Arizona Nuclear Power Project
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October 15, 1985
ANPP-33720-TDS/TPS

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

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

Subject: Final Report - DER 85-25
A 50.55(e) Reportable Condition Relating
to Auxilary Feedwater Pump Turbine Quick Start Failure
File: 85-[illegible]216; D.4.33.2

Reference: A) Telephone Conversation between A. Hon and T. Siegfried on August 6, 1985
B) ANPP-33392, dated September 3, 1985 (Interim Report)
C) ANPP-33551, dated September 23, 1985 (Time Extension)

Dear Sir:

Attached is our final written report of the Reportable Deficiency under 10CFR50.55(e), referenced above. The 10CFR21 Evaluation is included in this report.

Very truly yours,

EE Van Brunt Jr/NH

E. E. Van Brunt, Jr.
Executive Vice President
Project Director

EEVB/TPS/ldf
Attachment

cc: See Page Two

Ltr Encl
Add: EDO 1 1
ACRS 1 1
ELD 1 1
IE19 1/1 NRR/DE/SGEB 1 1
Add

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FINAL REPORT - DER 85-25

DEFICIENCY EVALUATION 50.55(e)

ARIZONA NUCLEAR POWER PROJECT (ANPP)

PVNGS UNITS 1, 2, 3

I. Description of Deficiency

As documented in Startup Field Report No. 2AF-5471, during performance of Unit 2 Hot Functional Testing (HFT) per test procedure 91HF2AF01, the turbine-driven Auxiliary Feedwater Pump (2AFA-P01) tripped on overspeed when starting from a cold condition after receiving an Auxiliary Feedwater Actuation Signal 2 (AFAS 2). This failure was not repeated on subsequent AFAS 2 starts when the system was hot, nor was it experienced when starting on AFAS 1 either hot or cold. AFAS 1 pertains to steam generator 1 and AFAS 2 actuation circuit pertains to steam generator 2.

In order to maintain water inventory during emergency operation when the main feedwater system is inoperable, and to provide feedwater for the removal of decay heat under accident conditions, the turbine-driven auxiliary feedwater pump shall be capable of delivering full flow to the steam generators within 29 seconds regardless of power condition after receipt of an AFAS.

EVALUATION

The steam for the auxiliary feedwater pump turbine is supplied from either steam generator upstream of the Main Steam Isolation Valves, (MSIV's) via 6-inch steam supply valves UV-134 and UV-138 for Steam Generator 1 and 2 respectively. The discharge flow from these valves is combined into a common header and fed through the turbine Trip and Throttle (T&T) valve prior to entry into the turbine. One inch steam bypass valves UV-134A and UV-138A are installed around UV-134 and UV-138 respectively, and open 10 seconds prior to actuation of the steam supply valves. The bypass valves perform the following functions:

1. Pressurize the steam supply line and roll the turbine up to a speed sufficient to develop the oil pressure needed to operate the hydraulic actuator, and

2. With the time delayed opening of the steam supply valves UV-134 and UV-138, allow the governor to take control on the bypass steam to prevent turbine overspeed.

Whenever an AFAS is generated from either steam generator, the corresponding bypass valve with its steam supply valve will open automatically in sequence to start the turbine-driven auxiliary feedwater pump.

The six inch steam supply lines branch off from the 28 inch main steam headers at elevation 132'-0". Steam traps SGN-M02 and SGN-M03 drain the condensate collected at the low point of the main steam headers between the steam generator 1 and MSIV SG-UV-180 and steam generator 2 and MSIV SG-UV-171 respectively. The two supply lines are connected to a six inch header at elevation 88'-1" and enter the Auxiliary Feed Pump Turbine at elevation 83'-9 1/4". A steam trap (SGN-M23 and SGN-M24) is provided on each supply line to drain any condensate collected upstream of the

normally closed steam supply and bypass valves during normal plant operation. An excess flow check valve (AF-XCV-101) located upstream of the T&T valve is provided in order to drain any condensate which is collected in the section of the piping between the steam supply valves and the inlet nozzle of the turbine, after supply valves are closed and the system is not in operation. Another excess flow check valve (AF-XCV-102) is provided to drain the T&T valve body. The system also has several fully open or partially throttled manual valves to provide drainage of the turbine casing, the steam ring and the exhaust pipe.

Since the turbine had undergone satisfactory quick start from a cold condition on steam from Steam Generator 1 alone, steam supply piping unique to Steam Generator 1 and piping common to both steam generators were eliminated as the cause of the problem. Likewise, the turbine drains, including the excess flow check valves, were ruled out as the cause. The design of the steam supply piping and its drainage system unique to Steam Generator 2 was reviewed and determined to be adequate to remove condensate prior to startup. In particular, a survey of horizontal runs in the supply piping indicated there was no need to rework this piping since water pockets could contain no more than a total of one gallon.

Further investigation of this problem has revealed that the steam trap SGN-M03 on the steam generator 2 steam header supplying steam to the pump turbine was inoperable during the performance of the AFAS 2 quick start test. It has also been concluded that the operability of Steam Trap SGN-M23 during the performance of the test could not be categorically established. Since these failures occurred while the plant was in Hot Functional Testing, with the turbine stop valves closed, and the steam bypass and the atmospheric dump valves being cycled to control primary pressure and temperature, the flow of steam through the main steam headers was not continuous. While the steam flow was interrupted steam traps SGN-M02 and M03 were required to remove resulting condensate.

Since the operability of Steam Trap SGN-M23 could not be ascertained, it is postulated that the steam header supplying steam to the auxiliary turbine of AFAS 2 had a buildup of condensate which was admitted into the turbine in addition to the normal amount of steam condensed in the cold piping. The vertical section of the supply line alone, upstream of the normally closed valve can hold approximately 40 gallons of condensate. Only a small portion of this water was removed by the turbine drain system during startup. Most of it had to go through the turbine and discharged out the exhaust stack. While the turbine was being accelerated to normal operating speed under control of the governor, water inside the turbine acted as a retardant. Due to this impeding effect, the governor valve went to wide open to achieve the programmed ramp speed. As soon as the water was cleared, i.e. the impeding medium was removed, the turbine suddenly accelerated and the govenor valve responded by closing to prevent overspeed. With a 4.5 second ramp, the governor failed to catch the turbine before it tripped.

Based on the above evaluation, the root cause for the failure is determined to be excessive water getting into the turbine as a result of the inoperability of steam traps, which restricted the steam flow through the turbine during cold startup.

Unit 1 has not had any significant problems with steam traps. The failure of steam traps in Unit 2 can be attributed to a system cleanliness problem carried over from the construction/startup phase and is considered an isolated incident.

II. Analysis of Safety Implications

Based on the above, this condition is evaluated as reportable under the requirements of 10 CFR 50.55(e) and 10 CFR 21 since, if this condition were to remain uncorrected, it would represent a significant safety condition. While this condition has not affected Unit 1, the equipment in Unit 2 has been turned over to operations and therefore it has been determined reportable under 10 CFR 21. (This report addresses the reporting requirements of both regulations.

III. Corrective Action

In order to assure proper operation of the Auxiliary Feedwater Pump Turbine during cold quick start, the following corrective actions have been completed.

a. All Unit 2 steam traps have been inspected and serviced in accordance with work order SWA 18097.

b. To minimize the discharge of steam into the room and to provide maximum drainage capability, the turbine manual drain valves have been realigned for plant normal operation as follows:

1. AFV-158, 159, 161 Full open to maximize drainage
2. AFV-160 1/8 turn open to minimize water hammer
3. AFV-155 1/2 turn open to reduce steam in room
4. AFV-157 1/2 turn open to reduce steam in room
5. AFV-162, 163 closed to prevent steaming

A Drawing Change Notice (DCN) No. 68 to P&ID 13-M-AFP-001 has been issued to implement this realignment.

c. The governor ramp time has been increased from 4.5 seconds to 12 seconds to allow more time for a slug of water to clear the turbine. At the same time, the SGA-UV138 time delay (agastat setting) was reduced from 10 seconds to six seconds to keep the time required for delivery of full flow to the steam generators within 29 seconds. The revised timing is addressed in EER 85-AF-032. Drawing Change Notice (DCN) 29 to 13-E-SGB-001, and DCN 29 to 13-E-SGB-002 have been issued.

d. The Unit 2 pump/turbine has been repeatedly cold quick started without water hammer and tripping on overspeed using SGA-UV138A and SGA-138 (AFAS 2). In addition to preop starts, five successive cold quick

HFT starts were successfully completed. Within 23 seconds of receiving an AFAS 2, the turbine-driven Auxiliary Feedwater Pump was able to deliver full flow to the steam generator.

e. As a long term corrective action, the operability of Steam Trap SGN-M23 and M24 will be routinely demonstrated on all three units as part of the surveillance testing (Test 41ST-2AF02) of the auxiliary feedwater pumps per Technical Specification Section 4.7.1.2. AFAS-1 and AFAS-2 are tested on an alternating basis at a frequency of once a month. If any problems with steam traps are identified during these tests they will be resolved by operations engineering per the Technical Specification requirements.

REFERENCE

1. Startup Field Report 2AF-5471 (NCR No. SM-5932)
2. P&ID 13-M-AFP-001 Rev. 20
3. Procedure 91HF2AF01
4. Terry Turbine Instruction Manual, Bechtel Log No. 10407-M21-158