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May 28, 1985
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Director of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. James R. Miller, Chief
Operating Reactors Branch No. 3
Division of Licensing

References: (a) License No. DPR-36 (Docket No. 50-309)
(b) USNRC Letter to MYAPCo dated August 17, 1984
Maine Yankee Reactor Coolant Pump Trip Review

Subject: Response to Questions Regarding Reactor Coolant Pump Trip

Gentlemen:

In Reference (b) above you transmitted to Maine Yankee a number of questions regarding our submittal concerning the reactor coolant pump trip issue. In subsequent letters and meetings with members of your staff and your contractor all but fourteen of the original questions have been resolved. In the Attachment to this letter we address the remaining fourteen questions.

We believe that this information will make possible the completion of your review of our RCP trip submittal.

If you have any questions, please feel free to contact us.

Very truly yours,

MAINE YANKEE ATOMIC POWER COMPANY

G. D. Whittier

G. D. Whittier, Manager
Nuclear Engineering & Licensing

GDW/bjp

Enclosure:

cc: Dr. Thomas E. Murley
Mr. Cornelius F. Holden

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ATTACHMENT

RESPONSE TO NRC QUESTIONS REGARDING MAINE YANKEE REACTOR COOLANT PUMP TRIP STRATEGY

The question numbers match those of the enclosure in Reference 1.

Q1. Assure that RCP trip will not occur for Steam Generator Tube Ruptures (SGTRs) up to and including the design-basis SGTR?

R1. The design basis SGTR assumption of a double-ended guillotine break of one U-tube at the tube sheet elevation on the side of the primary fluid outlet has been analyzed. The analysis, initiated at 102 percent power and carried out with the reactor coolant pumps in operation throughout the event, shows that the primary system coolant subcooling margin remains above 39°F (Figure 1). Therefore, RCP trip will not occur for these ruptures when operators are instructed to trip the pumps on the 25 F subcooling monitor alarm.

Q2. Assure that symptoms and signals differentiate between LOCAs and other transients?

R2. Vendor analyses of credible events for the assessment of alternate RCP trip criteria (Reference 2) show that, except for the SGTR, the Reactor Coolant System subcooling margin will increase during the non-LOCA transients of concern, as shown in Figure 2 from Reference 2.

Figure 1 shows the behavior of the Reactor Coolant system subcooling for our SGTR analysis discussed in R1.

It follows from these results that for credible non-LOCA events the subcooling margin remains above 39°F.

In the case of LOCA events, the pressure histories of Reference 3 have been used to show that the subcooling margin drops below 25°F in less than two minutes.

Hence, the Reactor Coolant System subcooling margin is an appropriate criterion to differentiate between LOCAs and other credible non-LOCA transients.

Q3. Assure that adequate recovery procedures are developed and in place to handle upper-vessel head steam-bubble conditions following delayed RCP trip?

R3. The current set of Emergency Operating Procedures adequately address the recovery of the RCS from an upper head voiding condition. This recovery is accomplished through the use of procedural steps regulating the minimum degree of system subcooling, safety injection termination or throttling criteria, secondary cooling influences, and the monitoring of the upper head thermocouples.

The planned Emergency Operating Procedure revision set coordinates all of these operating directives into a single procedure.

Q4. Assure that RCP operation is excluded in a voided system where pump head is more than ten percent degraded unless analyses or tests can justify pump and seal integrity when operating in a voided system?

R4. The adverse containment uncertainty on the RCS subcooling monitor is 12°F. Therefore, tripping the RCP at 25°F subcooling, assures that pump operation is excluded in a voided system.

Q5. Assure that unnecessary challenges to the PORVs are not introduced by the RCP trip scheme?

R5. The discussion of R1 and R2 shows that the RCPs will remain in operation for credible non-LOCA events. Therefore, the operator can retain normal pressurizer pressure control and will not be required to open the pressurizer PORVs.

Q6. Provide guidance for detecting, managing and removing voids following delayed RCP trip with a partially-voided system?

R6. Guidance on the detection of voiding in the RCS is provided within the existing EOPs with the monitoring of the vessel level trend, the upper head thermocouples, the subcooled margin monitors (core exit, upper head, and all three steam generator outlets), and the behavior of the pressurizer level.

Management of existing voids is performed with the "bumping" of either a single or sequential RCP(s) in order to relocate the potential voids to the upper head region.

Removal of voids within the system is initially performed by increasing system subcooling by squeezing the pressurizer vapor space with either safety injection or charging flows. The minimum level of subcooling required to terminate either injection mode is 50°F. As an alternative technique, Maine Yankee has proposed changes to the Technical Specifications to permit the use of vent paths at the top of the reactor head. Procedures governing the use of these vents will be generated following NRC approval of the Technical Specification change.

The planned EOP revision set will also include the same guidance with regard to voiding in the RCS.

Q7. Assure that containment isolation will not cause problems if it occurs for non-LOCA transients and accidents?

R7. It is possible to postulate non-LOCA accident conditions which would lead to containment isolation. However, the objective of the proposed RCP trip strategy is to establish reasonable assurance of continued pump operation during non-LOCA events. In this context, a "credible", non-LOCA accident that could lead to containment isolation would be a stuck open Steam Generator Safety Relief Valve (SGSRV), as assumed in the study of Reference 2. However, the Maine Yankee SGSRVs are not located inside the containment. Hence, it is felt that Maine Yankee is not subject to "credible" (e.g., stuck open SGSRVs) non-LOCA events resulting in containment pressurization. Nevertheless, a break in one of the smaller lines connected to the steam generator was postulated. The containment pressurization rate for an event of this type can be best estimated by assuming a break in the instrument tap connected to the steam generator head. The continuous blowdown of dry, saturated steam at normal steam generator operating pressure, through a complete severance of the tap was analyzed with the CONTEMPT-LT code. It was found that it would take more than one hour to overpressurize the containment by 3.75 psi, the amount required for isolation (Figure 3). In this large time frame, operator action would have been taken to arrest the pressurization and to avoid any potential problems due to containment isolation.

Q8. Address the consequences of pump and/or pump-seal failure in the analyses if this integrity cannot be assured?

R8. The pump trip criteria at Maine Yankee proposes that the reactor coolant pumps be manually tripped at the subcooled margin monitor low margin alarm of 25°F. In addition, Maine Yankee proposes to institute additional requirements to manually trip individual reactor coolant pumps on either excessive pump shaft vibrations or excessive oscillations of the pump-motor amperage. These criteria for tripping of the Maine Yankee reactor coolant pumps provide adequate assurance of the pump and/or pump-seal integrity.

Q9. Evaluate the capability to continue RCP operation without essential-water services?

R9. The reactor coolant pumps at Maine Yankee are not designed to continue to operate without essential cooling water services. Consequently, Maine Yankee procedures prohibit the reactor coolant pumps from being operated following a loss of essential cooling services. However, based on information received from the manufacturer, Byron-Jackson, operation of the reactor coolant pump for a reasonable time period following a loss of cooling services should not result in shaft seal failure. This position is based on the results of a test in which a similar pump was operated without cooling services to the shaft seal for approximately 35 minutes without loss of sealing function.

The limiting component for RCP operation without cooling water services is the pump motor heatup. These services are terminated upon receipt of a containment isolation signal. However, the RCP trip criterion and the applicable procedures ensure that the pump integrity is maintained under all system conditions and that the RCPs are available for operation when required.

Q10. Evaluate the capability to rapidly restore essential-water services?

R10. Essential water services to the RCPs fall into two categories:

1. Cooling to the RCP motor is provided by component cooling water.

2. Cooling to the RCP shaft seal is provided by either seal injection flow or component cooling water.

The seal injection flow is isolated upon receipt of a safety injection signal; the component cooling water isolates on a containment isolation signal. To restore either of these two flows, the operator must first block and/or clear the indicating closure signal.

As explained in R9, Maine Yankee procedures do not permit RCP operation in the event of loss of essential water services.

Q12. Does the successful compliance of Phase I mean that operators have the option of tripping the RCPs during a SGTR or other non-LOCA upset events?

R12. Operators will be instructed to keep the pumps running during these events based on the subcooling margin criterion described in R1 and R2.

Q13. If RCPs are to remain on during SGTR events, how will operators distinguish between SBLOCA and SGTR events?

R13. The 25°F subcooling margin will be reached during LOCAs and not during SGTR events as discussed in R1 and R2.

Q14. Are the number of PORV challenges independent of RCP trip scheme?

R14. The answer is yes for SBLOCAs due to the depressurization nature of those events.

For non-LOCA events the minimum number of PORV challenges results when the RCPs are kept in operation. This is because maintaining the pumps on leads to better heat removal from the core and allows the operators to retain normal control of the system pressure and therefore no pressurizer PORV challenges will occur.

Q15. If not, what are the optimum RCP trip times to reduce PORV challenges for both SBLOCA and non-LOCA upset events?

R15. It follows from R14, that the proposed subcooling margin RCP trip criterion described in R1 and R2 minimizes PORV challenges because it maximizes the means available to the operator for maintaining normal control of the system pressure.

Q16. How does Phase I address recovery of a partially-voided system?

R16. Phase I of the RCP trip study does not address the recovery of a partially voided system. This recovery is adequately covered within the current Emergency Operating Procedures and is specifically addressed by the planned Emergency Operating Procedure revisions.

REFERENCES

1. J. R. Miller, USNRC Letter to J. B. Randazza Concerning Maine Yankee Reactor Coolant Pump Trip Review, Docket No. 50-309, August 17, 1984.

2. R. M. Kemper et al., "Evaluation of Alternate RCP Criteria", Westinghouse Report Prepared for the Westinghouse Owners Group, 4497Q:lD/081283, August 1983.

3. L. Schor et al., "Justification of Reactor Coolant Pump Operation During Small Break LOCA Transients", YAEC-1423, April 1984.

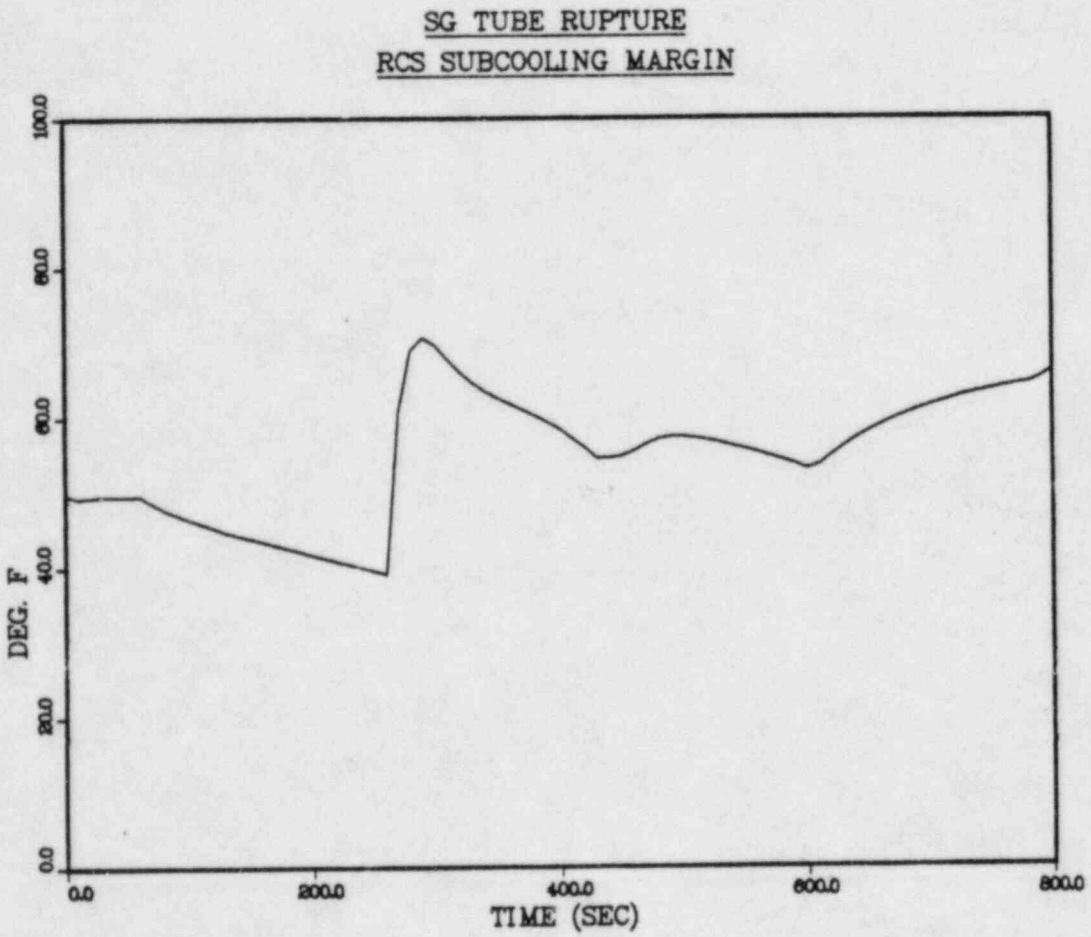

FIGURE 1 RCS Subcooling for SGTR at Maine Yankee

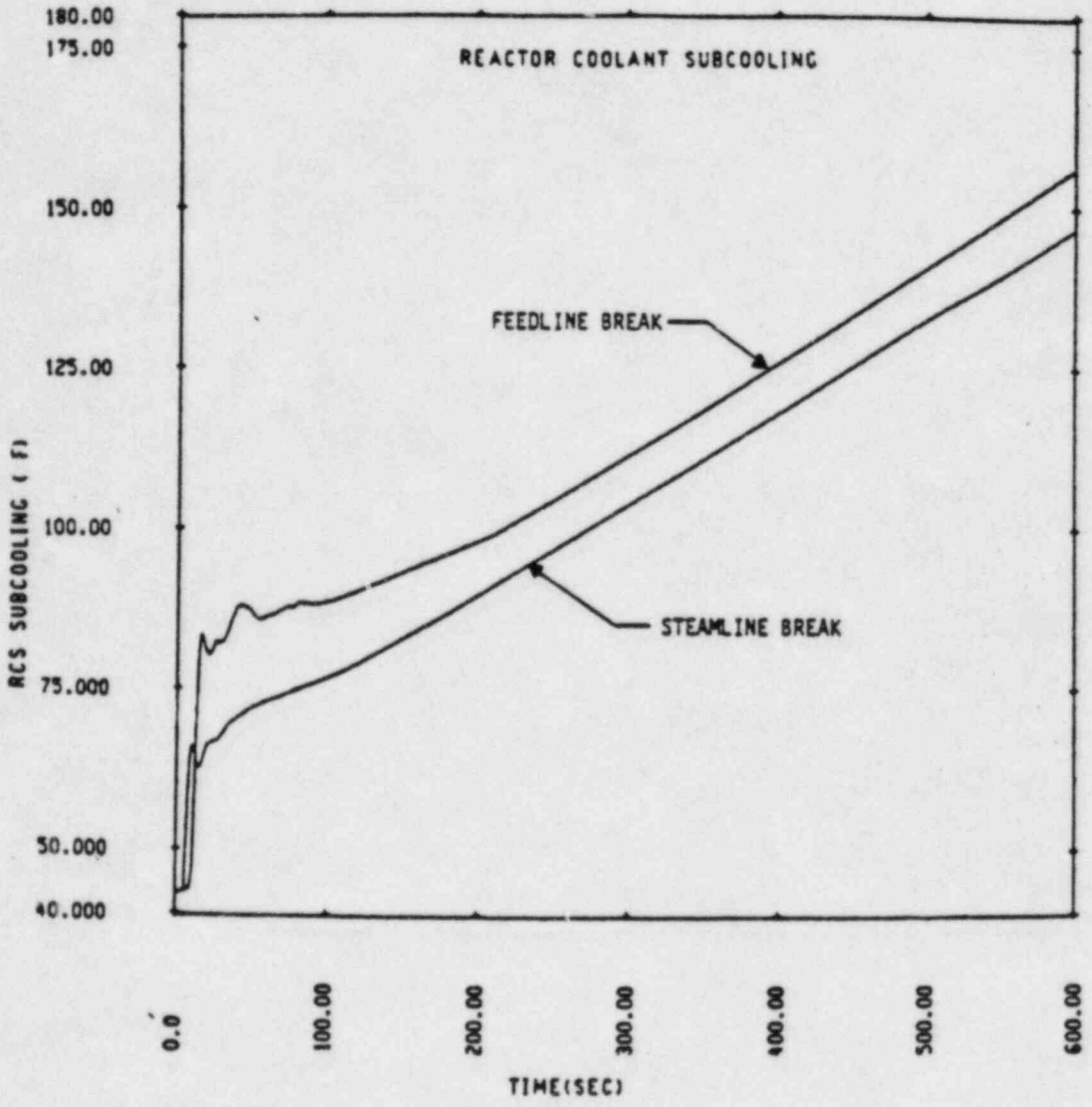

FIGURE 2 Typical RCS Subcooling Transients (Reference 2)

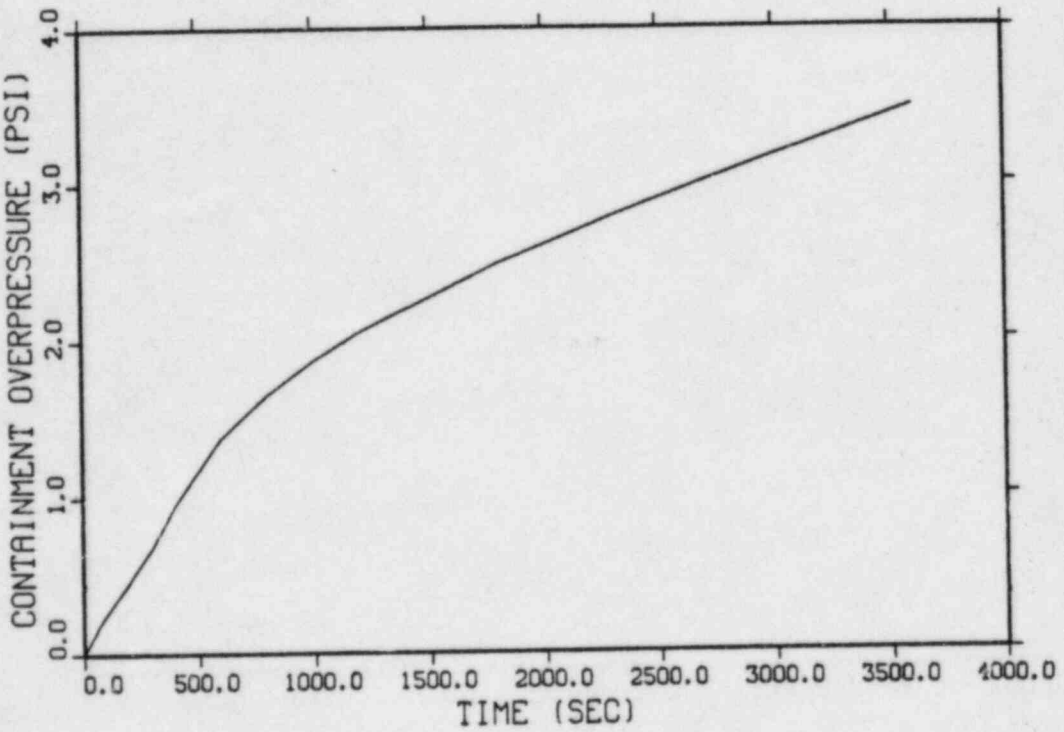

FIGURE 3 Containment Overpressurization Due to Rupture of 1-Inch Instrument Tap on the Steam Generator