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August 15, 1983
5211-83-219

Office of Nuclear Reactor Regulation
Attn: D. G. Eisenhut, Director
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
Auto RC Pump Trip (NUREG 0737, II.K.3.5)

Our letter of March 31, 1983 (5211-83-017) notified you of our plans to revise the RCP trip criterion from 1600 psig ESAS to 25°F subcooling margin. This has been accomplished. Our letter of June 8, 1983 also advised you of our intent to join the B&W Owners Group on this subject to further analyze and quantify the margins associated with the new criterion we have adopted. Enclosed is a description of the plan for the submission of the supplemental information consistent with the other B&W Owners. GPU will provide the information consistent with other B&W Owners in May, 1984.

Sincerely,

H. D. Hukill
Director, TMI-1

HDH:LWH:vjf

cc: R. Conte
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PLAN FOR RESOLUTION OF TMI
ACTION ITEM II.K.3.5

"Automatic Trip of Reactor Coolant Pumps"

INTRODUCTION

The criteria for resolution of NUREG-0737, Item II.K.3.5, "Automatic Trip of Reactor Coolant Pumps", are provided in a letter from D. G. Eisenhut (NRC) to GPU Nuclear on March 4, 1983. As discussed in our letter of March 31, 1983, GPUN has revised the RCP Trip Criteria from 1600 psig ESAS to 25°F subcooling margin under 10CFR 50.59. The B&W Owners Group has been formulating a plan to demonstrate compliance with those criteria. The following represents this overall position and plan.

PLAN FOR TREATMENT OF RC PUMP OPERATION

The treatment of reactor coolant pumps during accidents and transients has received extensive attention over the past several years. THE B&W Owners Group has performed analyses evaluating the effect of a delayed RC pump trip using Appendix K assumptions during the course of a small break LOCA accident and has determined that an early trip of RC pumps is required to show conformance to 10CFR 50.46 for a range of break sizes. Therefore, to be consistent with the conservative analyses performed, it is our position that the reactor coolant pumps should be tripped if indications of a small break LOCA exist.

The B&W Owners Group and B&W maintain that it is highly desirable to maintain RC pump operation during non-LOCA events, as an aid in the mitigation of transients. Consistent with this phiolosophy, the concept of subcooling margin was chosen as an indicator for the need to trip RC pumps. It is our intention to demonstrate that this concept is consistent with our philosophy for handling RC pumps during transient conditions and complies with the intent of the criteria stated in your letter of March 4, 1983. The symptom approach of subcooling margin, developed as part of the Abnormal Transient Operating Guidelines Program, is intended to replace the present guidelines of tripping solely on the presence of a low RC pressure ESFAS signal.

It is the position of the B&W Owners Group and B&W that reactor coolant pump trip can be achieved safely and reliably by the operator. It has been determined that a loss of subcooling margin will occcur for those SBLOCAs where a pump trip is required for compliance with 10 CFR 50.46.

The B&W Owners Group will undertake a program based on the above positions to demonstrate that the concept of subcooling margin is an appropriate indicator of the need to trip RC pumps, yet still allows continued RCP operation for steam generator tube ruptures (SGTR). The concept of subcooling margin will be examined for the more likely non-LOCA transients to demonstrate that under realistic conditions an indication requiring RC pump trip is unlikely.

This program is also intended to provide the justification for manual RCP trip on indication of loss of subcooling margin. Tripping on loss of subcooling margin will assure pump trip prior to the development of significant system voids. No attempt will be made to demonstrate acceptability of continued RCP operation during small break conditions. No request for an exemption of 10CFR 50.46 will be made to allow continued RCP operation during SBLOCA.

The specific plan for resolution of the RC pump trip issue is structured to address the specific criteria stated in the March 4, 1983 letter. A description of the plan, related to the criteria with which it is intended to address, follows:

I. Pump Operation Criteria Which Can Result in RCP Trip During Transients and Accidents

1. Setpoints for RCP Trip:

a. The RCP trip criterion, based on loss of subcooling margin, was developed with the intent of assuring that an indication for RC pump trip would occur for those SBLOCAs where pump trip was required to meet the criteria of 10CFR 50.46. A spectrum of analyses has been performed using Appendix K assumptions which demonstrate that a loss of subcooling will always occur for small breaks that have the potential to uncover the core and exceed 10 CFR 50.46 criteria if the RCPs are tripped under certain two-phase conditions. Therefore, loss of subcooling can be used as an indicator of the need for RCP trip. The actual value of the setpoint (25°F) will be verified to ensure that this indicator will allow continued forced RCS flow during realistic SGTRs up to and including the design basis SGTR - a single double ended rupture. The setpoint will also be verified to include consideration for minimizing the indication for need to trip RC pumps for more likely non-LOCA events such as a mild overcooling transients.

No partial or staggered RCP trip schemes will be considered except for the extreme case where mechanical damage to the pump is likely as this adds to increased decision making on the part of the operator during transient conditions.

b. The RCP trip criterion based on subcooling margin precludes operation of the RC pumps in a highly voided system (except for ICC conditions).

c. A primary objective of the parameter and setpoint verification is the avoidance of reactor coolant pump trip for non-LOCA events particularly SGTR. Realistic operator actions in accordance with the procedures are expected to avoid loss of subcooling and the need to trip the reactor coolant pumps for this event. Furthermore, since subcooling margin would be quickly regained following makeup or HPI initiation, without loss of natural circulation even if the operator failed to take actions to prevent RCP tripping and ESFAS actuation, restart of the pumps would be allowed. Consequently, reliance on the PORV for depressurization is unlikely.

d. The significance of primary system voiding due to flashing of hot coolant is disucssed as part of operator training. The subject void treatment is being supplemented by additional guidance on prevention, detection, and mitigation of voids. This is considered outside of the ATOG scope but will be addressed.

e. Actions following containment isolation signals will be reviewed to ensure consistency in the treatment of availability of cooling water and seal injection to prevent pump damage. Instructions for pump trip are provided in the ATOG guidelines in the unlikely event of mechanical pump damage. Crtieria for restart of RC pumps include assuring that cooling water and seal injection are available. Existing TMI-1 procedures also include the guidance.

f. Instructions for maintaining or reinitiating forced RC flow are contained in ATOG for ICC conditions.

2. Guidance for Justification of Manual RCP Trip

a. A spectrum of small break LOCAs has been analyzed for 177 and 205 FA plant types using the CRAFT2 code. Using the Appendix K evaluation techniques, there exists a combination of break sizes and RC pump trip times which result in exceeding 10 CFR 50.46 limits. For the worst break size, i.e., that size which requires the earliest pump trip, trip must occur within 2 minutes of the indication of need for pump trip. As break size decreases, more time is available for operator action. the critical time period of high void formation (>70%) when RC pump trip is not recommended, has also been determined. The critical time period for the break requiring the earliest operation action time is short (5 minutes) when pump trip could result in exceeding 10 CFR 50.46 criteria.

b. A best estimate SBLOCA analysis will be performed for each general plant type, over the spectrum of sizes determined by the conservative analyses to determine (a) the time available for a required RC pump trip, and the period of time when RC pump trip is not recommended or (b) the lack of indication for a required pump trip. If it is determined that a need for RC pump trip exists, the time for operator action will be determined and justified by comparison to ANSI Standards and operating experience. An indication of reasonable operator action time is expected to justify manual RCP trip.

3. Other Considerations

a. The level of quality of instrumentation, as described in the enclosure to the March 4, 1983 letter, used to produce the signal indicating the need for RC pump trip, will be provided by GPUN to supplement the B&WOG generic submittal for treatment of RC pumps during transients.

b. The ATOG guidelines and plant specific Emergency Operating Procedures contain criteria for the timely restart of reactor coolant pumps when conditions which will support safe pump operation exist. Table 6 of the Equipment Operator chapter of ATOG provides the conditions when RC pumps can be restarted.

c. Plant operators have been trained in their responsibility for performing RCP trip in the event of a small break LOCA. Current plant procedures (non-ATOG) require RC pump trip on 25°F subcooling margin. Instructions for plant operation are reinforced by regular requalification class and simulator training. Operators have been trained on the concept of RC pump trip on subcooling margin.

II. Pump Operation Criteria Which Will Not Result in RCP Trip During Transients and Accidents

Since it is the position of the B&WOG and B&W that the safest method for RC pump operation following SBLOCA is (manual) trip, the criteria stated in this section will not be addressed.