



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

August 15, 1989

Docket Nos: 50-361
50-362
50-368
50-382
50-528
50-529
50-530

MEMORANDUM FOR: John N. Hannon, Director
Project Directorate III-3
Division of Reactor Projects - III, IV, V
and Special Projects

FROM: M. David Lynch, Senior Project Engineer
Project Directorate III-3
Division of Reactor Projects - III, IV, V
and Special Projects

SUBJECT: SUMMARY OF MEETING WITH THE COMBUSTION ENGINEERING OWNERS
GROUP (CEOG) REGARDING THE DEFAS DESIGN FEATURES TO BE
INSTALLED PER 10 CFR 50.62 (THE ATWS RULE)

A meeting was held in Bethesda, Maryland on July 12, 1989, between members of the NRC staff and representatives of four licensees who form the Combustion Engineering Owners Group (CEOG). The four licensees are: Louisiana Power & Light Company (Waterford); Arkansas Power & Light Company (ANO-2); Southern California Edison Company (San Onofre 2 & 3) and Arizona Public Service Company (Palo Verde 1, 2 & 3). A list of attendees is presented in Enclosure 1.

Background

A previous meeting with the CEOG was held on May 1, 1989, to discuss the general design features of the diverse emergency feedwater actuation system (DEFAS) portion of the ATWS equipment to be installed per the requirements of 10 CFR 50.62. The meeting on May 1, 1989, discussed the overall approach by the CEOG in designing the DEFAS as contained in the report, CE NPSD-384, which was docketed on April 30, 1989. There was a subsequent telephone conference on June 21, 1989, between the NRC staff and representatives of the CEOG which was focused on six concerns identified by the staff regarding the overall design features of the DEFAS. It was agreed by the parties to this telephone conference that these six concerns would form the agenda for the meeting to be held on July 12, 1989.

Contact:
H. Li (SICB/DEST), X-20781
D. Lynch (PD/3-3), X-23023

DF01

11

8908310071 890815
PDR ADOCK 05000361
P PNU

memo 4
gh

Summary

The staff concluded early in the meeting on July 12 as a result of the CEOG presentation that there would be such differences in the DEFAS equipment to be installed by the four licensees that a final NRC acceptance of the DEFAS design features could only be given following a staff review of the plant specific submittals. On this basis, the staff will not issue a generic SER on the CE report cited above. However, there was sufficient information presented in the meetings on May 1 and July 12, 1989, to permit the staff to make specific comments on the DEFAS design features which would be common to all four licensees' plant specific designs. The intent of the staff comments was to reflect the view that the general design features of the DEFAS concept presented by the CEOG was consistent with the intent of the ATWS rule. It was clearly noted by the staff, however, that staff acceptance of the DEFAS design was contingent on a review of the plant specific submittals.

A summary of the staff's comments on the information presented at the two meetings cited above is presented below. Enclosure 2 is a copy of the slides presented by the CEOG on July 12, 1989.

Staff Comments on the CEOG DEFAS Design Features

The following is the staff's understanding of the Diverse Emergency Feedwater Actuation System (DEFAS) as presented in the meetings held on May 1 and July 12, 1989. The DEFAS consists of sensors, signal conditioning, trip recognition, coincidence logic, initiation logic, and other circuitry and equipment needed to monitor plant conditions and initiate emergency feedwater actuation during conditions indicative of an ATWS. The purpose of the DEFAS is to mitigate ATWS event consequences by providing a diverse means to initiate emergency feedwater, thereby minimizing the potential for a common mode failure affecting both the reactor trip system and the existing emergency feedwater actuation system.

The DEFAS initiation signals cause actuation of the auxiliary/emergency feedwater pumps and valves only if there is a demand for auxiliary/emergency feedwater actuation system (EFAS) signal and this signal has not been generated by the plant protection system (PPS). The occurrence of the EFAS actuation signal by the PPS, concurrent with the absence of an enable from the diverse scram system (DSS), indicates that an ATWS condition does not exist and that emergency feedwater actuation by the DEFAS is not necessary. Under these conditions, the DEFAS actuation will be blocked through logic in the auxiliary relay cabinet.

The staff's understanding of the functional requirements for the DEFAS is that:

- DEFAS must initiate emergency feedwater flow for conditions indicative of an ATWS where the EFAS has failed.
- The DEFAS will not be required to provide mitigation of an accident such as isolating feedwater flow to a ruptured steam generator.

- DEFAS will stop feedwater flow to the affected steam generator after reaching a pre-determined level setpoint at about 30 minutes after actuation; thereafter, manual operator intervention will control the system.
- DEFAS will utilize logic and redundancy to achieve a 2-out-of-2 initiation, as a minimum.
- DEFAS will utilize steam generator water level as the parameter indicative of the need for EFAS actuation.
- DEFAS will interface with the actuated components via the existing auxiliary relay cabinet (ARC) relays. These relays are not used in the reactor trip system.
- DEFAS will be blocked by the EFAS to prevent control/safety interactions and to disable DEFAS when the EFAS actuates.
- DEFAS will be blocked by the main steam isolation system (MSIS) signal to prevent control/safety interactions and to disable the DEFAS when conditions for MSIS exist.
- DEFAS will be enabled by a signal from the DSS indicating DSS actuation.
- DEFAS will include capabilities to allow testing at power.
- DEFAS will include features that provide alarms, plant computer data and other operator interfaces to indicate system status and meet operability requirements.
- DEFAS setpoints will be coordinated with the existing PPS setpoints so that a competing condition between the PPS and DEFAS will be prevented.
- DEFAS will be interfaced with existing sensors and output devices by a fiber optic (F.O.) technique which has been approved by the NRC for nuclear plant safety related system application. The DEFAS is fiber optically isolated via qualified devices and physically and electrically separated from the existing PPS. It does not degrade the existing separation criteria of the PPS.
- DEFAS logic will use two microprocessor based programmable logic controllers (PLC). Each licensee will perform software verification and validation (V&V). The record of the V&V process will be available for staff audit during the post-implementation inspection.
- DEFAS equipment will be qualified for anticipated operational occurrences.
- DEFAS will be designed under the suitable Quality Assurance procedures consistent with the requirements and clarification of 10 CFR 50.62 contained in Generic Letter 85-06.

- DEFAS logic power will be separate and independent from the existing PPS power. Each DEFAS logic power supply is capable of providing 120 VAC uninterruptable power for up to one hour following the loss of its power bus.
- DEFAS will use a single-board computer with solid state I/O modules as contrasted with the PPS which uses analog bistable trip units. Therefore, the DEFAS logic is diverse from the PPS.

Based on the review of information docketed on April 30, 1989 and the meeting presentations on May 1 and July 12, 1989, the staff commented that the proposed CEOG design for a diverse emergency feedwater actuation system is in general agreement with the ATWS rule and guidance published in Federal Register Vol. 49, No. 124, dated June 26, 1984. However, since there may be differences in hardware equipment between the various plants, staff acceptance of the DEFAS portion of the ATWS implementation for the affected plants can only be made after receipt of the plant specific designs.

During the meeting, the following technical issues were discussed; the staff positions were stated for each issue.

- (1) The interlock from the DSS allows the DEFAS to initiate feedwater flow only if a DSS actuation has occurred.

The staff expressed its concern whether the timing of the DSS actuation is sufficient to allow the actuation of emergency feedwater to perform its mitigation function. The CEOG provided an analysis demonstrating the effect of DEFAS timing on peak pressure. The typical difference in time between the reactor system pressure reaching the RTS setpoint and reaching the DSS setpoint is about 8 seconds. The timing of DEFAS actuation has a negligible effect on the peak reactor vessel pressure for the limiting ATWS event. Accordingly, the staff commented that the design basis of the DSS for interlocking the DEFAS initiation would be appropriate.

- (2) Power sources common for final actuation device between the existing RTS and the DEFAS.

It is the staff's understanding that the DEFAS cabinet circuitry uses independent power sources which are backed up by batteries for up to one hour. The DEFAS inputs to the auxiliary relay cabinet are through qualified isolators. A fault at the DEFAS cabinet will not propagate to the auxiliary relay cabinets. The staff commented that this is consistent with the intent of the ATWS rule. However, because some components located in the auxiliary relay cabinets will be shared for both EFAS and DEFAS and hence share RPS power, it is the staff's position that each individual licensee should provide an analysis to demonstrate that power supply faults (e.g., overvoltage and undervoltage conditions, degraded frequencies, and overcurrent) will not compromise the RTS, the EFAS or the DEFAS equipment. This analysis should include consideration of alarms for early detection of degraded voltage and frequency conditions to allow for operator corrective action while the affected circuits/components are still capable of performing their intended functions. This will be reviewed on a plant specific basis.

(3) Operator actions

The DEFAS will secure feeding the affected steam generator after reaching a pre-determined level setpoint (about 30 minutes after actuation); thereafter, manual operator intervention will control the system. The staff commented that an operator action after 30 minutes from automatic actuation is consistent with staff policy.

(4) Separation from existing system

The DEFAS final actuation devices are common to existing emergency feedwater system. The ATWS rule guidance states that the implementation must be such that separation criteria applied to the existing protection system are not violated. The DEFAS will use qualified F.O. isolators for interfacing with the existing EFAS. The separation criteria applied to the existing protection system will not be violated. The staff commented that this is consistent with the intent of the ATWS rule.

(5) Assumption on control system failure impact to the accident analysis.

The CEOG presented justification to show that the DEFAS design will have minimal impact on the accident analysis. With the DSS, ESAS, and MSIS interlocks, the Owners Group indicated that a single failure would not cause the DEFAS to erroneously actuate such that it could adversely impact FSAR Chapter 6 and 15 event analysis. The staff acknowledged that the Standard Review plan required a consideration of the effects of control system action and inaction when assessing the transient response of the plant. The staff agreed that the conceptual design proposed by the CEOG adequately minimized the potential for improper actuation of the DEFAS during non-ATWS accident conditions.

In the course of the meeting, the CEOG asked the staff to consider reviewing a set of assumptions which would be used in performing plant specific 10 CFR 50.59 analyses of modifications to be made when installing the ATWS hardware. The staff responded that preparation of an analysis pursuant to a 10 CFR 50.59 licensee review was the sole responsibility of each licensee and that the staff would neither do a prior review nor consider approving any such analysis. However, the staff stated that it would review the pertinent aspects of a design and analysis submitted in compliance with 10 CFR 50.62 (the ATWS rule). In this regard, the staff indicated that its comments, as documented above, on the information submitted at the meeting on May 1, 1989, and at this meeting, reflects its view that the proposed DEFAS design is in general agreement with the intent of the ATWS rule. The staff also emphasized that the four licensees should proceed with all aspects of the plant specific designs and analyses.

With regard to implementation of the DEFAS portion of the ATWS design, the staff stated its position that the licensees in attendance should proceed in an expedited manner to design, procure and install the hardware for the DEFAS. While the staff will review each of the CEOG plant specific ATWS

designs and issue an SER for each submittal, the staff also stated that design, procurement and implementation by the licensees of the DEFAS portion of ATWS should not be delayed pending issuance of these SERs. The staff noted that 10 CFR 50.62(d) required each licensee to "develop and submit a proposed schedule (for implementation)...Each shall include an explanation of the schedule along with a justification if the schedule calls for final implementation later than the second refueling outage after July 26, 1984..."

As done in prior reviews of other ATWS submittals, the staff again stated its position that delays attributable to disagreements over minor technical points is not sufficient basis for a schedular exemption request pursuant to 10 CFR 50.62(d). This position derives from the staff's acceptance of the CEOG's ATWS discussions on May 1 and July 12, 1989, as documented above, thereby resolving the major technical issues. In this regard, the staff promised a relatively quick review of plant specific ATWS submittals in recognition of the differences in plant hardware between each of the affected CE plants.

/s/

M. David Lynch, Senior Project Engineer
Project Directorate III-3
Division of Reactor Projects - III, IV, V
and Special Projects

DISTRIBUTION:

Docket Files
NRC & Local PDRs
PD III-3 RF
SICB RF
H. Li
J. Mauck
S. Newberry
A. Thadani
W. Hodges
J. Wermiel
OGC
B. Grimes
ACRS (10)
CRGR/E. Jordan

J. Thoma
V. Thomas
D. Wigginton
D. Hickman
T. Chan
C. Poslusny
D. Lynch
M. Virgilio

SEE PREVIOUS CONCURRENCE

SICB:DEST
*HLi
07/20/89

SICB:DEST
*JMauck
07/20/89

SICB:DEST
*SNewberry
07/20/89

PD3-3
*DLynch
07/20/89

SRXB:DEST
WHodges
7/21/89

SAD:DEST
ATHadani
8/11/89

#28/14
ADR3-5
MVirgilio
8/15/89

designs and issue an SER for each submittal, the staff also stated that design, procurement and implementation by the licensees of the DEFAS portion of ATWS should not be delayed pending issuance of these SERs. The staff noted that 10 CFR 50.62(d) required each licensee to "develop and submit a proposed schedule (for implementation)...Each shall include an explanation of the schedule along with a justification if the schedule calls for final implementation later than the second refueling outage after July 26, 1984..."

As done in prior reviews of other ATWS submittals, the staff again stated its position that delays attributable to disagreements over minor technical points is not sufficient basis for a scheduler exemption request pursuant to 10 CFR 50.62(d). This position derives from the staff's acceptance of the CEOG's ATWS discussions on May 1 and July 12, 1989, as documented above, thereby resolving the major technical issues. In this regard, the staff promised a relatively quick review of plant specific ATWS submittals in recognition of the differences in plant hardware between each of the affected CE plants.

M. David Lynch, Senior Project Engineer
Project Directorate III-3
Division of Reactor Projects - III, IV, V
and Special Projects

DISTRIBUTION:

Docket Files
NRC & Local PDRs
PD III-3 RF
SICB RF
H. Li
J. Mauck
S. Newberry
A. Thadani
W. Hodges
J. Wermiel
OGC
B. Grimes
ACRS (10)
CRGR/E. Jordan

J. Thoma
V. Thomas
D. Wigginton
D. Hickman
T. Chan
C. Poslusny
D. Lynch
M. Virgilio

SICB:DEST
HLi
7/20/89

SICB:DEST
JMauck
7/20/89

SICB:DEST
SNewberry
7/20/89

PD3-3
DLynch
07/20/89

SRXB:DEST
WHodges
/ /89

SAD:DEST
ATHadani
/ /89

ADR3-5
MVirgilio
/ /89

ENCLOSURE 1

LIST OF ATTENDEES

JULY 12, 1989

NRC

M. D. Lynch
D. Wigginton
T. Carnes
V. Thomas
J. Mauck
A. Thadani
H. Li
S. Newberry
C. Poslusny
W. Hodges
L. Tran
J. Wermiel
D. Hickman
J. Hannon
A. Nolan (EG&G)

ACRS

S. Long

NUS

M. Cheok

APS

K. L. McCandless Clark

LP&L

D. W. Gamble
R. W. Prados
M. Meisner

SCE

I. Katter
D. Mercurio
J. Redmon
C. Diamond

CE

M. Ryan
J. Kapinos

AP&L

M. W. Tull
R. A. Barnes

**PRESENTATION ON THE RESPONSE
TO
THE NRC REQUEST FOR ADDITIONAL INFORMATION
ON
CE NPSD-384
DESIGN FOR A DIVERSE EMERGENCY FEEDWATER
ACTUATION SYSTEM CONSISTENT WITH
10CFR50.62 GUIDELINES**

**ARIZONA PUBLIC SERVICE COMPANY
ARKANSAS POWER AND LIGHT COMPANY
LOUISIANA POWER AND LIGHT COMPANY
SOUTHERN CALIFORNIA EDISON COMPANY**

JULY 12, 1989

PRESENTATION OUTLINE

- 0 STATEMENT OF INFORMATION REQUEST
- 0 RESPONSE TO QUESTION
- 0 DISCUSSION
- 0 REQUESTED NRC POSITIONS

QUESTION 1

PROVIDE AN ANALYSIS FOR AN ATWS TO ILLUSTRATE THAT THE TIMING OF THE DSS ACTUATION IS SUFFICIENT TO ALLOW THE ACTUATION OF EMERGENCY FEEDWATER FOR MITIGATION

RESPONSE

CENPD-158, REVISION 1 CONCLUDES THAT AUX. FEED. DELIVERY HAS NO IMPACT ON THE LIMITING EVENT OR THE PEAK RCS PRESSURE

CENPD-263 CONCLUDES THAT THE TIMING OF AUX. FEED. DELIVERY HAS A SMALL IMPACT ON THE LIMITING ATWS EVENT

SUBSEQUENT ANALYSES PERFORMED TO DETERMINE THE SENSITIVITY OF DEFAS TIMING ON PEAK PRESSURE SHOWS NEGLIGIBLE EFFECT ON PEAK PRESSURE FOR LIMITING ATWS EVENT

SEQUENCE OF EVENTS LOFW ATWS WITH DSS BUT NO TRIP
3410 MW_T CLASS

<u>TIME(SEC)</u>	<u>EVENT</u>
0.0	LOSS OF ALL NORMAL FEEDWATER
37.6	LOW SG LEVEL AUXILIARY FEEDWATER ACTUATION SIGNAL
62.0	DSS SETPOINT REACHED
86.6	MAXIMUM RCS PRESSURE
90.3	AUX. FEED. DELIVERED FOR SONGS 2 & 3
91.6	AUX. FEED DELIVERED FOR WSES-3
114.7	DEFAS INITIATED FLOW DELIVERED SONGS 2&3
116.0	DEFAS INITIATED FLOW DELIVERED FOR WSES-3
116.6	AUX. FEED DELIVERED FOR WSES-3
135.0	AUX. FEED. DELIVERED FOR ANO-2
159.4	DEFAS INITIATED FLOW DELIVERED FOR ANO-2

SEQUENCE OF EVENTS LOFW ATWS WITH DSS BUT NO TRIP
3800 MWT CLASS

<u>TIME (SEC)</u>	<u>EVENT</u>
0.0	LOSS OF ALL NORMAL FEEDWATER
22.8	LOW SG LEVEL AUXILIARY FEEDWATER ACTUATION SIGNAL
32.0	DSS SETPOINT REACHED
68.8	AUX. FEED DELIVERED
78.8	DEFAS
82.0	MAXIMUM RCS PRESSURE

AUXILIARY FEEDWATER TIMING SENSITIVITY

PLANT CLASS	LLSG SIG. (SEC)	ASSUMED AFW DELIVERY (SEC)	PEAK PRESSURE (PSIA)
3410 MWt	38	58*	4250
3410 MWt	38	**	4290
3800 MWt	23	33*	3800
3800 MWt	23	**	3820

* NOT ACHIEVABLE. FOR DEMONSTRATION PURPOSES ONLY.

** AUXILIARY FEEDWATER INITIATED AFTER THE TIME OF
PEAK PRESSURE

QUESTION 2

PROVIDE A DISCUSSION OF SGLL AS AN ALTERNATIVE TO THE DSS INTERLOCK

REAL ISSUE

WILL EARLIER AUX. FEED ACTUATION MITIGATE AN ATWS EVENT FOR LATER TIMES IN THE CYCLE

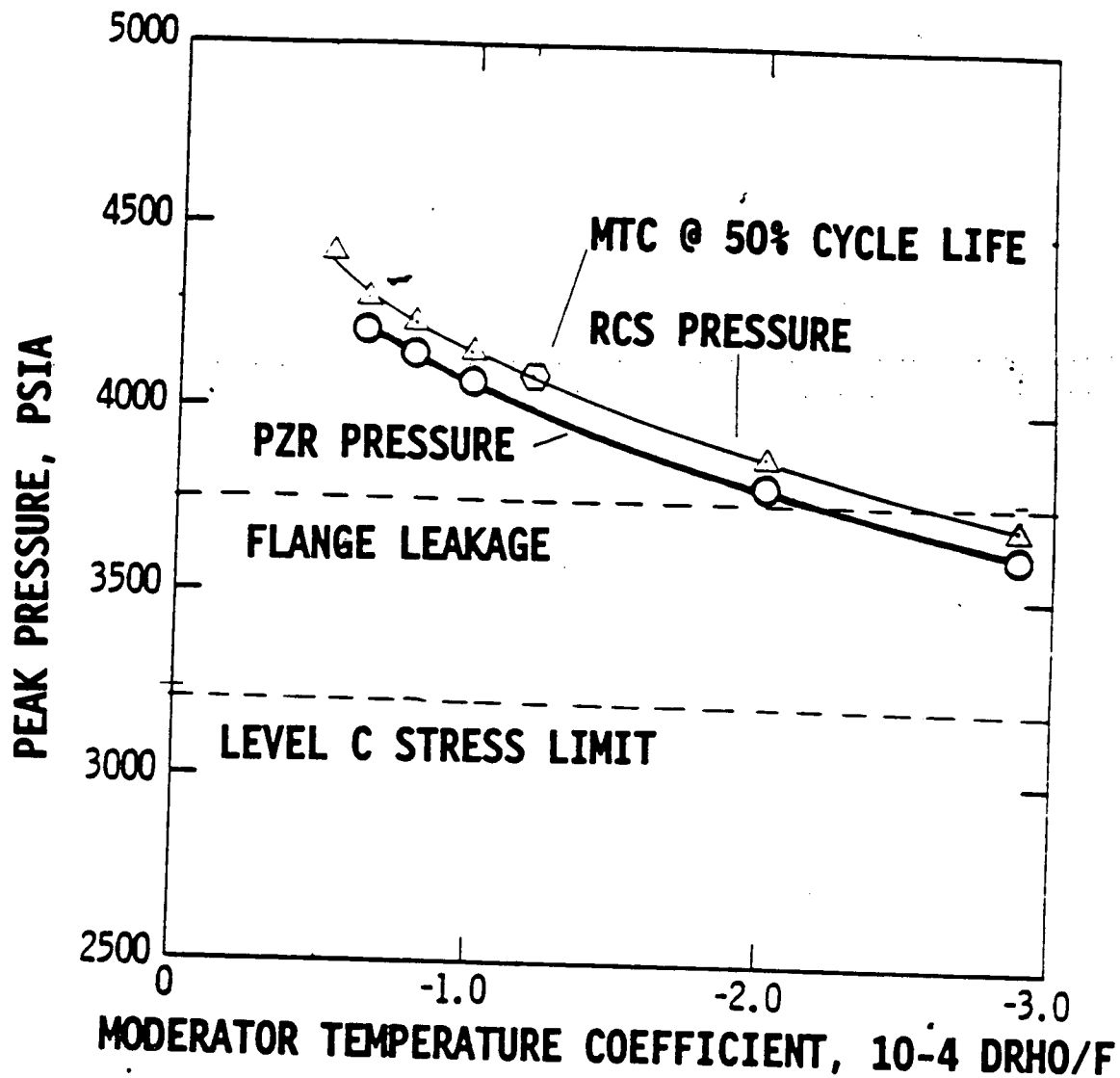
RESPONSE

FOR LIMITING ATWS SCENARIO, AUX. FEED TIMING HAS LITTLE IMPACT ON PEAK PRESSURE

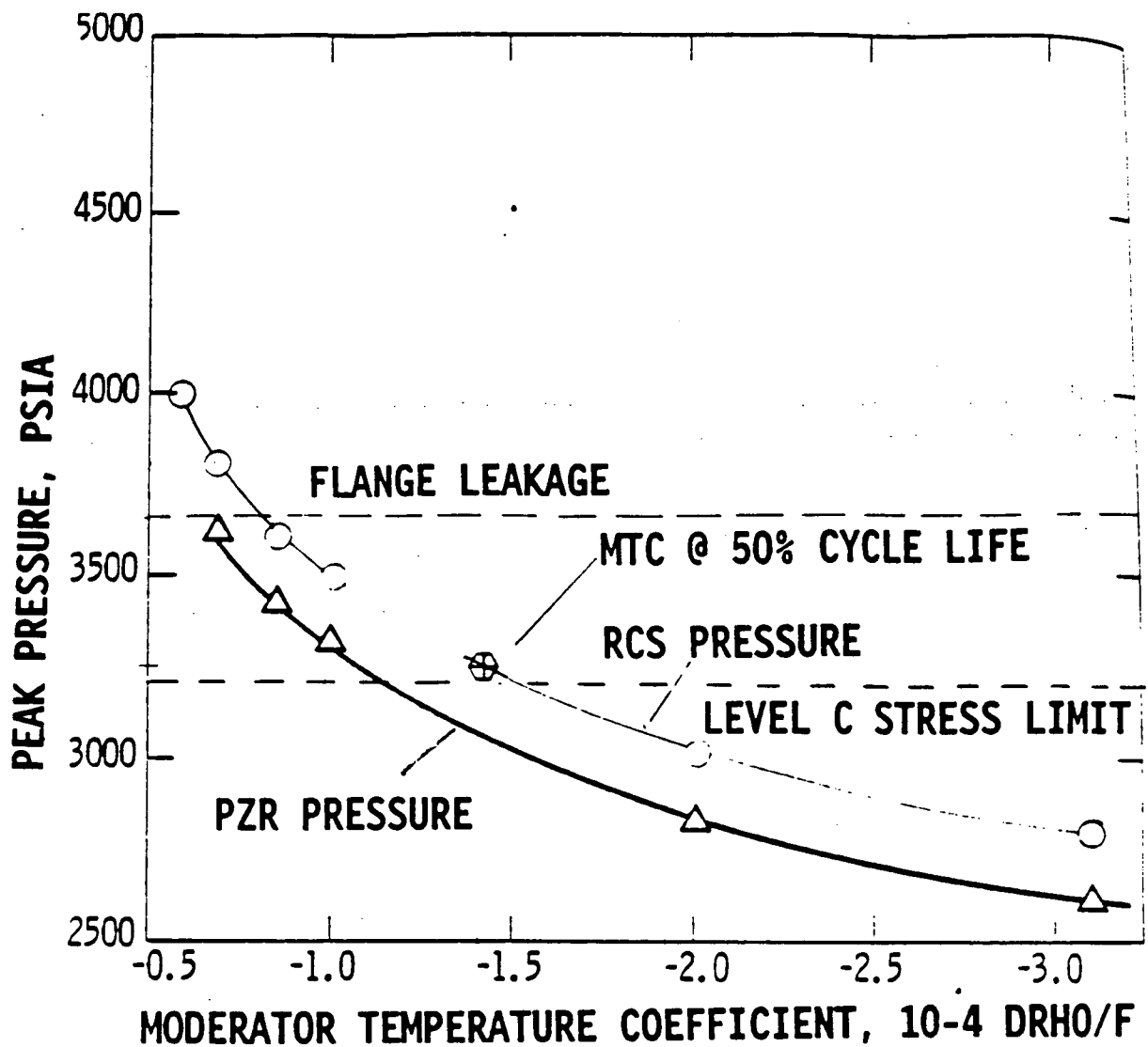
FOR THE 3410 MW_T CLASS THERE IS NO TIME IN THE CYCLE WHICH YIELDS ATWS PEAK PRESSURES BELOW LEVEL C STRESS LIMITS (CENPD-263)

FOR THE 3800 MW_T CLASS THERE MAY BE A SMALL IMPACT ON PEAK PRESSURE FOR LATER TIMES IN CORE CYCLE, I.E., BELOW LEVEL C STRESS LIMITS (CENPD-263)

3410 MWt PLANT CLASS
LOFW ATWS
PEAK PRESSURE VERSUS MODERATOR TEMPERATURE COEFFICIENT



3800 MWT PLANT CLASS
LOFW ATWS
PEAK PRESSURE VERSUS MODERATOR TEMPERATURE COEFFICIENT



QUESTION 3

TESTING CAPABILITIES

RESPONSE

**TEST PROCEDURES WILL BE DETERMINED ONCE THE
FINAL DESIGN IS ESTABLISHED ON A PLANT SPECIFIC
BASIS**

QUESTION 4

V&V PROGRAM FOR PROGRAMMABLE LOGIC CONTROLLERS

RESPONSE

WSES DESIGN DOES NOT USE PLCs

**V&V PROGRAM WILL BE ESTABLISHED ON A PLANT
SPECIFIC BASIS AT AN APPROPRIATE LEVEL FOR
NON-SAFETY SYSTEMS**

QUESTION 5

**CURRENT PLANS AND PROCEDURES FOR AMSAC (DEFAS)
INOPERABLE**

RESPONSE

PLANS UNDER CONSIDERATION:

- 0 IF FEASIBLE, REPAIR AT POWER ON A SCHEDULE
CONSISTENT WITH SAFETY SIGNIFICANCE**
- 0 IF NOT FEASIBLE, REPAIR AND PLACE IN
SERVICE UPON ENTERING MODE 1 AFTER NEXT
REFUELING OUTAGE**
- 0 IF NOT REPAIRABLE DURING THE OUTAGE,
DETERMINE LONG-TERM CORRECTIVE ACTIONS**

QUESTION 6

ASSUMPTIONS REGARDING CONTROL SYSTEM FAILURES
AND IMPACT ON 10CFR50.59 NEGATIVE FINDING FOR
INSTALLATION

RESPONSE

IMPACT ON CHAPTER 15 EVENTS

- 0 COMMON MODE FAILURE POSTULATED BY ATWS
RULE NOT ASSUMED
- 0 A SINGLE FAILURE WILL NOT CAUSE THE DEFAS
TO ADVERSELY IMPACT CHAPTER 6 AND 15
EVENTS

REQUEST FOR NRC POSITIONS

0 CE NPSD-384, SECTION 5 CONCERNS:

- APPLICATION OF 10CFR50.59 VERSUS SRP SECTION 7.7
- POWER SOURCES COMMON FOR FINAL ACTUATION DEVICE BETWEEN EXISTING RTS AND DEFAS
- SEPARATION FROM EXISTING SYSTEM - DEFAS FINAL ACTUATION DEVICE IS COMMON TO EXISTING AUX. FEED SYSTEM
- OPERATOR ACTION REQUIRED AFTER DEFAS HIGH SG LEVEL SETPOINT REACHED

0 DOCUMENTED NRC POSITIONS TO FACILITATE DESIGN AND IMPLEMENTATION