Y	Y	Y	
28	33		N-7			Y	Y	Y	
29	34		A-9		Y	Y	Y	Y	
30	35		N-12			Y		Y	
31	37		H-4			Y			
32	38		H11		Y				
33	39		D-5		Y	Y			
34	40		L-6		Y				
35	42		G-14		Y			Y	
36	45		H-3		Y	Y		Y	
37	46		N-8				Y	Y	
38	48		L-11					Y	
39	49		E-5						
40	50		L-5						
** Represent Calibration Thimble									

TABLE 3.1

Calculation of Available Thimbles for Flux Map Number 6									
					Case 1	Case 2	Case 3	Case 4	
Item	Thimble Number		Thimble ID		Del =Y	Del =Y	Del =Y	Del =Y	
========	========	========	========	========	========	========	========	================	
1	1		M-3			Y	Y	Y	
2	3		F-4		Y	Y	Y	Y	
3	5		F-8			Y		Y	
4	7		B-5						
5	8		H-6			Y			
6	9		J-3		Y	Y	Y	Y	
7	10		D-3		Y	Y		Y	
8	11		L-9					Y	
9	12		B-10		Y	Y	Y		
10	13		L-4			Y			
11	14		F-13		Y	Y	Y	Y	
12	15		F-6				Y		
13	16		J-12		Y		Y		
14	17		B-7		Y	Y	Y		
15	19		G-9				Y	Y	
16	20		G-7				Y	Y	
17	21		F-11 **						
18	23		J-10		Y				
19	24		J-5		Y			Y	
20	25		B-8		Y	Y	Y	Y	
21	26		N-10		Y				
22	27		C-12				Y	Y	
23	28		J-7						
24	29		D-7		Y			Y	
25	30		L-14			Y			
26	32		F-9			Y		Y	
27	33		N-7		Y		Y		
28	34		A-9		Y	Y	Y	Y	
29	35		N-12			Y			
30	37		H-4		Y			Y	
31	38		H11				Y		
32	39		D-5		Y	Y	Y	Y	
33	40		L-6						
34	42		G-14			Y	Y	Y	
35	45		H-3		Y				
36	46		N-8		Y	Y	Y	Y	
37	48		L-11		Y	Y	Y		
38	49		E-5			Y			
39	50		L-5					Y	
** Represent Calibration Thimble									

TABLE 3.1

Calculation of Available Thimbles for Flux Map Number 7						
			Case 1	Case 2	Case 3	Case 4
Item	Thimble Number	Thimble ID	Del =Y	Del =Y	Del =Y	Del =Y
========	========	========	========	========	========	========
1	1	M-3			Y	Y
2	3	F-4		Y		Y
3	5	F-8	Y	Y		Y
4	7	B-5			Y	
5	8	H-6			Y	
6	9	J-3	Y		Y	
7	10	D-3	Y	Y		Y
8	11	L-9**				
9	12	B-10				Y
10	13	L-4		Y	Y	
11	14	F-13		Y	Y	
12	15	F-6				Y
13	16	J-12	Y	Y	Y	Y
14	17	B-7		Y	Y	Y
15	19	G-9	Y			
16	20	G-7		Y		Y
17	21	F-11	Y			
18	23	J-10			Y	Y
19	24	J-5	Y	Y		
20	25	B-8	Y	Y	Y	
21	26	N-10	Y	Y		Y
22	27	C-12	Y	Y	Y	Y
23	28	J-7	Y	Y	Y	
24	29	D-7	Y	Y	Y	
25	30	L-14	Y	Y		Y
26	32	F-9	Y			
27	33	N-7	Y	Y	Y	
28	34	A-9	Y	Y	Y	Y
29	35	N-12	Y		Y	
30	37	H-4				Y
31	38	H-11		Y	Y	
32	39	D-5		Y		Y
33	40	L-6	Y			Y
34	42	G-14	Y		Y	
35	45	H-3	Y			Y
36	48	L-11			Y	Y
37	49	E-5			Y	
38	50	L-5		Y		Y
** Represent Calibration Thimble						

TABLE 3.2

						Relative
			Axial	Percent Difference		Difference
Map	FDH	Fq	Offset	FDH	Fq	A. O
========	========	========	========	========	========	========
Map 4	1.4806	1.9462	4.211			
Case 1	1.4897	1.9476	4.189	-0.6282	-0.0360	0.032
Case 2	1.4819	1.9119	4.133	-0.1013	1.7977	0.088
Case 3	1.4766	2.0350	4.116	0.2567	-4.5251	0.105
Case 4	1.4887	2.0010	4.227	-0.5607	-2.7788	-0.006
Map 5	1.5041	1.9470	3.394			
Case 1	1.4960	1.9661	3.373	0.5385	-0.9810	0.021
Case 2	1.5189	1.9662	3.372	-0.9840	-0.9861	0.022
Case 3	1.4564	1.9086	3.413	3.1713	1.9723	-0.019
Case 4	1.4897	1.9827	3.366	0.9574	-1.8336	0.028
Map 6	1.4736	1.9237	1.551			
Case 1	1.4765	1.9628	1.460	-0.1968	-2.0325	0.091
Case 2	1.4635	1.9345	1.486	0.6854	-0.5614	0.065
Case 3	1.4885	1.9566	1.543	-1.0111	-1.7102	0.008
Case 4	1.4761	1.9026	1.659	-0.1697	1.0968	-0.108
Map 7	1.4672	1.[illegible]91	0.485			
Case 1	1.4785	1.8696	0.764	-0.7702	-1.1086	-0.279
Case 2	1.4732	1.8772	0.548	-0.4089	-1.5197	-0.063
Case 3	1.4571	1.8524	0.692	0.6884	-0.1785	-0.207
Case 4	1.4775	1.8519	0.322	-0.7020	-0.1514	0.163
	FDH		Fq		Axial Offset	
	X(%)	S(%)	X(%)	S(%)	X(%)	S(%)
	========	========	========	========	========	========
Map 4	-0.2584	0.4156	-1.3855	2.8138	0.0548	0.0511
Map 5	0.9208	1.7166	-0.4571	1.6684	0.0130	0.0216
Map 6	-0.1730	0.6928	-0.8018	1.4145	0.0140	0.0884
Map 7	-0.2982	0.6761	-0.7395	0.6845	-0.0965	0.1949
Combined	0.0478	1.0414	-0.8460	1.6600	-0.0037	0.1146
FDH uncertainty		1.0489				
Fq uncertainty		1.0605				
A O Uncertainty		-0.0772	0.070			

4.0 References

4.1 Letter from W. L. Klaum (Westinghouse) to L. Rodriguez (FPL), "Florida Power and Light Company Turkey Point Units 3 and 4 Thimble Reduction Study," 87FP*-G-0004, dated March 4, 1987.

4.2 Letter from W. L. Klaum (Westinghouse) to G. T. Zamry (FPL), "Florida Power and Light Company Turkey Point Units 3 and 4 Thimble Reduction Study Update," 88FP*-G-0021, dated April 12, 1988.

4.3 JPN Calculation, PTN-3FJF-93-021, "Turkey Point Unit 3 Cycle 13 Verification of Westinghouse Analysis for Reduced Number of Operable Thimbles," Rev. 0, dated March 31, 1993.

4.4 SCR Sandia Corporation, "Factors for One-sided Tolerance Limits and for Variables Sampling Plans," by D. B. Owen, dated March 1963.