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February 8, 1974



Mr. R. H. Engelken, Director
Directorate of Regulatory Operations
Region V
P. O. Box 1615
Berkeley, CA 94701

Dear Mr. Engelken:

Docket No. 50-206,
San Onofre Nuclear Generating Station,
Unit No. 1:
Regulatory Operations
Information Request No. 74-1

This letter is in response to the Directorate of Regulatory Operations Information Request No. 74-1. Three incidents in piping systems have occurred at San Onofre Unit 1 which are discussed below. Additionally, with regard to containment liners, San Onofre Unit 1 utilizes a one-inch thick steel containment vessel which has never displayed the difficulties described in the subject Information Request.

Item 1

Cause and Operational Sequences:

On April 29, 1972, a unit trip and safety injection initiation occurred during a unit start-up. A summary report dated May 30, 1972 was previously submitted to the Commission.

The event was precipitated by failure of the positioner on the "C" main feedwater regulating valve. Valve positioner failure was due to an internal cam follower slipping off the cam. During this start-up, a water hammer occurred in the feedwater piping when the "C" steam generator feed ring was uncovered. Under this condition steam backs up into the feed ring and header. When feed to the steam generator is resumed, the steam trapped in the ring and header collapses and a water hammer results. This situation is possible when steam flow rates are near the capacity of the auxiliary feed pump during low power operation.

The exact cause of the positioner failure could not be determined. However, as a result of the water hammer, it is theorized that the cam follower on the "C" feedwater control valve "jumped its cam". This caused the valve to fail in a partially open position even though the remote manual controller was on manual and adjusted

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to the valve closed position. No other damage to the affected feed-water line was evident.

Corrective Actions:

The valve positioners were replaced with a different type which is constructed such that the cam and the cam follower are securely fastened to the positioner case.

Item 2

Cause and Operational Sequences:

On October 21, 1973, during a safety injection initiation following a unit shutdown, the Loop B safety injection valve was disabled and a pipe hanger mounting bracket was damaged due to water hammer. A summary report dated October 31, 1973 was previously submitted to the Commission.

Post-occurrence investigation revealed that an air pocket existed in the Loop B safety injection piping. This was verified by manually venting the line. Apparently, air was collected and trapped during valve operation with the primary system drained. The entrapped air caused a water hammer and resultant pipe movement when the safety injection system was actuated.

The Loop B safety injection valve was disabled by the failure of four bolts holding the motor casing in place. Failure of these bolts resulted in the casing, stator and end bell dropping from their mounting.

Corrective Actions:

Vent piping changes were made to facilitate on-line venting of all sections of the safety injection piping which could conceivably trap air pockets. Procedures were developed to specify venting frequency such that reasonable assurance will be provided that air pockets will not exist in this piping.

Although non-destructive testing did not indicate any apparent damage, the section of Loop B safety injection piping affected by the water hammer was replaced to assure that the original design requirements are met.

The Loop B safety injection valve was disassembled, inspected and tested for any further signs of distress. No additional damage was noted. The original motor mounting bolts were replaced with those of stronger material and larger size. This modification was also made to the Loop A and C safety injection valves.

The damaged pipe hanger mounting bracket was replaced with a stronger bracket and the pipe hanger was re-installed to the original design specifications.

Item 3

Cause and Operational Sequences:

On January 14, 1974, during a unit outage, a main steam line knee support attached to the secondary shield was found displaced from its normal position. An inspection of all main steam and feedwater line supports and restraints within containment was performed. The inspection revealed that three knee supports and one hydraulic restraint anchor (snubber) were damaged. Two of these knee braces support the "B" feedwater line and one supports the main steam line. The inspection also revealed that the phenolic pad from one other main steam line support was missing and the pad from an additional support was displaced. The phenolic pads provide a bearing surface between knee supports and the main steam piping.

The upper vertical anchor plates on the three damaged knee supports were found to have experienced movement which caused spalling of the adjacent concrete. The upper plate on the steam line knee brace was also pulled loose from the secondary shield structure. In addition, one of the knee supports for the "B" feedwater line exhibited one sheared and three missing bolts. These bolts mount the pipe support pedestal securely to the knee support providing a rigid restraint for the line.

The anchor plates are fastened to the wall (secondary shield structure) by J bolt anchors imbedded in the concrete. The anchor bolts are screwed into nuts which are in turn welded to the back side of each corner of the anchor plates. In the case of the plate on the main steam line knee support, the J bolts became disengaged from the nuts. The resulting disengagement allowed the plate to be pulled loose from the wall. The damaged hydraulic restraint anchor exhibited spalled concrete and was pulled loose from the wall at the top. The upper J bolts were found to be missing.

A program was initiated to verify design calculations and determine the cause of the above failures. The following conclusions concerning these items are presented below:

- a. Review of the original design calculations revealed that original design assumptions included lateral loadings which were neglected in the final design of the supports.
- b. Failure of the anchor plates was due to improper installation. Investigation of the failures indicated that the J bolts had insufficient thread engagement in the nuts on the back of the anchor plates.
- c. The phenolic pads were probably displaced from their original positions due to abnormal line movements caused by failure of the knee supports.

- d. Examination of the pedestal mounting bolt revealed that the bolt diameter (5/8") did not conform to the size stipulated on design drawings (3/4").

Corrective Action:

- a. Anchor plates were returned to their original configuration and additional supports added to secure them to the secondary shield structure.
- b. Additional lateral struts were added to the knee supports where appropriate. Design calculations were used to verify the adequacy of the modifications.
- c. The single sheared and three missing bolts in the pedestal to knee support interface on the "B" feedwater line were replaced with 3/4" bolts.
- d. The displaced phenolic pad was returned to its original position and the missing pad was replaced.
- e. The integrity of the main steam and feedwater headers was verified by calculations.
- f. All spalled concrete was repaired.

Sincerely,

Robert M. C...
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