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AUTH.NAME AUTHOR AFFILIATION
OHRIG,R.E. Florida Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION
EISENHUT,D.G. Division of Operating Reactors

SUBJECT: Forwards Westinghouse ECCS evaluation of effect of fuel clad research data on ECCS analysis. No addl adjustment necessary to Fq limit of 1.89. Current models are conservative & in compliance w/code requirements.

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P[illegible]OX 529100, MIAMI, FL 33152

FLORIDA POWER & LIGHT COMPANY

January 23, 1980
L-80-34

Office of Nuclear Reactor Regulation
Attention: Mr. Darrell G. Eisenhut, Acting Director
Division of Operating Reactors
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Eisenhut:

Re: Turkey Point Units 3 & 4
Docket Nos. 50-250 & 50-251
Effects of Fuel Clad Research Data on ECCS Analysis

Our letter L-80-10 of January 10, 1980 responded to your letters of November 9 and November 27, 1979 concerning the potential effect of new fuel clad research data on the ECCS analysis for Turkey Point Units 3 and 4. This letter follows up our commitment to provide the results of an evaluation by our fuel vendor.

Over the past few months, our fuel vendor has been engaged in discussions with the NRC Staff regarding the ECCS evaluation model and, based on the results of these discussions, has prepared the evaluation for Turkey Point Units 3 and 4 shown in Attachment 1. The evaluation shows that no additional adjustment need be made to the Fq limit of 1.89.

As stated in a letter to the NRC dated December 10, 1979, (NS-TMA-2175) Westinghouse believes their current models to be conservative and in compliance with Appendix K of 10 CFR 50.

Very truly yours,

Robert E. Uhrig
Vice President
Advanced Systems & Technology

REU/MAS/SKM/cph

cc: Mr. J. P. O'Reilly, Region II
Harold Reis, Esquire

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ATTACHMENT 1

A. Evaluation of the potential impact of using fuel rod models presented in draft NUREG-0630 on the Loss of Coolant Accident (LOCA) analysis for Turkey Point Units 3 and 4.

This evaluation is based on the limiting break LOCA analysis identified as follows:

BREAK TYPE - DOUBLE ENDED COLD LEG GUILLOTINE

BREAK DISCHARGE COEFFICIENT 0.4

WESTINGHOUSE ECCS EVALUATION MODEL VERSION Modified* February, 1978

* The fuel rod burst model was modified to factor in heatup rate dependence as documented in WCAP-8970-P-A "Westinghouse Emergency Core Cooling System Small Break, October 1975 Model." Fuel rod burst curves used in this analysis represented clad heatup rates of 15 Degrees F for the Hot Rod and 11 Degrees F for the Average Hot Assembly Rod.

CORE PEAKING FACTOR 1.89

HOT ROD MAXIMUM TEMPERATURE CALCULATED FOR THE BURST REGION OF THE CLAD - 2161. °F = PCT_B

ELEVATION - 6.0 Feet.

HOT ROD MAXIMUM TEMPERATURE CALCULATED FOR A NON-RUPTURED REGION OF THE CLAD - 1982. °F = PCT_N

ELEVATION - 7.75 Feet

CLAD STRAIN DURING BLOWDOWN AT THIS ELEVATION 0.32 Percent
MAXIMUM CLAD STRAIN AT THIS ELEVATION - 5.5 Percent

Maximum temperature for this node occurs when the core reflood rate is (GREATER/[redacted]) than 1.0 inch per second and reflood heat transfer is based on the (FLECHT/[redacted]) calculation.

AVERAGE HOT ASSEMBLY ROD BURST ELEVATION - 6.0 Feet

HOT ASSEMBLY BLOCKAGE CALCULATED - 28.2 Percent

1. BURST NODE

The maximum potential impact on the ruptured clad node is expressed in letter NS-TMA-2174 in terms of the change in the peaking factor limit (FQ) required to maintain a peak clad temperature (PCT) of 2200°F and in terms of a change in PCT at a constant FQ. Since the clad-water reaction rate increases significantly at temperatures above 2200.°F, individual effects (such as ΔPCT due to changes in several fuel rod models) indicated here may not accurately apply over large ranges,

but a simultaneous change in FQ which causes the PCT to remain in the neighborhood of 2200.°F justifies use of this evaluation procedure.

From NS-TMA-2174:
For the Burst Node of the clad:

- 0.01 ΔFQ → ≈ 150°F BURST NODE ΔPCT
- Use of the NRC burst model could require an FQ reduction of 0.015
- The maximum estimated impact of using the NRC strain model is a required FQ reduction of 0.03.

Therefore, the maximum penalty for the Hot Rod burst node is:

$$\Delta PCT_1 = (.015 + .03)\ (150^{\circ}F/.01) = 675^{\circ}F$$

Margin to the 2200°F limit is:

$$\Delta PCT_2 = 2200.^{\circ}F - PCT_B = \underline{39.}\ ^{\circ}F$$

The FQ reduction required to maintain the 2200°F clad temperature limit is:

$$\Delta FQ_B = (\Delta PCT_1 - \Delta PCT_2) \left(\frac{.01\ \Delta FQ}{150^{\circ}F}\right)$$

$$= (\underline{675} - \underline{39}) \left(\frac{.01}{150}\right)$$

$$= \underline{0.042} \quad \text{(but not less than zero).}$$

2. NON-BURST NODE

The maximum temperature calculated for a non-burst section of clad typically occurs at an elevation above the core mid-plane during the core reflood phase of the LOCA transient. The potential impact on that maximum clad temperature of using the NRC fuel rod models can be estimated by examining two aspects of the analyses. The first aspect is the change in pellet-clad gap conductance resulting from a difference in clad strain at the non-burst maximum clad temperature node elevation. Note that clad strain all along the fuel rod stops after clad burst occurs and use of a different clad burst-model can change the time at which burst is calculated. Three sets of LOCA analysis results were studied to establish an acceptable sensitivity to apply generically in this evaluation. The possible PCT increase resulting from a change in strain (in the Hot Rod) is +20.°F per percent decrease in strain at the maximum clad temperature

locations. Since the clad strain calculated during the reactor coolant system blowdown phase of the accident is not changed by the use of NRC fuel rod models, the maximum decrease in clad strain that must be considered here is the difference between the "maximum clad strain" and the "clad strain during blowdown" indicated above.

Therefore:

$$\Delta PCT_3 = \left(\frac{20^\circ F}{.01 \text{ strain}}\right) (\text{MAX STRAIN} - \text{BLOWDOWN STRAIN})$$

$$= \left(\frac{20}{.01}\right) (.058 - .032)$$

$$= \underline{\quad 109. \quad}^\circ F$$

The second aspect of the analysis that can increase PCT is the flow blockage calculated. Since the greatest value of blockage indicated by the NRC blockage model is 75 percent, the maximum PCT increase can be estimated by assuming that the current level of blockage in the analysis (indicated above) is raised to 75 percent and then applying an appropriate sensitivity formula shown in NS-TMA-2174.

Therefore,

$$\Delta PCT_4 = 1.25^\circ F\ (50 - \text{PERCENT CURRENT BLOCKAGE}) + 2.36^\circ F\ (75-50)$$

$$= 1.25\ (50 - \underline{\quad 28.2 \quad}) + 2.36\ (75-50)$$

$$= \underline{\quad 96. \quad}^\circ F$$

If PCT_H occurs when the core reflood rate is greater than 1.0 inch per second $\Delta PCT_4 = 0$. The total potential PCT increase for the non-burst node is then

$$\Delta PCT_5 = \Delta PCT_3 + \Delta PCT_4 = 109 + 0 = 109.^\circ F$$

Margin to the 2200°F limit is

$$\Delta PCT_6 = 2200^\circ F - PCT_H = 218.^\circ F$$

The FQ reduction required to maintain this 2200°F clad temperature limit is (from NS-TMA-2174)

$$\Delta FQ_H = (\Delta PCT_5 - \Delta PCT_6) \left(\frac{.01 \Delta FQ}{10^\circ F\ \Delta PCT}\right)$$

$$\Delta FQ_H = \underline{\quad -0.10 \quad} \text{ but not less than zero.}$$

$$= 0$$

STATE OF FLORIDA)
) ss.
COUNTY OF DADE)

Robert E. Uhrig, being first duly sworn, deposes and says:

That he is a Vice President of Florida Power & Light Company, the Licensee herein;

That he has executed the foregoing document; that the statements made in this said document are true and correct to the best of his knowledge, information, and belief, and that he is authorized to execute the document on behalf of said Licensee.

Robert E. Uhrig

Robert E. Uhrig

Subscribed and sworn to before me this

23 day of January, 1980

Cheryl I. Fredrick

NOTARY PUBLIC, in and for the county of Dade, State of Florida

My commission expires: Notary Public, State of Florida at Large My Commission Expires October 30, 1983 Bonded thru Maynard Bonding Agency