Arizona Public Service Company

September 26, 1984
ANPP-30662-TDS/TRB

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

Attention: Mr. T. W. Bishop, Director
Division of Resident
Reactor Projects and Engineering Programs

Subject: Final Report - DER 84-49
A 50.55(e) Reportable Condition Relating To Auxiliary Feedwater System Experiences Hydraulic Resonance.
File: 84-019-026; D.4.33.2

Reference: A) Telephone Conversation between P. Narbut and T. Bradish on August 1, 1984
B) ANPP-30445, dated September 6, 1984 (Interim Report)

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.
APS Vice President
Nuclear Production
ANPP Project Director

EEVB/TRB/nj
Attachment

cc: See Page Two

IE07 1/1

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

T. G. Woods, Jr.
D. B. Karner
W. E. Ide
D. B. Fasnacht
A. C. Rogers
L. A. Souza
D. E. Fowler
T. D. Shriver
C. N. Russo
J. Vorees
J. R. Bynum
J. M. Allen
A. C. Gehr
W. J. Stubblefield
W. G. Bingham
R. L. Patterson
R. W. Welcher
H. D. Foster
D. R. Hawkinson
R. P. Zimmerman
L. Clyde
M. Woods
T. J. Bloom
D. N. Stover
J. D. Houchen
J. E. Kirby
D. Canady

Records Center
Institute of Nuclear Power Operations
1100 Circle 75 Parkway, Suite 1500
Atlanta, GA 30339

FINAL REPORT - DER 84-49
DEFICIENCY EVALUATION 50.55(e)
ARIZONA PUBLIC SERVICE COMPANY (APS)
PVNGS UNITS 1, 2, 3

I. Description of Deficiency

During preoperational testing of the auxiliary feedwater pumps, the piping system connected to both the motor-driven and turbine-driven Q-Class pumps (Tag Nos. 1MAFBP01 and 1MAFAP01) experienced hydraulic resonance when operating in the normal miniflow configuration with the first discharge block valve open and the regulating valves closed (See attached sketch).

The piping system resonated due to hydraulic resonance in the pump suction line. The high vibration and the asssociated noise have been witnessed by visual and aural observations and documented by instrument records. Nonconformance Reports (NCRs) SM-4497 and SM-4500 were issued when the deficiency was discovered. During additional testing, it was observed that this unstable condition disappears when either the mini-flow is increased or the first discharge block valve is closed.

The Auxiliary Feedwater System is designed to provide emergency feedwater to the steam generators following a main steam line break, a main feedwater line break, or a tube rupture in the steam generator. Sustained pump operation is not permissible with the high vibration and noise levels observed due to the risk of damaging the pumps and other safety-related components of the system.

Evaluation

Based on detailed evaluation of the available data, it is concluded that the resonance was the result of:

a) The pump being located approximately one-fourth wave length from the dead end formed by the regulating valves.

b) The pump, when operating at mini-flow, is operating essentially on a flat head-discharge curve.

c) Some secondary flow source in the pumps, created by operating at much below the design point, is the energy source for the resonance.

The two acceptable methods available for the resolution of this problem are:

a) Detune the piping system by moving the regulating valves to the immediate vicinity of the block valve, or

b) Place the mini-flow operating point at a position on the head-discharge curve where a positive slope exists to minimize surging.

After careful evaluation, method 'b' was selected to resolve this problem. This method was evaluated as the most effficient and feasible to accomplish.

The multistage orifice in the train "A" and train "B" mini-flow return lines were individually modified in gradual steps to increase the mini-flow in 50/25/25/15 gpm increments and tne pumps were tested at each flow rate. Acceptable conditions were reached when the measured mini-flows were 260 gpm and 238 gpm for pumps A and B respectively. This corresponds to an increase of 125 gpm and 103 gpm over the 135 gpm minimum flow rate specified by the supplier of the pumps.

The Combustion Engineering (C-E) Interface Requirements specify that auxiliary feedwater at a flow rate of 875 gpm be delivered to the steam generators following the initiation of an Auxiliary Feedwater Actuation Signal (AFAS). Based on the C-E requirements, the manufacturer of these pumps has guaranteed the pump performance at 1010 gpm at 3280 feet TDH. C-E has performed an analysis and has accepted 750 gpm feedwater delivery in lieu of the previously established 875 gpm to allow for increased mini-flow.

II. Analysis of Safety Implications

The Auxiliary Feedwater System is essential for plant safety. It delivers emergency feedwater to the steam generators for removal of decay heat from the Reactor Coolant System under accident conditions.

The system is required to operate in the configuration described in Section I in the following modes:

1) Periodic testing

2) After steam generator water level has been restored following an AFAS

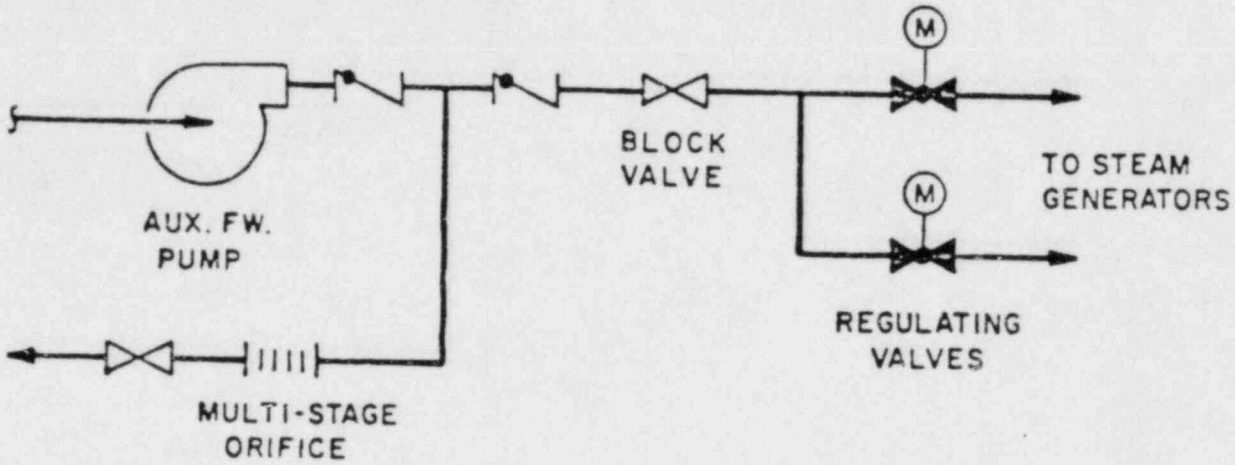
Based on the above, this condition is evaluated as reportable under the requirements of 10CFR50.55(e); since, if this condition were to remain uncorrected, it would represent a significant safety condition.

The project has evaluated this condition as not reportable under 10CFR21, since the system had not been turned over for use by operations.

III. Corrective Action

Bechtel's Revision 3 to the C-E interface requirements (Bechtel Log No. N001-22.01-9) and SAR Change Notice 1239 have been initiated to reflect the change in the flow to the steam generators from 875 gpm to 750 gpm.

Due to the nature of the problem, mini-flow must be individually adjusted for each pump to reduce the vibration to acceptable limits. The mini-flow at the operating point shall not exceed 260 gpm which corresponds to 750 gpm to the steam generators. NCRs SM-4497 and SM-4500 have been final dispositioned accepting the tested vibration level and mini-flow on pumps 1MAFBP01 and 1MAFAP01 respectively. Units 2 and 3 will be addressed by NCRs and adjusted during startup testing on a case-by-case basis.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