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ANPP-31149-TDS/TRB REGION V I&E

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

Attention: Mr. D. F. Kirsch

Subject: Final Report - DER 84-68
A 50.55(e) Reportable Condition Relating To The Essential
Chiller Temperature Switch.
File: 84-019-026; D.4.33.2

Reference: A) Telephone Conversation between L. Miller and K. Parrish on
September 10, 1984
B) ANPP-30785, dated October 10, 1984 (Interim Report)
C) ANPP-30996, dated October 29, 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, Jr.
NPS Vice President
Nuclear Production
ANPP Project Director

EEVB/TRB/nj
Attachment

cc: See Page Two

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Mr. D. F. Kirsch
DER 84-68
Page Two

cc: Richard DeYoung, Director
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FINAL REPORT - DER 84-68
DEFICIENCY EVALUATION 50.55(e)
ARIZONA PUBLIC SERVICE COMPANY (APS)
PVNGS UNITS 1, 2, 3

I. Description of Deficiency

During the integrated safeguards pre-operational test program the Train "A" Essential Chiller 1-M-ECA-E01 failed to re-start after a simulated loss-of-power (LOP). Two unrelated conditions caused this failure:

- A. Bearing temperature switches that protect the chiller motor from overheating will trip after a LOP. After restoration of power, these switches will remain in the trip position until the sensed temperature is at or below reset temperature of the switches. Normally, bearing temperature is above this reset point.
- B. The chiller is equipped with a 20-minute start-to-start anti-recycle timer circuit. This circuit allows restart of the chiller in 2-1/2 minutes instead of 20 minutes, only if one of the following two conditions is met:
 - 1) If the chiller had been operating for 20 consecutive minutes prior to shutdown, or
 - 2) The previous start occurred longer than 20 minutes before the re-start.

Evaluation

A. Temperature Switches

- 1) The installed temperature switches were Robert Shaw Model No. MP11. They are factory calibrated so that they open (trip) at 221°F and do not close again until the lower "re-set" temperature at 168°F is reached. Their internal circuitry is designed so that on LOP the switch opens (trips), independent of the sensed temperature, and does not close upon return of power unless the temperature is below 168°F.
- 2) These temperature switches have been or will be replaced with a Robert Shaw Model No. MP33 that will close (remove trip) when power is restored after a LOP if the sensed temperature is below the trip point. Accordingly, Unit 1 temperature switches TSH-503, -504, -505, -506, -593, and -594 were replaced with the Robert Shaw Model No. MP33. It should be noted that only TSH-505 and -506 monitor high thrust bearing

oil temperature, and that only TSH-505 failed to go out of the "trip" position after recovery from a LOP event. TSH-503 and -504 monitor high motor temperature and TSH-593 and -594 monitor high refrigerant discharge temperature. Only TSH-505 was sensing a temperature above the re-set point at the time of LOP. Subsequent essential chiller tests have proven that these switches meet all their functional requirements.

- 3) The root cause of this problem is that the Essential Chillers were equipped with temperature switches that will remain in a trip position after a momentary loss of power, even though the sensed temperature is below the trip point. This condition was not addressed by either the Bechtel Purchase Specification or information provided by Carrier.

B. Start-To-Start Circuit

- 1) As described previously, the Essential Chiller will not re-start for a 20-minute period if it has not been running for 20 minutes prior to the re-start attempt. This feature has been purposely installed by the chiller's manufacturer by means of a start-to-start anti-recycle timer. This device (a 20-minute timer) and its associated circuit assures that the chiller cannot repeatedly be re-started at intervals less than 20 minutes, since motor overheating and its subsequent deterioration would result. This feature had been recognized during the design of the chiller's start circuit. Accordingly, a 30-second by-pass (within the Balance of Plant Engineered Safety Actuation System (BOP ESFAS sequencer) of the previously mentioned 20-minute motor re-start protection timer had been provided. However, the chiller itself has an "internal" sequencer that does not allow it to start until typical parameters such as sufficiently high lube oil pressure are present.
- 2) During the pre-operational tests it was noted that this chiller start sequence can last as long as 2-1/2 minutes. Therefore, a 2-minute time-delay relay was installed across the motor re-start protection timer. This now provides for a total of 2-1/2 minutes bypass across this timer and allows a re-start of the chiller when required subsequent to a LOP event, even though the criteria of no re-start for 20 minutes has not been met. This override has been approved by the chiller's manufacturer, Carrier Corporation, as long as it is used infrequently.

During normal plant operation two chiller re-starts within a period of less than 20 minutes can only occur under the conditions listed below:

- a) During repetitious testing
- b) If a SIAS (which starts the chiller) is followed in less than 20 minutes by a LOP. In that case a one-second load shed occurs, stopping the chiller. Then the chiller must re-start.
- 3) The root cause of this problem was the assumption at the time the chiller start circuit was designed, with the override of the 20-minute start-to-start anti-recycle timer, that the chiller's "internal" start sequence will not last longer than 30 seconds.

II. Analysis of Safety Implications

A. Temperature Switches

The originally installed bearing temperature switches could prevent Class 1E equipment from performing its function in a timely fashion. It is estimated that under some circumstances it would take more than 30 minutes before the sensed temperature has decreased to the reset point, causing the switch to go to "normal" and allow the chiller to re-start. 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.

This project also has evaluated this condition as reportable under 10CFR21.21(b)(3). This report addresses the reporting requirements of the regulation with the exception of subpart VI, regarding the number and location of such components supplied to other facilities.

B. Start-To-Start Circuit

Based upon the deficiency evaluation, the condition is considered as not reportable under the requirements of 10CFR50.55(e) and/or 10CFR Part 21 as discussed below:

- 1) If the override of the 20-minute start-to-start anti-recycle timer fails, the chiller will re-start either in 2-1/2 minutes or 20 minutes, depending upon how long the chiller had been operating previously.

- 2) The maximum elapsed time of 20 minutes for the chiller to re-start will not cause overheating of any safety-related component.

III. Corrective Action

A. Temperature Switches

The new temperature switches (Robert Shaw Model No. MP33) were installed into both Unit 1 Essential Chillers (1-M-ECA-E01 and M-ECB-E01) as per Field Change Requests 83.027-M, 83.028-M, 83.029-M, and 83.030-M, which have been incorporated into Dwgs. Nos. M723-1, M723-2, M723-20, M723-289.

The corresponding Unit 2 and 3 temperature switches will be replaced per DCPs 2SE-EC039 and 3CE-EC039.

B. Start-To-Start Circuit

The Unit 1 start-to-start anti-recycle timer was overridden by means of Field Change Requests 83.218-M, 83.219-M, and 83.220-M which have been incorporated into Dwgs. No. M723-20, M723-22, M723-289.

The corresponding changes for Unit 2 and 3 will be made per DCPs 2SE-EC039 and 3CE-EC039.

IV. References

Letter, October 5, 1984, United Technologies Carrier to Bechtel MIC No. 233362.