

MAY 02 1988

Docket No. 50-213

LICENSEE: Connecticut Yankee Atomic Power Company

FACILITY: Haddam Neck Plant

SUBJECT: SUMMARY OF MARCH 30, 1988 MEETING REGARDING LARGE BREAK LOCA
PERFORMANCE WITH REDUCED ECCS FLOWRATE

On March 30, 1988, the staff met with Connecticut Yankee Atomic Power Company (CYAPCO) to discuss their justification for continued operation (JCO) at reduced power levels because of calculated reduced ECCS flow during a large break LOCA. In a conference call on March 24, 1988, the staff agreed that CYAPCO had adequate basis for providing a JCO to operate at 40 percent power. The staff felt a complete reanalysis of the large break LOCA with the reduced flow was necessary to go to higher power levels. CYAPCO on March 25, 1988 submitted a JCO for 80 percent power operation. The staff reviewed the JCO and concluded that operation at 40 percent power was warranted but not enough technical justification was presented to respond to CYAPCO's request to operate at 80 percent power.

CYAPCO requested this meeting to clarify their JCO and provide the basis for the conclusions in their JCO allowing operation at power levels up to 80 percent.

CYAPCO stated, based on a different single failure scenario than was used by Westinghouse, the NSSS vendor, that the failure of LPSI isolation valve during large break LOCA would reduce ECCS flow by about 20 percent. This 20 percent reduced flow is expected to cause the peak clad temperature to exceed the 2300°F limit. CYAPCO provided references to substantiate their assumption that, to reduce the peak clad temperature by 100°F, a decrease in the linear heat generation rate by approximately 0.8Kw/ft was needed.

CYAPCO provided the following as the basis for their JCO:

- 1) The maximum linear heat generation rate limit was reduced by 1Kw/ft from 14.3Kw/ft to 13.3Kw/ft,
- 2) The maximum power was reduced by 20 percent even though preliminary calculations indicate operation up to 90 percent is warranted in the current configuration, and
- 3) Based on the linear heat generation rate limit, the axial offset limits were adjusted. Operating at 90 percent power assures the linear heat rate will be less than 12.6Kw/ft.

The staff agreed that operation at 80 percent power is warranted. CYAPCO closed the meeting stating that a revised JCO would be prepared and that the Westinghouse reanalysis of the large break LOCA would be completed in seven to 10 days. Assuming a favorable result from Westinghouse analysis, CYAPCO proposed to operate at 100 percent power by using more restrictive administrative procedures until the TS amendment can be processed. The staff stated this proposal was untenable and that a TS change would need to be approved before 100 percent power is authorized.

Enclosed is CYAPCO's handout for the meeting and the attendance list.

"ORIGINAL SIGNED BY:"

Alan B. Wang, Project Manager
Project Directorate I-4
Division of Reactor Projects I/II

Enclosures:
As stated

cc: See next page
w/enclosures

DISTRIBUTION

~~Docket File~~

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ACRS(10)

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Haddam Neck Plant

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CONNECTICUT YANKEE ATOMIC POWER COMPANY

MARCH 30, 1988

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On Conference Line
Lee Betthenhausen Region I
Tom Shedlosky Senior Resident

HADDAM NECK PLANT
DOCKET NO. 50-213

MEETING WITH NRC STAFF
ON
LARGE BREAK LOCA PERFORMANCE
WITH
REDUCED ECCS FLOWRATE

MARCH 30, 1988
ROCKVILLE, MD.

NORTHEAST UTILITIES REPRESENTATIVES

C. F. SEARS	VICE-PRESIDENT, NUCLEAR AND ENVIRONMENTAL ENGINEERING
J. A. BLAISDELL	MANAGER, SAFETY ANALYSIS
P. F. L'HEUREUX	CONNECTICUT YANKEE ENGINEERING SUPERVISOR
W. M. HERWIG	REACTOR ENGINEERING
S. D. VICK	GENERATION FACILITIES LICENSING

OUTLINE OF MEETING

INTRODUCTION AND OVERVIEW OF NU EFFORTS FRED SEARS

DISCUSSION OF PROBLEM JOHN BLAISDELL

- BACKGROUND
- INTERIM ACTION
- SOLUTION
- SINGLE FAILURE EVALUATION

CONCLUSIONS FRED SEARS

- COMPELLING ARGUMENTS
- CONSERVATISMS IN JCO
- JUSTIFICATION OF 80% POWER OPERATION

PURPOSE OF MEETING

- PRESENT DETAILS ON REDUCED ECCS FLOWRATE PROBLEM
- ANSWER QUESTIONS ON THE JCO
- DESCRIBE OUR ONGOING ACTIVITIES
- OBTAIN NRC CONCURRENCE TO OPERATE AT 80% POWER

CHRONOLOGY OF REDUCED ECCS FLOWRATE PROBLEM

POTENTIAL PROBLEM DISCUSSED WITH NRC	3/23/88
CONFERENCE CALL WITH THE NRC	3/24/88
PROMPT REPORT TO NRC AND STATE	3/24/88
JCO FOR 80% POWER SUBMITTED	3/25/88
QUESTIONS ON JCO RECEIVED	3/28/88
MEETING WITH NRC TO RESOLVE	3/30/88
CONCURRENCE FOR 80% POWER	3/30/88
SUBMITTAL OF WESTINGHOUSE REANALYSIS RESULTS AND AUTHORIZATION FOR 100% POWER OPERATION	week of 4/4/88

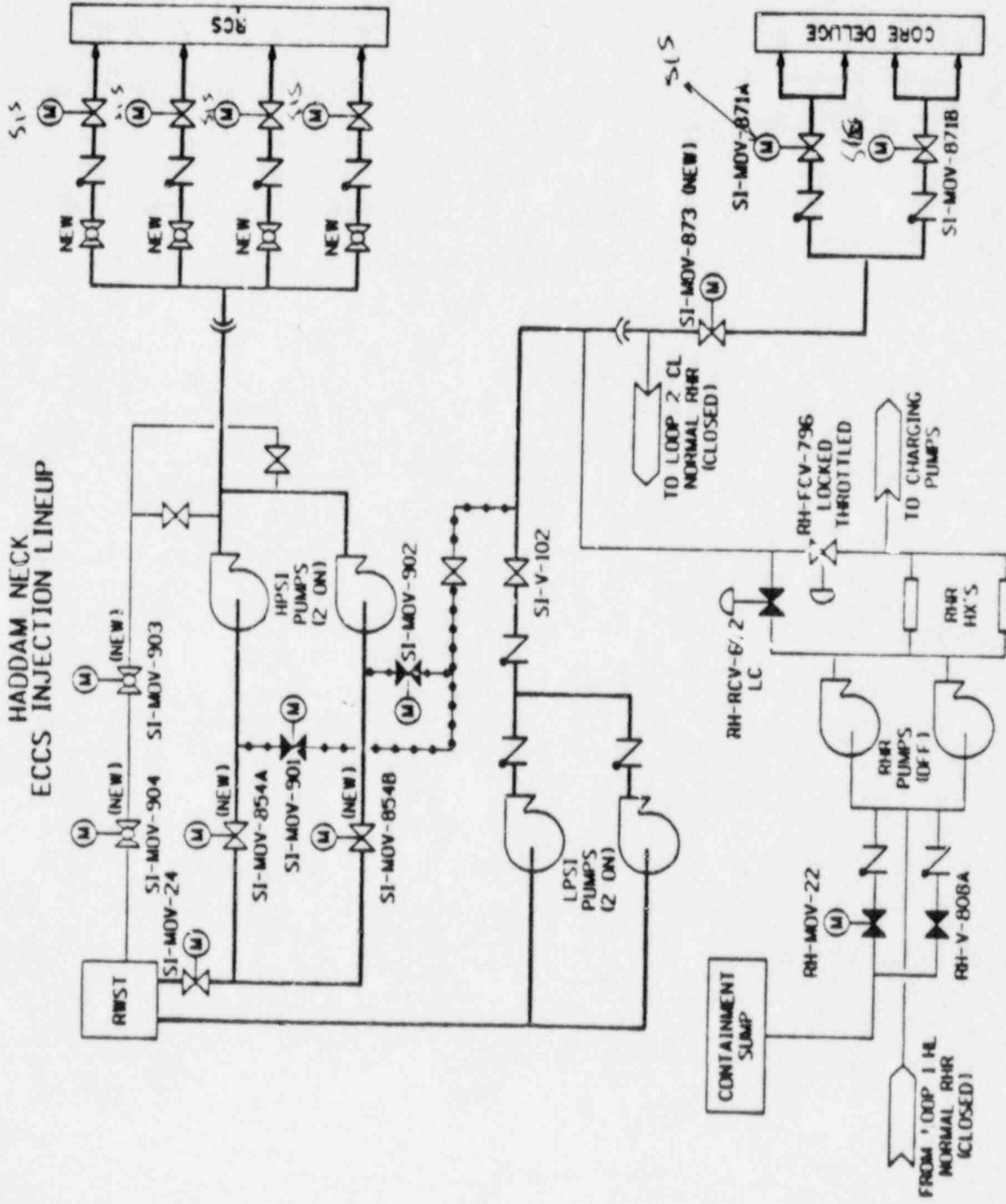
OVERVIEW OF NU SAFETY ANALYSIS EFFORTS FOR HADDAM NECK

SUBMITTAL

- SMALL BREAK LOCA REANALYSIS JUL '84 -
- LEVEL 1 PRA FEB '86 -
- NON-LOCA TRANSIENT ANALYSIS JUN '86 -
- LARGE BREAK LOCA ANALYSIS MID '89 -

Started about 2 years ago - large effort
4/28 Meeting to discuss

HADDAM NECK ECCS INJECTION LINEUP



NO FAILURES

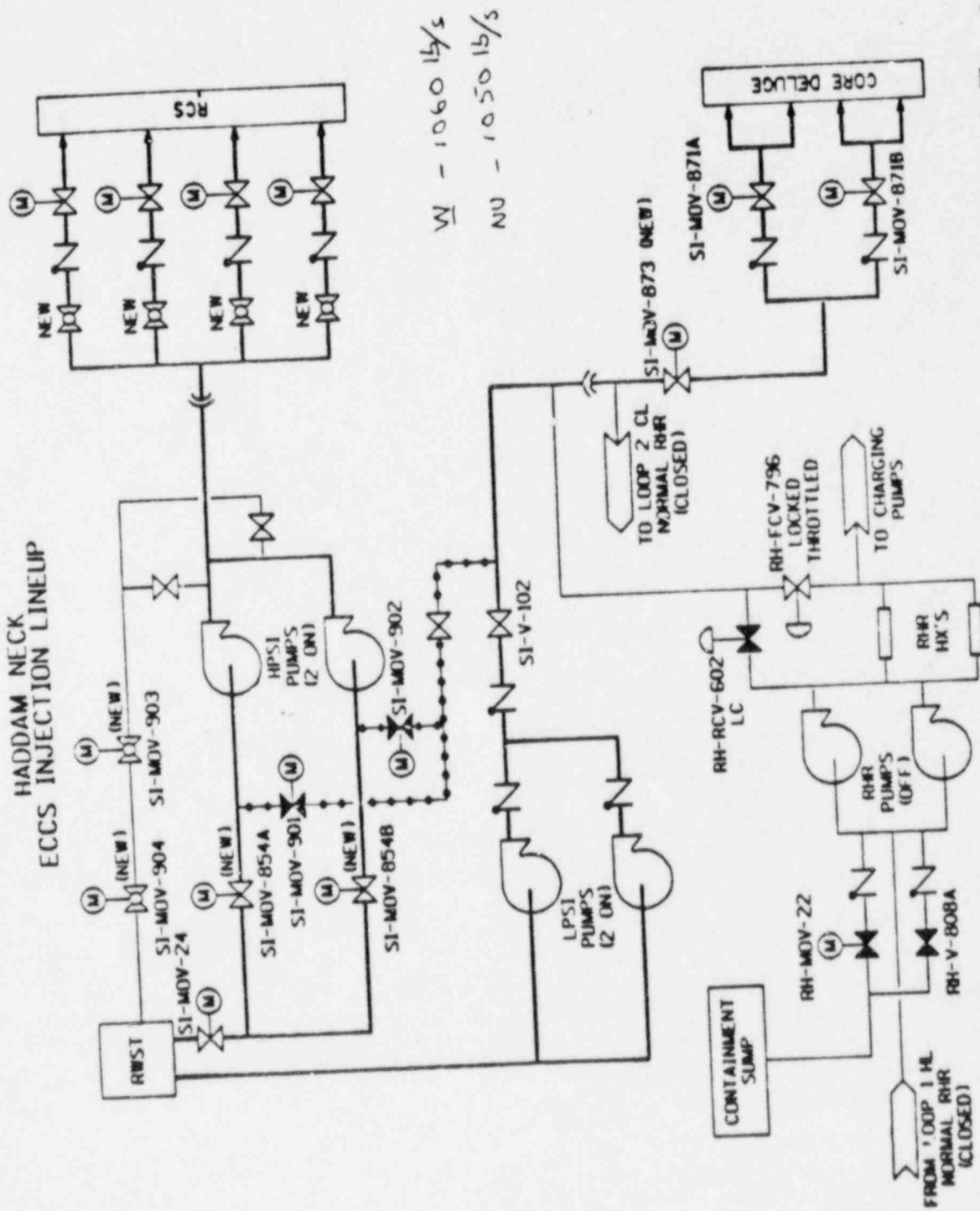
OVERVIEW OF HADDAM NECK ECCS (ON RECEIPT OF SIS)

- HPSI AND LPSI PUMPS AUTO-START
- CHARGING PUMPS AUTO-START IF OFFSITE POWER AVAILABLE
- FOUR HPSI INJECTION VALVES OPEN
- TWO CORE DELUGE VALVES OPEN
- CVCS VALVES REALIGN AND DIVERT CHARGING PUMP SUCTION FROM VCT TO RWST
- HPSI, TAKING SUCTION FROM RWST, DELIVERS TO FOUR COLD LEGS
- LPSI, TAKING SUCTION FROM RWST, DELIVERS TO THE UPPER HEAD VIA CORE DELUGE
- CHARGING (OFFSITE POWER AVAILABLE), TAKING SUCTION FROM RWST, DELIVERS TO LOOP 2 COLD LEG

THE PROBLEM

- ECCS DELIVERY CURVES WERE DEVELOPED IN-HOUSE TO SUPPORT THE PLANNED IN-HOUSE LOCA CALCULATIONS
- SIMILAR TO THE 1972 WESTINGHOUSE DELIVERY FLOWS, ECCS DELIVERY WAS EVALUATED FOR ALL POTENTIAL SINGLE FAILURES
- IN-HOUSE CALCULATIONS SHOWED THAT THE LIMITING SINGLE FAILURE WAS ONE LPSI INJECTION MOV
- IN THIS CASE, 2 LPSI PUMPS DELIVER THROUGH 2 OF THE 4 HEAD PENETRATIONS AND 2 HPSI PUMPS DELIVER THROUGH 4 INJECTION VALVES (1 PATH SPILLS TO CONTAINMENT)
- WESTINGHOUSE ECCS DELIVERY FLOW FOR CASE OF FAILED LPSI MOV WAS NOT LIMITING (W - 1140 LB/SEC NU - 866 LB/SEC)
- LIMITING FAILURE PREDICTED BY WESTINGHOUSE WAS ONE EMERGENCY BUS
- IN THIS CASE, 1 LPSI PUMP AND 1 HPSI PUMP DELIVER THROUGH ALL 6 INJECTION MCVs (W - 1060 LB/SEC NU - 1050 LB/SEC)
- IN-HOUSE CALCULATED FLOW IS POTENTIALLY 18% LESS THAN LIMITING WESTINGHOUSE FLOW

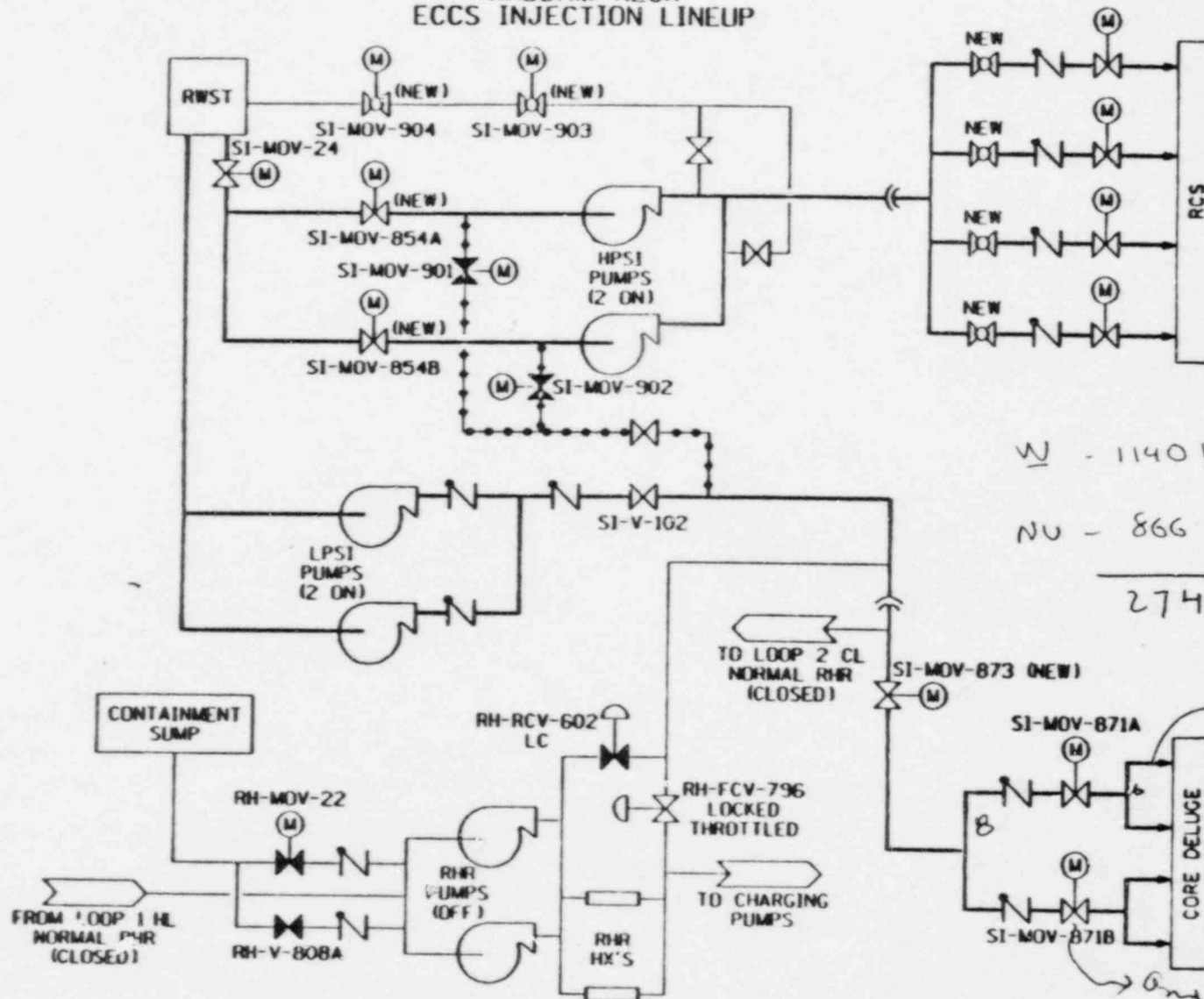
HADDAM NECK ECCS INJECTION LINEUP



W - 1060 lb/s
NU - 1050 lb/s

EMERGENCY BUS FAILURE

HADDAM NECK ECCS INJECTION LINEUP



$$W - 1140 \frac{lb}{s}$$

$$NU - 866 \frac{lb}{s}$$

$$274 \frac{lb}{s} \sim 18\% \text{ less}$$

2 3/4" ID

FAILURE OF LPSI MOV

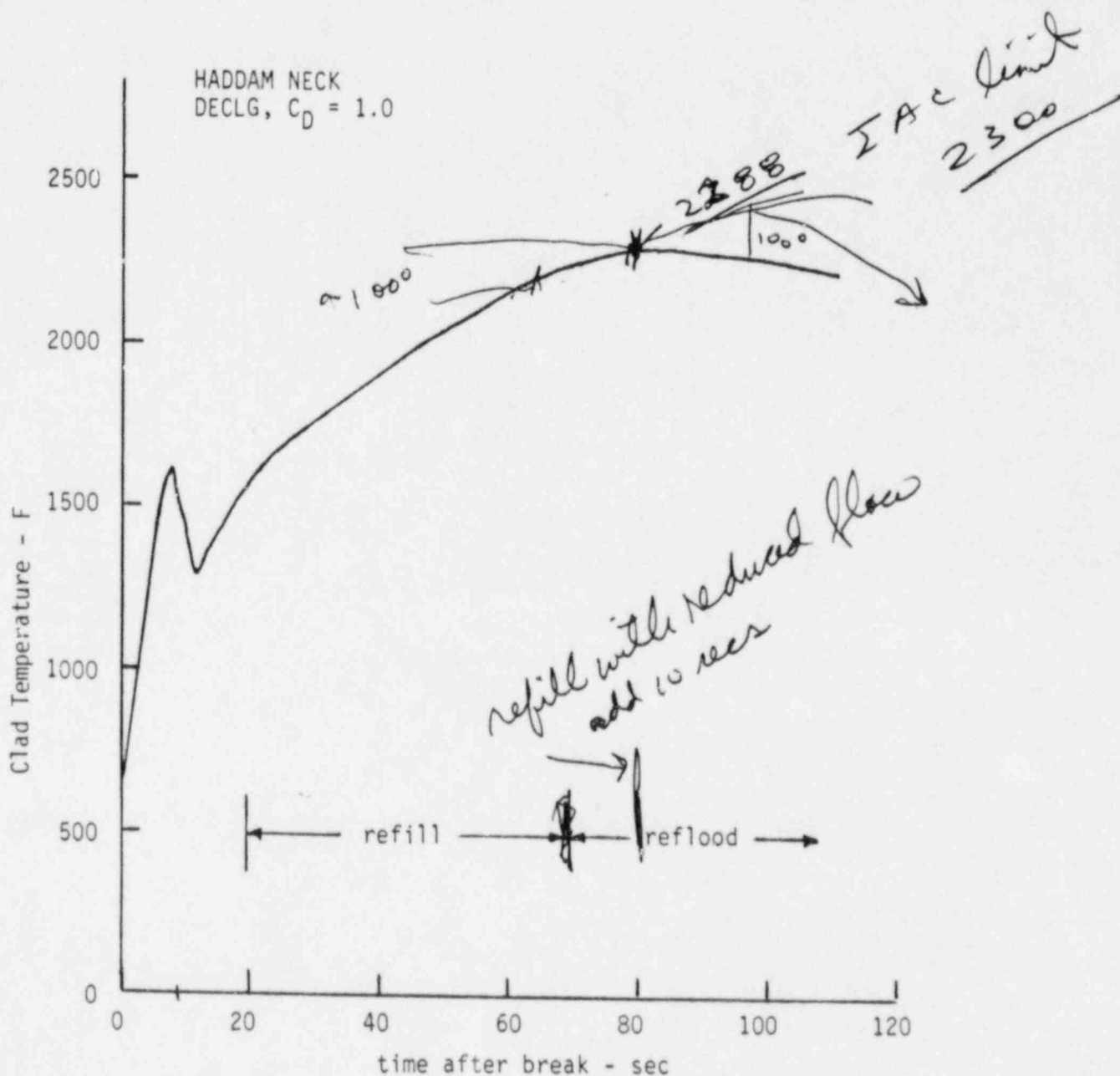
One Head Assembly
5' to head thru 10'
to head.

IMPACT ON LARGE BREAK LOCA LICENSING ANALYSIS

- REDUCTION IN FLOW RESULTS IN A 10 SEC DELAY IN FILLING THE LOWER PLENUM PRIOR TO REFLOOD AND
- A CORRESPONDING INCREASE IN HOT SPOT CLAD TEMPERATURE OF LESS THAN 100 F PRIOR TO REFLOOD
- THE RESULTING PEAK CLAD TEMPERATURE IS ESTIMATED TO BE 2388 F (IAC LIMIT IS 2300F)

IAC - Blowdown, Injection, Reflood

Does NOT allow injection until after blowdown,



With low Flow
Increase in reflood about equal to
increase in refill

INTERIM ACTIONS - JCO

- W SENSITIVITY STUDIES WITH HADDAM NECK'S LICENSING MODEL INDICATE THAT THE 100 F REDUCTION IN PCT CAN BE ACHIEVED BY REDUCING THE LINEAR HEAT RATE BY 0.8 KW/FT (REFERENCES)
- THE REDUCTION IN LINEAR HEAT RATE REQUIRED TO ENSURE THAT THE PCT STAYS BELOW 2300 F WAS CONSERVATIVELY ASSUMED TO BE 1 KW/FT (CURRENT LIMIT - 14.3 KW/FT INTERIM LIMIT - 13.3 KW/FT)
- THE AXIAL OFFSET LIMITS WERE EVALUATED TO DETERMINE REQUIRED REDUCTION IN OPERATING MARGIN
- IT WAS DETERMINED THAT 100% POWER IS ACHIEVABLE WITH TIGHTER AXIAL OFFSET LIMITS. AXIAL OFFSET LIMITS REQUIRE NO MODIFICATION BELOW 90% POWER.

@ 80%
Power

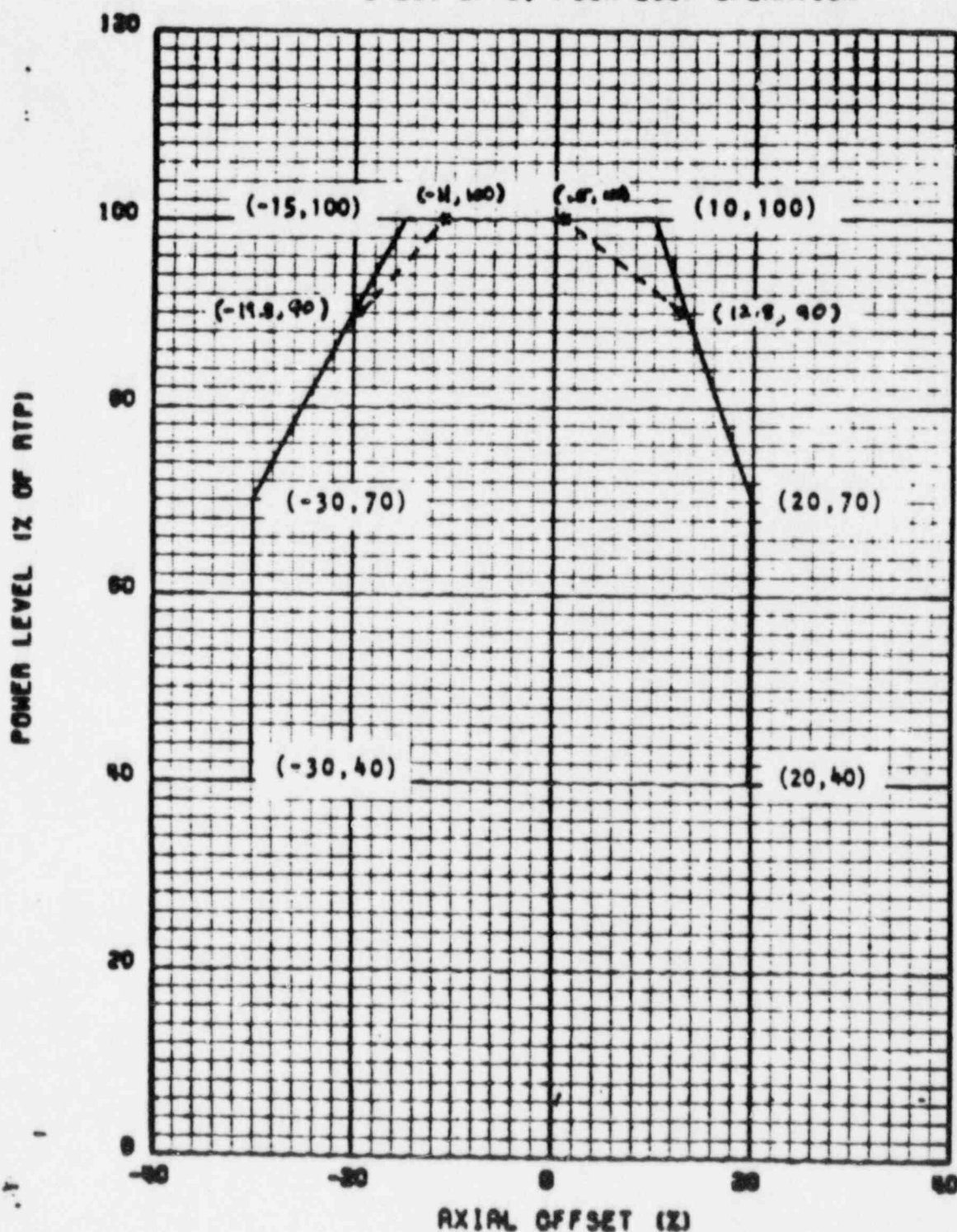
- AN INTERIM MAXIMUM POWER OF 80% WAS PROPOSED FOR CONSERVATISM. THIS ENSURES LINEAR HEAT RATE WILL BE LESS THAN 12.6 KW/FT

SUMMARY OF CONSERVATISMS

- INCREASED ASSUMED HEATUP RATE BY 10%
- INCREASED SENSITIVITY TO REQUIRED LINEAR HEAT RATE REDUCTION BY 20%
- REDUCED MAXIMUM POWER BY 20%
- AXIAL OFFSET LIMITS PROVIDE FURTHER CONSERVATISM

REFERENCES D. C. SWITZER TO R. A. PURPLE, DATED 6/23/75
W. G. COUNCIL TO W. A. PAULSON, DATED 8/31/84
D. L. FULLER TO J. A. BLAISDELL, DATED 3/29/88

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



NEAR TERM CORRECTIVE MEASURES

- WESTINGHOUSE IS CURRENTLY REANALYZING THE LIMITING BREAK ASSUMING AN 18% REDUCTION IN ECCS FLOW
completed early next week
- WESTINGHOUSE IS RECALCULATING ECCS DELIVERY ASSUMING 1 LPSI MOV FAILURE *Nearly complete - 21% is correct*
- WESTINGHOUSE WILL PERFORM ADDITIONAL LARGE BREAK LOCA ANALYSES IF NECESSARY
- REQUIRED CHANGES TO TECHNICAL SPECIFICATIONS WILL BE MADE TO ENSURE COMPLIANCE WITH IAC.
- INTERIM ADMINISTRATIVE CONTROLS WILL ENSURE PLANT LIMITS ARE NOT EXCEEDED

LONG TERM CORRECTIVE MEASURES

- LARGE BREAK LOCA WILL BE REANALYZED IN-HOUSE USING CURRENT-DAY METHODS (MID-1990s)
RELAP5 MOD2 F&GPA
- CURRENT EXPECTATIONS ARE THAT REANALYSIS WILL RESULT IN PEAK CLAD TEMPERATURES MUCH LOWER THAN CURRENT ANALYSES

Peak Clad ~ 2000°F

SINGLE FAILURE ANALYSES (REFERENCE)

- A DETAILED SINGLE FAILURE ANALYSIS OF ALL PUMPS AND VALVES REQUIRED TO CHANGE STATE TO MITIGATE LOCAs WAS PERFORMED IN 1987. THIS INCLUDED CONSIDERATION OF THE FOLLOWING:
 - 2 LPSI PUMPS
 - 2 CHARGING PUMPS
 - 2 HPSI PUMPS
 - 2 RHR PUMPS
 - 24 MOVs
- NO NEW LIMITING SINGLE FAILURES WERE IDENTIFIED. HOWEVER, THE WESTINGHOUSE ECCS FLOWS WERE USED TO ASSESS THE IMPACT OF THE FAILURE OF THE CORE DELUGE MOV. SINCE NO PIPING CHANGES HAVE BEEN MADE IN THE LPSI SYSTEM, THERE WAS NO REASON TO QUESTION THE WESTINGHOUSE RESULTS.

REFERENCE E. J. MROCZKA LETTER APRIL 1, 1987

Failure ^{mode} ~~effects~~ and ^{effects} ~~mode~~ analysis

CONCLUSIONS

- THIS IS NOT A 'SINGLE FAILURE' PROBLEM. OUR COMPREHENSIVE EVALUATION OF SINGLE FAILURES (APRIL 1,1987) REMAINS VALID
- THIS IS AN APPARENT CALCULATIONAL ERROR FOR AN INPUT TO AN ANALYSIS PERFORMED ALMOST TWO DECADES AGO. IT IS NOT A REQUIREMENT TO RECALCULATE INPUTS USED IN APPROVED, LICENSING BASIS ANALYSIS
- THE PROBLEM WAS IDENTIFIED BECAUSE OF OUR THOROUGHNESS IN VALIDATING INPUTS FOR OUR IN-HOUSE SAFETY ANALYSES
- THERE IS AMPLE CONSERVATISM TO JUSTIFY OPERATION AT 80 % POWER
- REANALYSIS IN PROGRESS TO PROVIDE ANALYTICAL BASIS FOR 100 % POWER OPERATION
- WITH THE COMPLETION OF THE LARGE BREAK LOCA ANALYSIS (SCHEDULED FOR MID-1989), THE HADDAM NECK SAFETY ANALYSIS UPGRADE WILL BE COMPLETED