**Arizona Nuclear Power Project**
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December 12, 1984
ANPP-31455-TDS/TRB

U. S. Nuclear Regulatory Commission
Region V
1450 Maria Lane - Suite 210
Walnut Creek, California 94596-5368

Attention: Mr. D. F. Kirsch, Acting Director
Division of Reactor Safety and Projects

Subject: Final Report - DER 84-64
A 50.55(e) Reportable Condition Relating To Pipe Support Could Not Be Cycled Through Entire Stroke.
File: 84-019-026; D.4.33.2

Reference: A) Telephone Conversation between D. Hollenbach and T. Bradish on September 4, 1984
B) ANPP-30734, dated October 3, 1984 (Interim Report)
C) ANPP-30993, dated October 29, 1984 (Time Extension)
D) ANPP-31150, dated November 15, 1984 (Time Extension)
E) ANPP-31261, dated November 30, 1984 (Time Extension)

Dear Sir:

Attached is our final written report of the Reportable Deficiency under 10CFR50.55(e) referenced above.

Very truly yours,

E. E. Van Brunt

E. E. Van Brunt, Jr.
APS Vice President
Nuclear Production
ANPP Project Director

EEVB/TRB/nj
Attachment

cc: See Page Two



IE-27
1/1

cc: Richard DeYoung, Director
Office of Inspection and Enforcement
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

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FINAL REPORT - DER 84-64
DEFICIENCY EVALUATION 50.55(e)
ARIZONA PUBLIC SERVICE COMPANY (APS)
PVNGS UNITS 1, 2, 3

I. Description of Deficiency

ANPP procedure 73TI9ZZ03, Revision 2, requires an inspection of all safety-related shock suppressors within a six-month period prior to testing activities. Because shock suppressors for pipe supports 1-CH-027-H-00F, 1-CH-027-H-00P, 1-CH-027-H-AAU, 1-SG-048-H-008, 1-SG-148-H-011, and 1-SG-048-H-019 were found damaged after Hot Functional Testing, they were reinspected after the hot pump test and again found damaged such that they could not cycle through their thermal expansion travel ranges. These nonconforming conditions were documented on SFR/NCR 1SG-309/SM-4682. Subsequent to these findings, all other safety-related, similar sized shock suppressors were inspected. During this inspection, shock suppressors for pipe supports 1-AF-031-H-001, 1-CH-021-H-00B, 1-CH-027-H-0AL, 1-SG-082-H-002, and 1-SG-169-H-006 were also discovered to be damaged and would not cycle through their thermal expansion travel ranges. These nonconforming conditions were documented on SFR/NCR 1CH-743/SM-4734. All damaged mechanical shock suppressors were in the #1/4 or #1/2 size ranges.

Evaluation

The shock suppressors were analyzed to determine what caused them to "lock-up." The mechanical shock suppressors were shipped to the manufacturer, Pacific Scientific, for analysis. This analysis required dismantling the shock suppressors to determine the possible cause of failure. Results of the analysis are listed in Table 1. In discussing the results of the analysis with the manufacturer, they concurred that a "locked-up" suppressor could result from causes other than pipe overload. Damage as a result of mishandling, as defined in DER 83-19, often gives the results of an overloaded shock suppressor. With this consideration, the systems were analyzed to see if any erratic behavior of the system could possibly have caused a dynamic failure of the shock suppressors. No erratic behavior could be postulated in any of the systems except for the Main Steam System (SG) involving Items 4 through 8 in Table 1.

An analysis of the effects of the "locked-up" condition for Items 4 to 6 was performed. Since these were also discovered in a similar condition during Hot Functional Testing, the Hot Functional Testing results were analyzed using data collected from the Piping Verification Group. Using the shock suppressors thermal travel settings as reference, the location of the pipe was documented before the test began, when the pipe was in its hot position, and again after the test was complete. The data was evaluated by Bechtel Engineering and determined that the pipe reached its intended thermal travel and the shock suppressors "locked-up" during the cool down cycle of the testing mode. An analysis of the effect of the

"locked-up" condition on the piping system shows that no overstress occurred. This is documented in Calculation 13-MC-SG-507R. These damaged shock suppressors were then replaced and data was taken which indicates that the pipe experienced no permanent deformation or that overstressing occurred.

Items 1, 2, 3, and 7 through 13 were also replaced and data was taken which indicated that those affected pipes experienced no permanent deformation or that overstressing occurred.

The piping systems were then analyzed to determine the effect if the problem had not been corrected. Due to the uncertain manner in which the shock suppressors might react if the piping systems went through another thermal cycle, the shock suppressors were postulated as extending to the hot thermal setting and then locking up permanently. This condition would cause a restraint to occur and not allow the pipe to return to its cold position at each affected suppressor point when the thermal cycle was complete. Once this condition was postulated in each of the affected systems, the stresses in the pipe, nozzle loadings, and the loading conditions in the supports were analyzed. The results indicated in Table 2 postulate that a number of safety significant problems could possibly arise.

Summary

The reasons for these conditions are classified into two root causes.

(1) The analytical evaluation for Items 4 through 8 in Table 1 established that in points where the piping system rests (dead weight of system) on structural steel, a certain amount of friction was generated. When this excessive friction is overcome by the piping system during the thermal cycle, a dynamic jumping occurred. Normal practice is to design shock suppressors for seismic and steam hammer dynamic loadings only. The effects of friction are not considered in the piping analysis because definitive analysis of the effects of friction are not available during the design phase. The thermal dynamic loading is believed to have overloaded the shock suppressors and damage the internals, causing them to "lock-up." This condition is evaluated as an isolated case.

(2) For the shock suppressors involving Items 1 through 3 and 9 through 11 in Table 1, the cause could not be completely defined. Since mishandling during or after installation (Reference DER 83-19) is the most possible cause, these installations will continue to be monitored in compliance with the piping verification program instituted to monitor such uncertainties.

II. Analysis of Safety Implications

Based on the above, this condition is evaluated as reportable under the requirements of 10CFR50.55(e); since, if this condition were to remain uncorrected, it would represent a significant safety condition.

III. Corrective Action

A. SFR/NCR 1SG-309/SM-4682 for Unit 1 was dispositioned rework and all the shock suppressors have been replaced with the same size shock suppressors.

B. SFR/NCR 1CH-743/SM-4734 for Unit 1 was dispositioned rework and all the shock suppressors have been replaced with the same size shock suppressors.

C. Design Change Package 10S-SG-131, 2SS-SG-131, 3CS-SG-131 has been initiated to install low friction slide plates in critical positions, and to increase all shock suppressors from #1/2 to #1 for piping systems SG-048 and SG-039. The shock suppressors (#1/2), which are currently installed, are designed to function properly during a seismic event. For this reason, this action is not required for Mode 6, but must be implemented before Mode 4.

D. SFR 1SG-346 has been initiated to effectively monitor these shock suppressors during the next Heat-up/Cool-down cycle. This SFR also includes monitoring of the shock suppressors located in the CH system.

E. The AF System will be visually checked during subsequent cycles to verify proper operability requirements.

F. The APS Piping verification group will monitor those systems which have not been subjected to thermal cycles in accordance with 73PA-1ZZ04.

TABLE #1

| | TAG NO. | SERIAL NO. | SUPPRESSOR SIZE | ASSUMED CAUSE |
|---|---|---|---|---|
| 1. | 1-CH-027-H-00F | 18992 | 1/4 | Overload |
| 2. | 1-CH-027-H-00P | 9549 | 1/4 | Overload |
| 3. | 1-CH-027-H-AAU | 25983 | 1/4 | Overload |
| 4. | 1-SG-048-H-008 | 8892 | 1/2 | Installation Problem* |
| 5. | 1-SG-048-H-011 | 11503 | 1/2 | Overload |
| 6. | 1-SG-048-H-011 | 11500 | 1/2 | Overload |
| 7. | 1-SG-048-H-019 | 3741 | 1/2 | Overload |
| 8. | 1-SG-048-H-019 | 3733 | 1/2 | Overload |
| 9. | 1-AF-031-H-001 | 23317 | 1/4 | Overload* |
| 10. | 1-CH-021-H-008 | 6416 | 1/4 | Installation Problem* |
| 11. | 1-CHM-027-H-0AL | 5926 | 1/4 | Overload |
| 12. | 1-SG-082-H-002 | 10696 | 1/2 | Installation Problem* |
| 13. | 1-SG-169-H-006 | 21936 | 1/4 | Overload |

* This is Pacific Scientific's opinion; however, this assumed cause was not verifiable by Bechtel or APS in all cases.

TABLE #2

| HANGER NO. | PROBLEM |
|---|---|
| 12-CH-027-H-00F<br>13-CH-027-H-00P<br>13-CH-027-H-AAU | Piping stress is within the allowable range. Penetration No. 40 is okay also. Load on hanger H-00P exceeds snubber capacity. Two supports carrying downward load only have small positive Y-Load. |
| 13-SG-048-H-008<br>13-SG-048-H-011<br>13-SG-048-H-019 | Thermal stress alone in cold condition exceeds code allowable limits. Support loads have increased significantly. |
| 13-AF-031-H-001<br>13-SG-082-H-002<br>13-SG-169-H-006 | Piping stress meets code requirement. Nozzle load is exceeded. Pipe support for these hangers exceeds snubber capacity. Also, three other hangers have loads increased but are not overloaded. |
| 13-CH-021-H-008 | Movement is negligible. Therefore, no effect on system. |
| 13-CH-027-H-0AL | Piping stress is okay. Nozzle load is exceeded. The load at this hanger has increased over the allowable. Loads on other supports have increased slightly but are not overloaded. |