Arizona Nuclear Power Project
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December 14, 1984
ANPP-31489-TDS/TRB

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

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

Subject: Final Report - DER 84-40
A 50.55(e) Reportable Condition Relating To Unit 2 Auxiliary Feedwater Pump Has Corrosion.
File: 84-019-026; D.4.33.2

Reference: A) Telephone Conversation between J. Ball and T. Bradish on June 5, 1984
B) ANPP-29867, dated June 29, 1984 (Interim Report)
C) ANPP-30566, dated September 19, 1984 (Time Extension)
D) ANPP-30930, dated October 23, 1984 (Time Extension)

Dear Sir:

Attached is our final written report of the deficiency referenced above, which has been determined to be Not Reportable under the requirements of 10CFR50.55(e).

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
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U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

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FINAL REPORT - DER 84-40
DEFICIENCY EVALUATION 50.55(e)
ARIZONA PUBLIC SERVICE COMPANY (APS)
PVNGS UNIT 2

I. Description of Deficiency

The resolution of DER 83-66 required rework of all auxiliary feedwater pump impeller assemblies. Upon inspection by Bechtel Engineering at the Supplier's (Bingham-Willamette Co.) facility for rework as described in DER No. 83-66, it was noted that the impeller assemblies for Auxiliary Feedwater Pumps 2-M-AFA-P01 (turbine driven) and 2-M-AFB-P01 (motor driven) had areas of corrosion with the turbine-driven pump having the greatest concentration. Analysis of the deposits indicated the presence of bacteria associated with "Microbiologically Influenced Corrosion" or MIC. Examination of the pump cases for these pumps also showed evidence of corrosion.

Nonconformance Reports (NCRs) MC-2229 and 2230 were initiated to document the condition for the pump cases. The corrosion on the pump rotating assemblies had been noted upon receipt of the assemblies at the supplier's shop. A separate inspection plan (Engineering log numbers M021-230 and 300) and Purchase Order Revision to P.O. 10407-13-MM-021 were initiated to determine the extent of corrosion on the rotating assemblies, and to determine if the assemblies' safety function had been adversely affected.

Evaluation

A. Background:

Microbiologically influenced corrosion is defined as the deterioration of a metal by corrosion processes which occur directly or indirectly as a result of the activity of living organisms.

Microorganisms that influence corrosion are found in soils, in natural waters such as well water, in oil wells, in silty river bottoms, in municipal sewage systems, and in numerous industrial environments. These living bacteria can be carried into a system in dust or sand. There are various types of microorganisms that influence corrosion; some are anaerobic and others aerobic. The mechanisms whereby they influence corrosion vary with the type of microorganism and the type of material involved. The details of some of the mechanisms of MIC are not completely understood. Microbiologically influenced corrosion requires both moisture and nutrients to occur. It occurs in a pH range of 0 to 10.5 and only where the velocity is below 3 ft/sec. It can result from water being left in systems after hydrostatic test. Natural waters, particularly well waters, and soil, including airborne dust and sand, contain several classes of microorganisms that thrive in moist environments and greatly accelerate metal corrosion.

These bacteria, as with any living organism, require certain conditions for growth, including nutrients. Open cooling systems, such as cooling towers, have almost unlimited nutrient sources from the air and dead organisms after chlorination. In systems which carry demineralized water, only traces of nutrients are present after flushing has removed the dirt debris from the construction process. Therefore, those safety-related systems at PVNGS which carry demineralized water in unlined pipe do not have the most favorable conditions for MIC.

B. Inspection of Auxiliary Feedwater Pumps and Piping:

In order to determine the extent of damage from the effects of MIC in the auxiliary feedwater system and provide a basis for further inspection and repair, if necessary, NCRs MC-2229 and 2230 were interim dispositioned as follows:

1. Inspect with radiographs the areas in the auxiliary feedwater system piping which could be sensitive to MIC.

2. Inspect the pump casings using dye-penetrant examination and grinding to base metal.

The impact of MIC on the rotating elements was evaluated by Bingham-Willamette Co. in accordance with the inspection plan referenced above.

The inspection program per NCRs MC-2229 and -2230 showed no extensive corrosion of the pump casings from the observed corrosion. In addition, radiographs of weld metal, known to be particularly susceptible to MIC, showed no evidence of corrosion. Samples of water from the pump casings showed traces of MIC bacteria.

The pump rotating assemblies were examined by Bingham-Willamette Co. Any surface corrosion was removed by a sand-water slurry, and the components were dye-penetrant examined. Defects were noted and ground out to base metal. An evaluation of the conditions found showed that the ability of the rotating elements to perform their safety function was not adversely affected.

The turbine-driven pump had by far the greatest concentration of corrosion. This is attributed in part to the fact that the pump was never operated (non-availability of steam) and to an inadvertent condition which happened during startup flushing of the system. Both the suction and discharge lines from this pump were separately flushed with the pump isolated from this activity; however, as discovered later, some water had leaked into the pump and was left to stand in excess of six months. The pump was not drained after system flush because startup had no knowledge of this seepage. The pump had been approximately half full as indicated by the water line and existence of corrosion on only the lower portions of the pump casings.

During the Unit 1 auxiliary feedwater pump impeller assembly rework described in DER 83-66, this condition was not observed because these assemblies had not been exposed to a long period of standing water. The Unit 3 auxiliary feedwater pumps have not yet been exposed to water at PVNGS.

C. Root Cause:

The root cause of the condition was the undetected retention of flushing water in the feedwater pump casings after the startup flushing operation of the feedwater system. This stagnant water contained sufficient microorganisms, and nutrients, to initiate and sustain a microbiological influenced corrosion process.

II. Analysis of Safety Implications

Evaluations of the rotating elements by Bingham-Willamette Co. and of the pump casings by Bechtel Material and Quality Services have determined that the existence of MIC did not adversely affect the capability of the auxiliary feedwater system to perform its safety-related function.

The auxiliary feedwater system uses demineralized water. Although conditions for bacterial growth existed, no corrosion had occurred. If left undetected, additional use of the system would have eliminated the conditions for growth.

Whereas MIC bacteria probably exists in other safety-related systems at PVNGS the conditions that existed in the auxiliary feedwater system are no more hospitable or inhospitable due to the startup flushing and testing.

Based on the above, this condition is evaluated as not reportable under the requirements of 10CFR50.55(e) or 10CFR Part 21 since if left uncorrected would not represent a safety-significant condition.

III. Corrective Action

This problem is isolated to the Unit 2 auxiliary feedwater pumps.

In accordance with the final dispositions of NCRs MC-2229 and MC-2230, the Unit 2 pump cases were cleaned of corrosion.

All parts of the Unit 2 rotating assemblies will either be cleaned or replaced at the vendor's facility.

The PVNGS Startup Manager has been requested to assure that flushing procedures ensure adequate system cleanliness and to notify PVNGS chemistry whenever there exists the possibility that any safety-related system could be left in a wet, untreated condition for a period in excess of one week. PVNGS chemistry will assure that proper operating and lay-up water chemistries are maintaned to minimize the potential for microbiological and other forms of corrosion.

The PVNGS Operations Managers have been requested to review applicable operating procedures to assure that for shut down periods in excess of one week measures will be implemented to ensure that proper operating and lay-up water chemistries are maintained in safety-related systems to minimize the potential for microbiological and other forms of corrosion.