



CONNECTICUT YANKEE ATOMIC POWER COMPANY

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March 25, 1988

Docket No. 50-213

B12866

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U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
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Gentlemen:

Haddam Neck Plant  
Justification for Continued Operation  
with Reduction in ECCS Flowrate

In this letter, Connecticut Yankee Atomic Power Company (CYAPCO) provides the justification for continued operation (JCO) of the Haddam Neck Plant in view of an apparent miscalculation by Westinghouse of the limiting single failure in the Large Break Loss of Coolant Accident (LOCA) analysis.

Background

While performing analyses to develop an in-house Large Break LOCA model, CYAPCO uncovered a disparity between the limiting condition Low Pressure Safety Injection (LPSI) flow rate calculated by Westinghouse and the flow rate calculated by CYAPCO. Specifically, the flow rate calculated by CYAPCO is approximately 1400 gpm less than that used in the original Westinghouse calculation.

The implications of this flow rate disparity is that, if CYAPCO's analysis is verified by Westinghouse as correct, a design basis Large Break LOCA with the limiting single failure would result in exceeding the Interim Acceptance Criteria Peak Cladding Temperature limits of 2300°F using the current allowable technical specification linear heat generation limits at full power.

CYAPCO first informed the resident inspectors at the Haddam Neck Plant of the potential problem with the LOCA analysis on the afternoon of March 23, 1988 - prior to the completion of our flow calculations. CYAPCO also discussed the issue with the NRC Project Manager on the morning of March 24. Subsequently, on the afternoon of March 24, CYAPCO and the NRC conducted a conference call to discuss the matter. In that call, CYAPCO described the results of our in-house analysis which provides sufficient conservatism to justify continued operation up to 80% power. This letter provides that justification to the Staff. However, the NRC Staff stated that power operations should not exceed 40% until the NRC Staff reviewed the JCO and was satisfied that there were no further problems with Haddam Neck's ECCS.

Attachment 1 provides the technical JCO of the Haddam Neck Plant to limit power at 80%. CYAPCO has performed an evaluation and determined that limiting

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power to 80% provides sufficient conservatism until a Large Break LOCA reanalysis has been performed. When the reanalysis has been completed, CYAPCO intends to provide justification to adjust this power limitation to the higher power allowed by the reanalysis. Attachment 2 provides a description of CYAPCO's work to compare the Westinghouse single failure analysis with our in-house efforts.

CYAPCO is providing this JCO at the request of the NRC Staff in a conference call on the afternoon of March 24, 1988. In that call, CYAPCO agreed to limit maximum power operations to 40% until the NRC Staff reviewed the JCO and provided approval for raising the power limit to 80% power. Accordingly, CYAPCO is administratively limiting power operations to 40%.

CYAPCO considers the discovery of this apparent error a positive, not negative, indicator. Though this is the third problem uncovered in recent years in the Haddam Neck ECCS system or analyses, each problem was discovered while upgrading current licensing basis analyses or while performing other analyses not required by regulations (e.g., Probabilistic Risk Assessment program work). Each problem was discovered by conscientiously looking at the current licensing basis analyses, was reported to the NRC Staff in a timely manner, and was resolved or is being resolved by plant modifications or analyses.

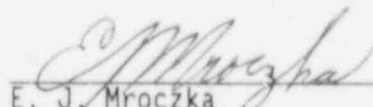
CYAPCO concludes that continued operation of the Haddam Neck Plant at 80% power is technically justified. However, CYAPCO will limit reactor power to less than or equal to 40% power (with the overpower trip setpoint adjusted to 49% power) until the NRC staff approves an increase in power. Our plans are to continue to work with Westinghouse to reanalyze the design basis LOCA using correct limiting case flow rates. When those results are available CYAPCO intends to request an adjustment of the maximum allowed operating power accordingly.

Until the reanalysis is complete, CYAPCO respectfully requests that the NRC Staff review the technical basis for this JCO which allows operation to 80% power and notify CYAPCO of its approval to operate up to 80% power. Until we receive your approval however, we will continue to limit power to 40%.

If you have any questions, please contact my licensing representatives.

Very truly yours,

CONNECTICUT YANKEE ATOMIC POWER COMPANY

  
E. J. Mroczka  
Senior Vice President

cc: W. T. Russell, Region I Administrator  
A. B. Wang, NRC Project Manager, Haddam Neck Plant  
J. T. Shedlosky, Resident Inspector, Haddam Neck Plant

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Attachment 1

Haddam Neck Plant

Justification for Continued Operation  
with  
Reduction in ECCS Flowrate

March, 1988

## HADDAM NECK PLANT - JUSTIFICATION FOR CONTINUED OPERATION WITH REDUCTION IN ECCS FLOW RATE

- REFERENCES: 1) D. C. Switzer to P. A. Morris, December 30, 1971.  
2) D. C. Switzer to D. J. Skovolt, May 10, 1972.  
3) J. F. Opeka to C. I. Grimes, January 9, 1986.

### INTRODUCTION

Northeast Utilities Service Company (NUSCO), on behalf of Connecticut Yankee Atomic Power Company (CYAPCO), is currently developing a new large break LOCA model to replace the existing design basis analysis that has been licensed by Westinghouse since 1971 (Reference 1). This design basis upgrade will be used to support operation with stainless steel and Zircaloy clad fuel beginning with Cycle 17.

The original Westinghouse large break analysis identified the failure of an emergency bus to energize, which results in the failure of one HPSI and one LPSI pump to start, as the limiting single failure. Other single failures that were considered included the failure of a motor operated valve to open and the failure of any one pump to start.

Core cooling flow delivery curves are currently being developed for use in the new large break LOCA model. These delivery curves are based on the single failures considered in the original Westinghouse analysis. An evaluation of the scenario that assumes a single failure of a motor operated valve in the LPSI line to open has shown that this failure may be more limiting than the previously assumed failure of an emergency bus to energize. The flow rate is potentially 20% less than the value assumed in the original analysis.

### IMPACT ON THE DESIGN BASIS ACCIDENTS

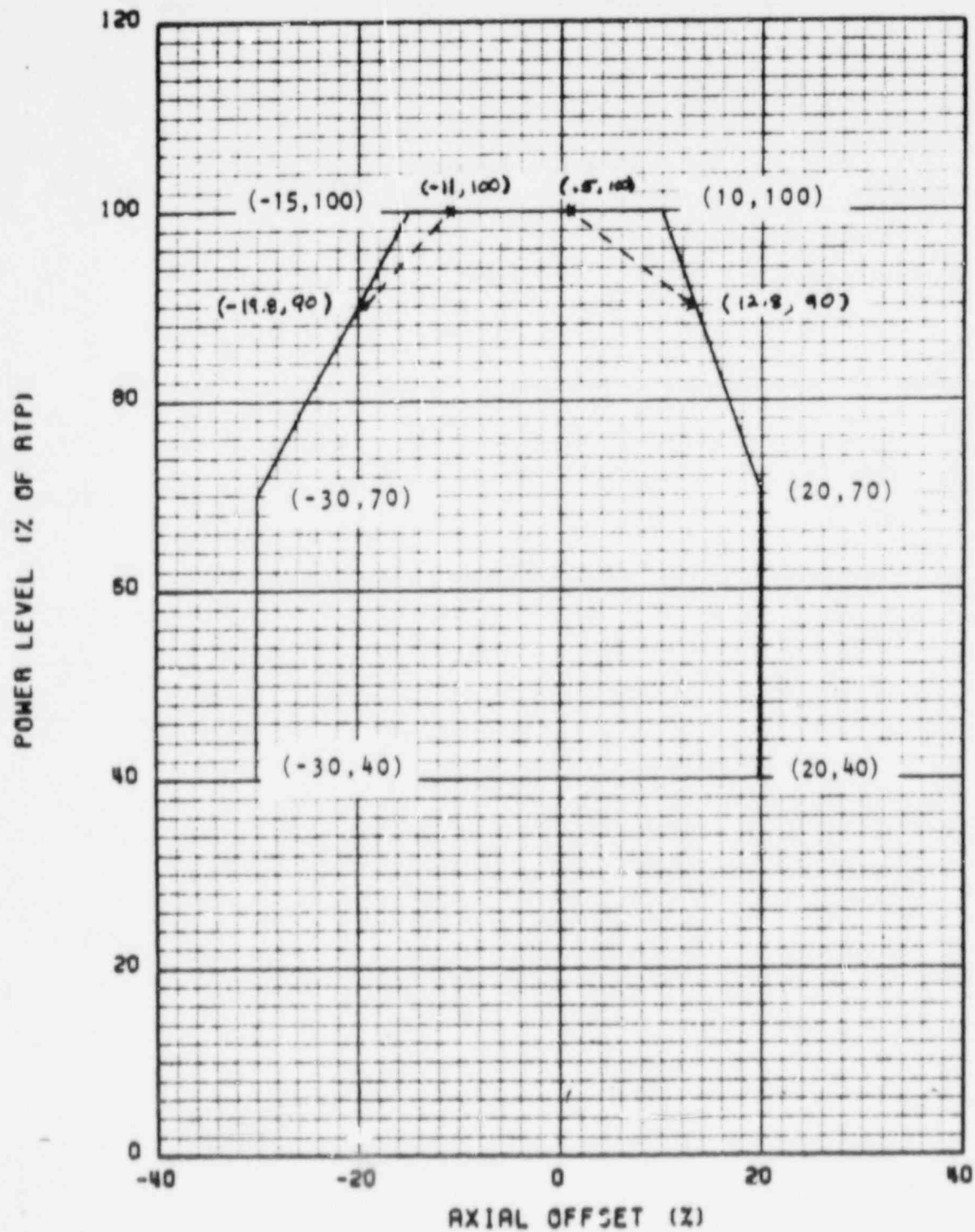
The impact of the potential flow reduction has been qualitatively assessed by Westinghouse based on sensitivity studies performed in support of a recent re-analysis (Reference 3). The reduced flow could yield approximately a 10 second increase in the adiabatic heat up time, which would yield a Peak Cladding Temperature (PCT) increase of approximately 100°F. In order to restore the PCT to a value less than the Interim Acceptance Criteria limit of 2300°F, the initial peak Linear Heat Generation Rate (LHGR) must be reduced from 14.3 to 13.3 kw/ft during the 0-125 EFPD burnup window.

The reduction in the peak LHGR from 14.3 to 13.3 kw/ft requires a re-evaluation of the axial offset limits. The axial offset limits must be reduced by the values shown in Figure 1, to assure that an LHGR value of 13.3 kw/ft would not be exceeded. Figure 1 shows that 100% power is achievable with axial offset limits reduced from -15% to -11% and +10% to +0.5%. Ninety percent power is achievable with axial offset limits reduced from -20% to -19.8% and +13% to +12.8%. The axial offset limits at 80% power are unaffected.

## CONCLUSIONS

Since the Westinghouse evaluation of the impact of the flow reduction is a qualitative assessment, reactor power level should be conservatively maintained at 80% until revised calculations are completed. The 80% power level and the current axial offset limits provide sufficient margin to assure that the peak cladding temperature limit of 2300°F would not be exceeded. The power derate reduces the initial average LHGR by 20%. The 80% power axial offset limit of -25% assures that the peak LHGR would remain less than 12.6 kw/ft, providing an additional margin of 0.7 kw/ft based on the Westinghouse preliminary assessment. This evaluation is based on the core burnup window of 0 to 125 Effective Full Power Days.

FIGURE 1 POWER LEVEL VS. AXIAL OFFSET LIMITS.  
0-250 EFPO, FOUR LOOP OPERATION



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Attachment 2

Haddam Neck Plant

Comparison of Westinghouse Single Failure Analyses  
with  
Connecticut Yankee Atomic Power Company's Analyses

March, 1988



## ATTACHMENT II - EVALUATION OF POTENTIAL SINGLE FAILURES

### REFERENCES

1. CYAPCO letter W. G. Council to J. A. Zwolinski, December 20, 1984.
2. CYAPCO letter J. F. Opeka to C. I. Grimes, June 30, 1986.
3. CYAPCO letter J. F. Opeka to C. I. Grimes, March 31, 1986.
4. CYAPCO letter D.C. Switzer to D. J. Skovolt, May 19, 1972.

### BACKGROUND

CYAPCO has undertaken a major effort to upgrade the accident analysis for the Haddam Neck plant. Much of this effort has been completed and submitted to the NRC for review and approval. Examples include completion of the small break LOCA analysis (Reference 1), completion of the non-LOCA analysis (Reference 2), and completion of the Level 1 PRA (Reference 3). Submittal of the large break LOCA analysis, scheduled for mid-1989, completes this major undertaking which began in 1981. As was expected before this project began, problems have been identified during this process. These problems have been resolved in a number of ways (e.g. changing procedures, technical specifications, system hardware, etc.). When potential problems have been verified, CYAPCO has performed reportability determinations, identified interim compensatory measures and, if necessary, determined long term corrective actions.

In performing in-house calculations to determine the limiting single active failure for the in-house large break LOCA reanalysis, an apparent discrepancy was identified between the Westinghouse safety injection flows and the in-house calculations. All potential single active failures have been considered.

### COMPARISON OF SINGLE FAILURE ANALYSES

CYAPCO calculations were performed to determine the limiting single active failure and to develop degraded ECCS delivery curves to support the in-house large break (LB) LOCA analysis for Haddam Neck. Reference 4 provides similar information on ECCS delivery flow for different assumed single active failures. The CYAPCO generated ECCS delivery flows, at conditions typical of reflood, are compared below to the Westinghouse calculated flows for the different assumed failures:

<u>Case</u>	<u>Assumed Failure</u>	<u>W</u>	<u>CYAPCO</u>
1	1 Emergency Generator	1060 lb/sec	1050 lb/sec
2	1 HPSI Injection Valve	1325 lb/sec	> Case 3
3	1 LPSI Injection Valve	1140 lb/sec	866 lb/sec
4	1 HPSI Pump	1140 lb/sec	> Case 1
5	1 LPSI Pump	1210 lb/sec	> Case 1

As shown, the limiting case in the Westinghouse analysis is Case 1 and it is the basis of the current LB-LOCA licensing analysis. The CYAPCO calculations show that Case 3 is the most limiting. Westinghouse is still reviewing the assumptions used in its calculations but it has been conservatively assumed that the CYAPCO calculation is correct. Westinghouse has been requested to verify the flow calculations and to reanalyze the limiting large break LOCA using the appropriate safety injection flow rate. The results of this analysis are expected in approximately two weeks.