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October 18, 1989

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Subject: **Docket No. 50-206**
10CFR50.72 Report Concerning Valves FCV 1112 and CV 305
San Onofre Nuclear Generating Station, Unit 1

On October 12, 1989, Edison made a one hour report pursuant to 10CFR50.72 in response to its identification that air operated valves FCV 1112 and CV 305 appeared to not meet requirements of the current design basis with respect to single failure. Our concern in this regard is based on the fact that these valves are not provided with nitrogen supplies to serve as backup to the instrument air system. Although design disclosures clearly do not call for backup nitrogen to be provided, this does not appear consistent with backup supplies which are provided to other air operated valves.

Since making the one hour report, Edison has pursued two courses of action in parallel, as follows:

1. Design and procurement activities are proceeding in order to permit installation of backup nitrogen supplies as soon as possible. If necessary, the unit will be shutdown to permit this backup to be installed not later than the end of October 1989. This action is being taken irrespective of the outcome of 2 below.

2. Valves FCV 1112 and CV 305 require pneumatic supply to operate in connection with the Hot Leg Recirculation (HLR) function. As noted in my letter to the NRC concerning Full-Term Operating License Open Items dated September 5, 1989, the status of the HLR function has recently been reviewed by Edison. Its design basis with respect to the need for backup nitrogen supply to these two valves is not immediately apparent and continues under review.

   The complex evolution of the design basis is summarized in the attachment to this letter. Two, independent and redundant paths are provided for the HLR function, and the instrument air system is relied upon for only one of these paths. This is identified as the primary HLR flowpath. Therefore, absence of backup nitrogen for the primary flowpath may reflect a prior determination that use of the alternate flowpath in the event of loss of instrument air was acceptable. Indeed, as discussed in the attachment, the risk of core melt resulting from the lack of backup nitrogen supply to the primary HLR flowpath is not large.

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Although it is possible that our continuing review of the HLR function design basis could determine that the existence of the alternate flowpath which does not rely on instrument air was considered acceptable grounds for not providing backup nitrogen supplies to the primary flowpath, such backup will be provided as discussed in 1 above. Based on the safety evaluation discussed in the attachment hereto, Edison considers that continued operation to the end of October is acceptable. If necessary, the unit will be shutdown at that time, and the modifications required to provide backup nitrogen supplies to FCV 1112 and CV 305 will be performed.

If you have any questions or comments concerning this matter, or if you would like additional information, please let me know.

Sincerely,

Harold B. Ray

Attachment

cc: J. B. Martin, Regional Administrator, NRC Region V
C. Caldwell, NRC Senior Resident Inspector, San Onofre

Enclosure

SUBJECT: Assessment of Operation Without Backup Nitrogen for Hot Leg Recirculation Primary Flow Path
San Onofre Nuclear Generating Station, Unit 1

I. PURPOSE

The purpose of this memorandum is to assess the safety impact of limited continued operation without backup nitrogen for Hot Leg Recirculation primary flow path valves FCV-1112 and CV-305.

II. SUMMARY

To preclude boron precipitation in the core following a cold leg LOCA, the NRC required installation of hot leg recirculation (HLR) capability. Two air-operated valves in the primary (original) HLR flow path which require air to move from their cold leg recirculation positions to the positions for HLR were not provided with safety related backup nitrogen during the Long Term Seismic modifications in 1986.

The instrument air system at San Onofre Nuclear Generating Station (SONGS) Unit 1 is a highly reliable source of compressed air with redundant air compressors powered from safety related sources, and other features which minimize the probability of its loss during most accident sequences. However, as the seismic upgrade project resulted in backup nitrogen installation for applications similar to FCV-1112 and CV-305, it is possible that backup nitrogen is also a design basis requirement for these valves. This potential discrepancy was reported on October 12, 1989 per 10 CFR 50.72 and continues to be evaluated. The identified vulnerability relates to only one of the two redundant HLR flow paths. The alternate flow path does not depend upon the instrument air system. A safety impact would result only if a large break LOCA in one of the cold legs were to occur coincident with two additional failures, that is: 1) failure of the air supply to FCV-1112 or CV-305, rendering the primary HLR flow path unavailable, and 2) a simultaneous failure which rendered the alternate flow path unavailable.

A limited PRA was performed to compare the probability of core melt with and without backup nitrogen for the primary path HLR valves, considering potential common-cause failures and no backup means of preventing boron precipitation in the core. The results of this analysis indicate that the lack of backup nitrogen for these valves does not result in a significant increase in the overall probability of core melt for SONGS 1.

It is concluded that limited continued operation of SONGS 1, until the end of October 1989 when modifications to provide backup nitrogen supplies will be performed, does not present an undue risk to the health and safety of the public.

III. BACKGROUND

A. HOT LEG RECIRCULATION REQUIREMENT

In March 1975, the NRC (Reference 1) requested information concerning the potential for boron precipitation during long term cooling subsequent to a Loss of Coolant Accident (LOCA). In July 1975 SCE responded (Reference 2), crediting hot leg recirculation flow via the pressurizer auxiliary spray path (i.e., charging system valves FCV-1112 and CV-305) as preventing post-LOCA boron precipitation. Current analysis shows that HLR must be initiated within 8 hours post-LOCA to perform this function.

B. SINGLE FAILURE CRITERIA FOR HLR

In December 1976, a single failure analysis of the emergency core cooling system (ECCS) was completed which identified system modifications to eliminate single point failures in the HLR flow path (Reference 3). In March, 1977, an alternate hot leg recirculation flow path was identified as an interim modification to provide hot leg recirculation in the event of a LOCA in one of the cold legs and the single failure of one of the valves in the primary hot leg recirculation flow path (Reference 4). This interim modification was installed prior to restart, and the NRC accepted this as a long-term solution in October 1978 (Reference 5). At that time, the instrument air system at Unit 1 was credited for providing air to all ECCS components following a pipe break in containment.

C. COMMON-CAUSE SEISMIC FAILURE OF HLR

Subsequent to resolution of the single point failure issue for HLR, the BOP Seismic Re-evaluation Program identified specific modifications to portions of the instrument air system serving accident mitigation and cold shutdown components, including HLR valves CV-305 and FCV-1112. In August 1982, the NRC issued a confirmatory action order requiring completion of all seismic upgrades prior to restart (Reference 6). However, in December 1983, work on accident mitigation and cold shutdown seismic upgrades was deferred as part of the Return to Service seismic program (Reference 7). SONGS 1 restarted under the provisions of a contingent recision of suspension issued by the NRC in November 1984, which required completion of the accident mitigation and cold shutdown seismic upgrades at the next refueling (Reference 8). The long term seismic (LTS)

upgrades installed in the Cycle 9 refueling outage, however, did not include backup nitrogen for the primary path HLR valves. A document search is in progress as of the date of this memorandum to determine the basis for this aspect of the LTS seismic upgrade scope.

D. COMMON-CAUSE FAILURE OF HLR DUE TO PIPE BREAK INTERACTION

Evaluation of SONGS 1 for HELBs inside containment was submitted to the NRC in October 1983 (Reference 9). Impacts on the non-seismic instrument air system were not evaluated. The updated HELB analysis submitted for SONGS 1 in January 1989 (Reference 10) similarly did not address the instrument air system, and was subsequently withdrawn by SCE to permit considering alternate means of compliance with NRC HELB requirements. As such, potential common-cause loss of the instrument air system due to cold leg LOCA pipe break interactions can not be excluded, and must be considered in the probabilistic risk assessment (PRA).

E. OTHER FEATURES OF THE AIR SYSTEM SUPPORTING HLR

There are three normal air compressors which supply the instrument air system, powered from redundant busses. Additionally, the auxiliary air compressor (K-12) would start automatically on low pressure to supply the redundant air header portion of the air system. Thus, the redundant air header, which serves the doghouse area, including FCV-1112, and containment, including CV-305, is a highly reliable source of instrument air.

In the event of a pipe break interaction, high instrument air flow would occur into containment. This condition would result in a high air flow alarm for which the operator response is isolation of the air supply into containment (Reference 11). This would disable CV-305 in the closed position, but preserve the outside containment portion of the instrument air system (i.e., the redundant air header) serving FCV-1112. Common-cause susceptibility of the instrument air supply must therefore be treated separately for FCV-1112 and CV-305 in the PRA.

IV. DISCUSSION

The common-cause failure potential of the HLR primary path was evaluated by a limited PRA (Reference 12) which considered the contribution to core melt due to the failure of the hot leg recirculation function from credible common-cause effects. The following assumptions were used:

- The failure probabilities were calculated for the HLR flow paths only, since the charging pumps, refueling water pumps, recirculation pumps, electrical system, etc. have been previously assessed for the cold leg recirculation functions.

- Operator error affecting the HLR flow paths was not modeled.

- Loss of instrument air due to a seismic event in the 120 days following a cold leg LOCA was not specifically modeled, since the probability of this combination in conjunction with other failures is judged to be low.

- Loss of instrument air to FCV-1112 was given a conditional probability of occurrence of 0.01, based on the large amount of time available to initiate HLR (8 hours), which makes recovery of the outside containment portion of the system very likely.

- Loss of instrument air to CV-305 due to LOCA pipe break interactions with the instrument air piping in containment was given a conditional probability of 0.1. Since walkdown data do not exist for HELB interactions with the instrument air system in containment, this value was based on a review of P&IDs, general layout drawings and NRC HELB criteria, which indicated that a) air operated components were principally located in small branch lines, and b) the limited extent of RCS branch piping between the minimum size requiring consideration as break sources and the maximum size not excludable by leak before break.

- The probability of loss of both instrument air and backup nitrogen (were it installed) to FCV-1112 or CV-305 was assumed to be 0.01.

- Recovery of failed valves was not modeled. If radiation levels at the failed valve(s) were low enough, recovery would decrease the overall failure probability.

- Failure of both primary and alternate hot leg recirculation flow paths following a large cold leg LOCA was assumed to lead to core melt (i.e., no credit was taken for any alternate means of preventing boron precipitation such as reflux cooling using steam generators).

- The probability of a LOCA with a break size greater than 3 inches is 8.66E-4 per year. The probability of the break being in a cold leg or branch line is 0.5.

Using the above assumptions, and modeling valves on both flow paths using best estimates of valve reliability and vulnerability to harsh environments, the probability of core melt due to a cold leg LOCA and loss of both HLR flow paths was determined to be 5.85E-05 per year, assuming the probability of common-cause failure of the instrument air supply to CV-305 is 0.1 (i.e., no backup nitrogen). The probability of core melt assuming a 0.01 instrument air failure probability to CV-305 (i.e., with backup nitrogen) was determined to be 2.37E-05 per year. This change in risk is small compared with the base SONGS 1 risk for LOCAs of 3.3 E-04 per year (Reference 13).

IV. CONCLUSION

It is concluded that limited continued operation of SONGS 1, pending preparation of necessary design change documentation and material procurement to permit modifications to be made, does not present an undue risk to the health and safety of the public.

REFERENCES:

1. NRC (Purple) letter to SCE (Moore) dated March 18, 1975, re: Post-LOCA boron precipitation

2. SCE (Haynes) letter to NRC (Purple) dated July 22, 1975, subject: "Emergency Core Cooling System Performance"

3. SCE (Baskin) letter to NRC (Schwencer) dated December 21, 1976, subject: "Single Failure Analysis, SONGS 1"

4. SCE (Baskin) letter to NRC (Schwencer) dated March 25, 1977, subject: "Plant Modifications to Eliminate Postulated Single Failure Effects, SONGS 1"

5. NRC (Ziemann) letter to SCE (Drake) dated October 16, 1978, re: ECCS Single Failure Modifications

6. NRC (Crutchfield) letter to SCE (Dietch) dated August 11, 1982, transmitting "Order Confirming License Commitments on Seismic Upgrading"

7. SCE (Medford) letter to NRC (Crutchfield) dated December 23, 1983, subject: "Return to Service Seismic Upgrade Program"

8. NRC (Eisenhut) letter to SCE (Baskin) dated November 21, 1984, re: Contingent Recision of Suspension

9. SCE (Krieger) letter to NRC (Crutchfield) dated October 11, 1983, subject: "SEP Topic III-5.A, Effects of Pipe Break Inside Containment, SONGS 1"

10. SCE (Nandy) letter to NRC dated January 31, 1989, subject: "SEP Topics III-5.A, III-5.B, III-7.b and V-5, SONGS 1"

11. Annunciator Response Instruction SO1-13-1 (Window 53)

12. Memorandum from D. E. Shull and M. L. Merlo to R. M. Rosenblum dated September 18, 1989, subject: "San Onofre Unit 1 Hot Leg Recirculation EQ Upgrade"

13. Quarterly Performance Report Notes, SONGS 1, 2 and 3, for 2nd Quarter 1988