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ACCESSION NBR:8103170507 DOC.DATE: 81/03/06 NOTARIZED: YES DOCKET #
FACIL:STN-50-528 Palo Verde Nuclear Station, Unit 1, Arizona Publi 05000528
STN-50-529 Palo Verde Nuclear Station, Unit 2, Arizona Publi 05000529
STN-50-530 Palo Verde Nuclear Station, Unit 3, Arizona Publi 05000530
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VAN BRUNT,E.E. Arizona Public Service Co.
RECIP.NAME RECIPIENT AFFILIATION
DENTON,H.R. Office of Nuclear Reactor Regulation, Director

SUBJECT: Forwards Bechtel Power Corp & util final responses to open items re auxiliary feedwater sys review for facility. Responses were reviewed by Auxiliary Feedwater Sys Review Board & found to sufficiently address outstanding concerns.

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ARIZONA PUBLIC SERVICE COMPANY

P. O. BOX 21666 · PHOENIX, ARIZONA 85036

March 6, 1981
ANPP-17417 - JMA/TFQ

RECEIVED MAR 16 1981 U.S. NUCLEAR REGULATORY COMMISSION

Dr. H. R. Denton
Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2 and 3 Docket Nos. STN-50-528/529/530

Reference: Letter from D. F. Ross, NRC, to All Pending Operating License Applicants of NSSS Designed by Westinghouse and Combustion Engineering dated March 10, 1980

Dear Dr. Denton:

The final responses of Bechtel Power Corporation (Attachment A) and Arizona Public Service Company (Attachments B, C, D) to the open items of the Auxiliary Feedwater System Review for PVNGS are attached for your use. These responses have been reviewed by the Auxiliary Feedwater System Review Board and were determined by the Board to sufficiently address all outstanding concerns. The modifications which resulted from this review are described in Attachment E. Arizona Public Service Company's response to the referenced letter, which is also related to this system, will be provided by April 30, 1981.

In keeping with our prior discussions respecting the institution of this type of review, we consider it is appropriate to establish whether or not the Auxiliary Feedwater System description and analysis is satisfactory to the NRC staff, or more specifically, whether the NRC staff has sufficient information and understanding to write the appropriate section of the Palo Verde Safety Evaluation Report.

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If your staff has any questions which were not dealt with satisfactorily by the Review Board or by our future response to the referenced letter, we believe such questions should be raised promptly so that such subjects can be closed out completely.

Very truly yours,

E. E. Van Brunt

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

EEVBJr/TFQ/av
Attachments
cc: J. Kerrigan (w/attach.)
O. Parr (w/attach.)
G. Bradley, Sandia Labs (w/attach.)

STATE OF ARIZONA)
) ss.
COUNTY OF MARICOPA)

I, Edwin E. Van Brunt, Jr., represent that I am Vice President Nuclear Projects of Arizona Public Service Company, that the foregoing document has been signed by me on behalf of Arizona Public Service Company with full authority so to do, that I have read such document and know its contents, and that to the best of my knowledge and belief, the statements made therein are true.

Edwin E. Van Brunt

Edwin E. Van Brunt, Jr.

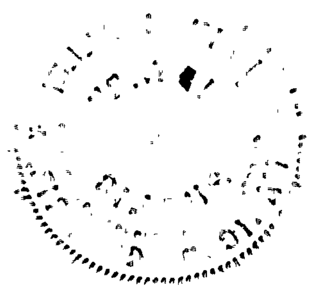
Sworn to before me this 9 day of MARCH, 1981.

John M. Allen

Notary Public

My Commission expires:

Jan 23 1983



Attachment A

Bechtel Power Corporation
Engineers – Constructors
12400 East Imperial Highway
Norwalk, California 90650
MAIL ADDRESS
P.O. BOX 60860 • TERMINAL ANNEX, LOS ANGELES, CALIFORNIA 90060
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B/ANPP-E-69604
MOC 138790
February 24, 1981

Arizona Nuclear Power Project
P. O. Box 21666 - Mail Station 3003
Phoenix, Arizona 85036

Attention: Mr. Edwin E. Van Brunt, Jr.
APS Vice President, ANPP Project Director

Subject: Arizona Nuclear Power Project
Bechtel Job 10407
Resolutions of Open Items from
Auxiliary Feedwater System Review Board
File: N.28.02

Reference: (A) Transcript of System Review Board, August 21 & 22, 1980
(B) Letter B/ANPP-E-67026, December 12, 1980
(C) Letter ANPP-17193-JMA/TFQ, January 30, 1981

Dear Mr. Van Brunt:

In response to Reference (C), enclosed are revised resolutions of the open items addressed at the System Review Board meeting for the Auxiliary Feedwater System held on August 21 and 22, 1980.

Very truly yours,

BECHTEL POWER CORPORATION

W. H. Wilson
Project Manager
Los Angeles Power Division

GFK:pb

Enclosures: Revised Resolutions of Open Items Addressed at System Review Board Meeting (24 pages, 4 copies)

cc: F. W. Hartley
D. B. Fasnacht
J. M. Allen
W. F. Quinn
N. Hoefert
A. C. Rogers
D. Thornburg
M. L. Hodge
R. Turk (CE)
M. Barnoski (CE)
All w/enclosure

REVISED RESOLUTIONS OF OPEN ITEMS ADDRESSED AT
SYSTEM REVIEW BOARD MEETING
FOR AUXILIARY FEEDWATER SYSTEM

ACTION #1

Verify results of Bechtel's pipe analysis showing that auxiliary feedwater piping can withstand the thermal shock of introducing the 40°F to 180°F auxiliary feedwater into the hot main feedwater line (this refers to Exhibit 1A-9, Item 23) (pages 50-51).

RESPONSE

The piping junction of the main feedwater line and the auxiliary feedwater line is classified as ASME Section III, Class 2. The rules of ASME Section III subsection NC, apply for stress calculations. The SA (stress allowable) found in subsection NC was developed to prevent plastic flow at either end of the temperature cycle. The rules do not take into account thermal gradients since the rules do not require thermal gradient calculations nor provide a method for such a calculation.

Bechtel's stress analysis, in accordance with subsection NC, allows for fatigue caused by thermal cycles by assigning a fatigue reduction factor to the SA. There will be 15,000 equivalent thermal cycles in 40 years, which results in a fatigue reduction factor of 0.8. The 15,000 cycles are based upon CE supplied transients plus 134 operations due to an AFAS.

The following table compares the allowable stress with the calculated stress for the Normal and Upset plant conditions (dead weight, thermal, seismic and pressure stress).

STRESS DESCRIPTION	CALCULATED STRESS	ALLOWABLE STRESS (including 15,000 Thermal cycles)	% DIFFERENCE
Secondary	15,230 psi	18,000 psi	15
Primary & Secondary	21,207 psi	33,000 psi	35

This demonstrates that the piping can withstand the thermal shock of introducing the $40^{o}F$ to $180^{o}F$ auxiliary feedwater into the main feedwater line.

ACTION #2

Re-examine the design of the piping from the main steam line to the turbine-driven auxiliary feedwater pump to assure the safest design is being utilized. Also verify whether there are cases where the high energy lines from one safety train are in the area of the opposite safety train (page 189).

RESPONSE

Check valve SG-V044 in the steam line passing through the train B motor-driven auxiliary feedwater pump room is being relocated from the train B pump room to the train A turbine-driven auxiliary feedwater pump room to enhance train separation of the pump rooms. An alternative to relocation of valve SG-V044 is to remove the steam line in the train B pump room and reroute the line above the 100 ft elevation of the main steam support structure. However, this alternative would then place the junction of the steam lines (one line from each steam generator) in the vicinity of the high-energy main feedwater lines. Therefore, a single high energy line break could eliminate both steam supplies to the turbine, and this violates separation criteria.

High energy lines from one train are separated by design from the opposite safety train. This separation is verified by high energy line break analysis and separation reviews. The Chemical and Volume Control System (CVCS) charging pumps, which are considered safety-related systems under certain circumstances, can not fully satisfy separation criteria since all three pumps discharge into a common header. However, since the High Pressure Safety Injection (HPSI) system provides backup capability for the CVCS, no change in design is required. This is the only instance in which one safety train has high energy lines in the vicinity of the other safety train.

ACTION #3

Is there an interface requirement to have a check valve to prevent cold condensate water from the startup pump from entering the economizer box on the steam generators? (pages 56-58)

RESPONSE

Combustion Engineering Document SYS80-PE-IR15, Rev. 4 (NSSS Interface Requirements for Main Steam and Feedwater Systems for Standard System 80), paragraph 4.1.2.4.8 states:

"Feedwater temperature shall be equal to or greater than 200°F prior to initiation of feedwater flow to the economizer nozzles during plant startup. The 200°F feedwater temperature shall be achieved prior to reaching 15% power. All feedwater at a temperature lower than 200°F shall be directed to

the downcomer feedwater nozzle. This requirement does not include post turbine trip conditions."

CESSAR Section 5.1.4M.18 requires that emergency feedwater shall be delivered to the downcomer nozzle via the downcomer feed line and requires a Safety Class 2 check valve upstream of the above connection in the downcomer line.

The above interface criteria are met in the PVNGS design by utilizing an extended range feedwater control system which controls feedwater using the downcomer control valve.

Cold water can not enter the economizer from the emergency feedwater pumps because of the check valves or from the startup pump because of the operating procedures during startup.

ACTION #4

Clarify plans to test the auxiliary feedwater system to identify the potential for waterhammer. Also, verify we do not plan to throttle back on the valves to prevent waterhammer. (Refers to NUREG-0635, p. III-26) (pages 61-62)

RESPONSE

Initial start-up testing of the auxiliary and main feedwater systems will include transient tests, such as pump trips, and emergency starts. Transient feedwater pressures will be recorded and pipe displacements will be measured

after each test phase. The system will be allowed to respond naturally, that is, no action will be taken to prevent or reduce water hammer by such means as throttling back on the valves during the test. In addition, the system will be monitored for vibration while operating normally during the startup testing program.

A description of the normal operation of the auxiliary feedwater system will be provided by APS.

ACTION #5

Do the hydraulic Institute Standards (HIS) allow the reducer to have the flat area on the bottom? (page 63)

RESPONSE

The HIS do not address the orientation of eccentric reducers on a pump suction when the suction piping runs vertically down to a pump. However, "Pump Handbook" by Karassik, Krutzsch, Fraser, and Mersina, McGraw Hill (1976) in Figure 9, page 13-8, shows the proper orientation of the reducer to be with the flat area on the bottom.

ACTION #6

How do you prevent feeding the intact steam generator with water from the startup pump when the plant is at zero power? (pages 166-167)

RESPONSE

This action was closed in the meeting and the response is presented on page 167 of the transcript.

ACTION #7

Verify that the tech specs will be clear to show that when the "B" diesel is out of service and the turbine drive is out that this will be an unacceptable condition. (page 68)

RESPONSE

Response to be provided by APS.

ACTION #8

Clarify how the tech spec requirements in CESSAR will be applied specifically to PVNGS so that PVNGS has tech specs with no cross references to CESSAR. (page 70)

RESPONSE

Response to be provided by APS.

ACTION #9

If the 135 gpm recirculation line is broken, does the condensate tank volume design meet the CESSAR interface requirement of having 300,000 gal. available to the intact steam generator. (pages 78-80)

RESPONSE

The condensate storage tank has 330,000 gallons of water dedicated for emergency feedwater use. A minimum of 300,000 gallons is required for orderly

shutdown. If the recirculation line should break, it would take approximately 3.7 hours to lose the 30,000 gallon excess at 135 gal/m. An orderly cooldown from reactor trip to shutdown cooling initiation at 75°F/hr takes approximately 3.5 hours. Therefore, with a recirculation line broken, there will still be at least 300,000 gallons of water available for emergency feedwater from the condensate storage tank at a cooldown rate of 75°F/hr.

ACTION #10

Provide the criteria or guidelines as to when the reactor operators can expect to have to take manual action to limit cooldown by the auxiliary feedwater system. (pages 171-172)

RESPONSE

1. Following receipt of an Axuiliary Feedwater Actuation Signal (AFAS) the operator should:

   a. Verify both pumps start and AFAS-1 and AFAS-2 valves open as required.

   b. Verify delivery of feedwater to steam generator(s) from Auxiliary Feedwater System (AFS) flow indication and wide range steam generator level response (steady or increasing).

2. After wide range SG level has stabilized (steady or increasing), immediately throttle both pumps to reduce total AFS flow to approximately 900 gpm (450 gpm to each SG if both are available).

3. Throttle AFS flow to the steam generator(s) as required to restore water level to the operating range while maintaining Reactor Coolant System (RCS) cold leg temperature (Tc) and pressure level within the control ranges of the Steam Bypass Control System (SBCS) and Pressurizer Level Control System (PLCS) respectively.

ACTION #11

Determine if a radiation monitor should be placed in the turbine driven pump steam exhaust line. (pages 88-89)

RESPONSE

The auxiliary feedwater pump turbine drive receives steam from the main steam lines under all operational conditions when the AFS is required to operate.

It is planned that each main steam line will be monitored using gross-gamma-reading exposed detectors to determine secondary steam radioactivity concentration. In conjunction with this concentration, steam flow to the turbine drive will be measured upstream of the pump. This will allow calculation of total and rate of release of radioactivity from the turbine driven auxiliary feedwater pump.

Contamination of the auxiliary steam system from the main steam system during AFS operation is prevented by a check valve in series with a locked-closed manually operated valve.

ACTION #12

Should a radiation monitor be placed in the recirculation line to the condensate tank from the auxiliary feedwater pumps to determine the radioactivity sent to the condensate tank when pump suction is from the Reactor Makeup Water Tank? (page 90)

RESPONSE

Both the Condensate Storage Tank (CST) and the Reactor Makeup Water Tank (RMWT) can receive demineralized water from the liquid radwaste system. This water will contain only slight amounts of tritium. This radioactivity can not be monitored by on-line detectors. Samples will be taken to determine radioactivity concentration. Therefore a radiation monitor is not required in the recirculation line to the CST from the auxiliary feedwater pumps when pump suction is from the RMWT.

ACTION #13

Evaluate whether the low level alarm on the condensate storage tank should be Class IE (safety related) and redundant. (pages 91-92)

RESPONSE

In accordance with the NRC letter of March 10, 1980, NUREG 0635 Appendix III paragraph 5.3.1, and Regulatory Guide 1.97, Revision 2, Bechtel recommends

an upgrade of the condensate storage tank level instrumentation. This will consist of changing the existing indication channel from non-Class IE to Class IE and adding a redundant Class IE instrument channel.

ACTION #14

If security is breached to the remote shutdown panel area, could a person take control away from the control room or is there some switching action required? (page 93)

RESPONSE

This action was closed in the meeting and the response is presented on pages 190 and 191 of the transcript.

ACTION #15

Has the auxiliary feedwater pump turbine drive been or will it be type tested? (page 95)

RESPONSE

The auxiliary feedwater pump turbine, Model GS-2, manufactured by Terry Steam Turbine Company, has had extensive operating experience. There are approximately 100 turbines of this model installed in various nuclear facilities around the world. The turbine case and rotor are the same design for all

Model GS-2 turbines. However, different sized steam nozzles are used, depending upon steam conditions and power output.

The PVNGS turbine has been tested as follows. The turbine has been seismically qualified by a shake test. The turbines have been shop tested in accordance with the ASME power test. Each load point test was conducted for one hour at stabilized steam conditions. The load point tests included tests at horsepowers greater than the rated horsepower. Plans are being prepared for environmental qualification of the turbine and control components.

ACTION #16

What inputs determined the 330,000 gal. condensate storage tank reserve? (i.e., was level instrument error and vortex formation taken into account?) (page 102)

RESPONSE

The interface criteria from CE is 300,000 gallons. A 10% conservatism factor has been added. Therefore the tank is designed for 330,000 gallons. All non-safety and pump recirculation lines penetrate the tank above grade at an elevation above the 330,000 gallon reserve to preclude draining the reserve by pipe rupture. When 300,000 gallons has been removed, assuming such a pipe rupture had drained all water except the reserve, there remains approximately 2'9" of water above the top of the feedwater pump suction piping.

The pump suction piping has a spool 2.5 pipe diameters long with a downward facing short radius ell on the end which precludes vortex introduction to the

suction piping until at least 330,000 gallons have been used. The ell on the suction piping is equivalent to the arrangement and submergence requirements which prevent vortex introduction to vertical pumps. The total theoretical available volume (to the opening of the ell) is approximately 347,000 gallons.

Instrument level set points are established such that the low-low level alarm (tolerance +0.5 ft, -0 ft) is at 377,000 gallons, which is a level corresponding to 375,000 gallons plus unusable volume. The alarm for an empty tank (tolerance +0 ft. -0.125 ft) is set approximately 8,500 gallons (or 8") above the level considered to meet the aforementioned submergence, although another 21,400 gallons can be withdrawn at less than design flow. In addition, the condensate storage tank is designed to be maintained at the design volume of 550,000 gallons by a level controller. The level controller (tolerance ±0.5 ft) will have the level valve fully open at a level corresponding to 337,600 gallons above the submergence level when the instrument is at the -0.5 ft tolerance.

Thus, level instrument error and vortex formation have been taken into account in the design of the condensate storage tank.

ACTION #17

What is the basis for the sizing of the safety relief valves on the condensate storage tank? (page 104)

RESPONSE

The safety relief valves were sized to relieve the nitrogen introduced into the condensate storage tank from a "fail-open" failure of the nitrogen regulating valve. The safety relief valves are redundant.

ACTION #18

Concerning the regulating and isolation valves -- would reliability be improved if only one of these valves was stroked? Determine this by comparing the complexity of the control systems needed to stroke 4 valves vs. the control system needed to stroke 2 valves. (pages 106-107)

RESPONSE

C-E interface requirements require that no single active component failure shall preclude isolation of the auxiliary feedwater system from the affected steam generator during auxiliary feedwater system design basis events. The logic used to determine the affected steam generator is the Engineered Safety Features Actuation System development of the Auxiliary Feedwater Actuation Signals (AFAS's). These requirements and the licensing requirements for separation and isolation mandate that each redundant pair of auxiliary feedwater regulating and isolation valves be controlled by the same automatic control logic for closure and opening. The design has also been reviewed to the intent of IEEE-279 to assure that no unnecessary interlocks, time delays or other complexities have been introduced into the ESFAS circuits.

Reliability considerations were employed to the extent practicable by using a minimum of initiation components to assure valve opening when required and by using redundant actuation components and a two-out-of-four initiation logic to meet the single failure requirements. Regardless of reliability considerations related to the operation of only one valve subsequent to the initial AFAS, the C-E criteria could not be met by operation of only one valve.

ACTION #19

Why does Valve UV-134 have 2 handswitches while UV-138 has 4 handswitches? (page 110)

RESPONSE

This action was closed in the meeting and the response is presented on page 194 of the transcript.

ACTION #20

Where do the floor drains in the auxiliary feedwater pump rooms drain to? What is the design basis for these floor drains? Does the radwaste system process this water? (pages 116-117)

RESPONSE

The auxiliary feedwater pump rooms drain to the non-ESF sump at the 40 foot elevation of the Auxiliary Building. The drain system is part of the radioactive drain system which inputs to the liquid radwaste system. The drain from the motor driven pump room has a valve that will be locked open. The turbine driven pump room drain also has a locked-open valve to allow condensate from the turbine to drain. Bechtel and APS agree that check valves will be provided in the drain lines from the auxiliary feedwater pump rooms to prevent backup into either pump room. The drains are 4 inch, in accordance with the PVNGS Design Criteria Manual, Section RD. The drains are not designed to drain water from any postulated line break inside the pump room.

Bechtel will provide check valves in the drain lines from the auxiliary feedwater pump rooms.

ACTION #21

Is the door between the AFW pump rooms designed for the pressurization caused by a break in one of those rooms? Is this door on the security system? Clarify the AFW pump room hatch design. (pages 119-122)

RESPONSE

The water-tight door between the AFW pump rooms has a design load of 38 feet of static head of water from either side, with a safety factor of 1.5. The room is 16 feet high. The door is monitored by the Plant Security System (PSS). There is a personnel access hatch to the motor driven pump room in the room ceiling. This hatch is also monitored by PSS. The personnel hatch can be opened from within or outside of the room. It is leak-tight and designed to withstand the downward pressure from a design basis accident in the main steam support structure (MSSS).

There is a steel equipment hatch for each AFW pump room. These hatches are also leak-tight and designed to withstand the downward pressure from a design basis accident in the MSSS.

ACTION #22

Clarify whether a low flow indication for the auxiliary feedwater pumps is required on the remote shutdown panel to provide runout protection for those pumps when the plant is in a condition where the remote shutdown panel is in

use. Include the instrumentation readouts that are available to determine pump runout conditions. (page 131)

RESPONSE

Indication of auxiliary feedwater flow to each steam generator is being added to each remote shutdown panel to provide runout protection.

The Remote Shutdown Room (RSR) is designed for use when the Main Control Room (MCR) cannot be used to achieve a cold shutdown condition. It is assumed that the operators have access to other plant areas, not only to operate equipment from a remote area, such as the switchgear room, but also to allow plant personnel to monitor equipment operation and communicate with the operators in the RSR.

Should there be an Auxiliary Feedwater Actuation Signal (AFAS), both pumps are started. Only one pump is required for shutdown, and the other pump is shut down or manually put on miniflow. Operating priority is given to the turbine driven pump, which is self-governing and prevents pump run-out.

Regardless of which pump operates, operator action is required to control steam generator level. The position of the flow control valves is indicated in the RSR, as is steam generator level. Should another AFAS occur on low level, indicator lights will alert the operator to valve movement and pump operation. Steam generator pressures are also indicated.

The design and operation of the RSR meets the design criterion to prevent run-out of the auxiliary feedwater pumps. The criterion is met by indication of auxiliary feedwater flow to each steam generator, priority operation of the turbine driven pump, operator control of flow to maintain steam generator level, and operator monitoring of the equipment.

ACTION #23A

Determine any reliability analysis differences due to the C-E Owners Group report results on steam generator boil dry time for System 80. (page 200)

RESPONSE

Mr. Turk of C-E stated (refer to page 199 of the transcript):

"These calculations, which were completed as part of the TMI owner's group, essentially calculated three boil dry times. The first was for a loss of main feedwater with loss of offsite power. This resulted in instantaneous reactor trips. Reactor trips as soon as feed is lost, and that results in the longest boil dry time of 24.9 minutes. A loss of main feedwater with power available and with the reactor cutback system operating, which also tends to reduce power prior to the trip and lengthen the boil dry time, has a boil dry time of 15.1 minutes. The worst case boil dry time, which would be a loss of main feedwater with no reactor cutback, is 7.5 minutes. The assumptions associated with this were end of core life, 1% MSR, steam generator blowdown maintained throughout, 100% initial power, the nominal low level steam generator set point, and in the two cases, besides the loss of offsite power the reactor coolant pumps operating, and in the loss of offsite power case, the reactor coolant pumps not operating."

The only effect that the boil dry time has on the reliability analysis is the remote manual start capability on the startup auxiliary feedwater train. The

other trains will be started automatically. Cases 1, 2, and 3 assumed manual starts on the startup auxiliary feedwater train. Case 2A assumed automatic start on that train.

In the reliability analysis, it was assumed that the operator had 15 minutes to remote manually start Train 3 for Cases 1, 2, and 3. With the assumed boil dry time of 20 minutes, a 5 minute margin was incorporated. Thus, for the loss of main feedwater (LMFW) due to loss of offsite power (LOOP) and AC blackout with LMFW, there would be no differences in the reliability analysis.

The LMFW with power available and with the reactor cutback system (which Palo Verde has) operating, the boil dry time is 15.1 minutes which still has no effect on the calculations.

For the worst case, LMFW with no reactor cutback, the boil dry time is 7.5 minutes. This case postulates an additional failure outside of the AFS. The reliability will be less, or the failure probability will be increased, because the operator error mean failure rate will be higher, i.e., 1.3E-1 per demand for 5 minute reaction time as opposed to the 2.7E-2 per demand for 15 minute reaction which was used in the reliability analysis.

Since the "human error" dominated the overall unavailability, it is difficult to qualitatively estimate this increase without numerical calculations. "Human error" was assumed to be the forgetting to reclose the full flow recirculation valve after a pump test as opposed to "operator error" which was an error in manual actuation of AFS from the control room in a post-accident situation.

Although the reliability of the cases involving manual starts on the startup auxiliary feedwater train will be less for LMFW with no reactor cutback, the order of preference among the alternatives will not change.

ACTION #23B

Determine if the required operator action to deliver the required auxiliary feedwater flow to the steam generator, when there is a pipe break downstream of the isolation valves, can be accomplished within the System 80 steam generator boil dry times.

RESPONSE

It is assumed that the postulated break occurs with both steam generators remaining intact and all four isolation valves open. There are two break locations downstream of the isolation valves which require two different operator responses:

A. Pipe between the isolation valve and either flow transmitter.

Both pumps discharge to the break. The low discharge pressure switch (Class 1E) on the motor-driven pump (Train B) is set at 1200 psi. This corresponds to a flow rate of approximately 1000 gal/min + 135 gal/min on mini-flow. If the operator does not read at least 1000 gal/min through the flow meters, he has a pipe break or crack in one of the rooms. Confirming this is a continued drop in steam generator level. (Note: An AFAS at a low steam generator pressure will result in a low pressure

alarm; the lower the steam generator pressure, the higher the flow, without any pipe breaks.)

The operator's first course of action after he ascertains a leak may exist is to close the cross-over flow control valves, HV-30 and HV-33. This action separates Train A from Train B. The intact flow path is indicated by the higher flow to one of the steam generators. In addition, the low pressure alarm will remain if the leak is in Train B, and disappear if the leak is in Train A. The operator then shuts the appropriate valve, HV-31 or HV-32, to isolate the leak.

B. Pipe break between the flow transmitter and the steam generator check valve.

Both pumps discharge to the break and, as in Case A, a low pump discharge pressure will be alarmed. The operator immediately determines the location of the leak by noticing the high flow differential between the two flow transmitters. The operator secures the appropriate valves to stop flow through the affected train. The operator must acknowledge the low pressure alarm and determine flow for either Case A or B.

We believe that the operator has sufficient information in the control room to detect and locate pipe breaks, has the means to isolate the break, and, since low pressure alarms may not be uncommon due to inherent characteristics of the system, the operator will have experienced low pressure alarms and can take appropriate action to ensure that sufficient auxiliary feedwater is supplied to the intact steam generator(s) before boil-dry.

ACTION #24

Correct Exhibit 2C-18 by adding the word "emergency" after necessary in Item 5. (page 160)

RESPONSE

Exhibit 2C-18 has been corrected and a copy provided for inclusion in the final transcript.

ACTION #25

Change "ASB" to MEB" on Exhibits 2C-1 through 2C-14. (page 141)

RESPONSE

Exhibits 2C-1 through 2C-14 have been corrected and copies provided for inclusion in the final transcript.

ACTION #26

Discuss the assumptions used to develop (a) the 875 gpm rate for the pump, (b) 75°F per hour cooldown rate on the steam generator for 8 hours and determination of the basis for the 300,000 gallon requirement for the condensate storage tank. (page 70)

RESPONSE

This action was closed in the meeting and the response is presented on pages 198 and 199 of the transcript.

ACTION #27

Describe the turbine speed control priorities between the control room, remote shutdown panel and local control. (page 136)

RESPONSE

This action was closed in the meeting and the response is presented on pages 195-197 of the transcript.

ACTION #28

Determine if the use of PVNGS specific design criteria instead of the design criteria stated for operating plants in NUREG-0635 would change the reliability study conclusions. (pages 235-239)

RESPONSE

The specific PVNGS design criteria state that the Q-Class auxiliary feedwater pumps shall be capable of delivering flow to the steam generators automatically upon receipt of an AFAS within 10 seconds when offsite power is available or within 45 seconds when offsite power is not available. If the non-Q-Class auxiliary feedwater pump is required to comply with the same criteria, then these times will preclude manual starts. Case 2, the manual starting of Train 3 including manual diesel generator loading, will then have the same reliability as Case 1. However, for Case 2 the non-Q-Class auxiliary feedwater pump is still available for manual loading on the diesel to prevent steam generator boil dry.

ACTION #29

Clarify the reliability of the auxiliary feedwater system to start and run for 8 hours and if this should be factored into the reliability analysis. (pages 239-240)

RESPONSE

The reliability of the auxiliary feedwater system was based on the requirements of NUREG-0635 page III-10, section 4.3 which states "The time interval

of interest for all the transient events considered is the unavailability of AFW systems during the period of time to boil the steam generators dry."

An additional analysis, based on an 8 hour operating time, would require the determination of log normal mean and standard deviation of site specific loss of offsite power duration time, the repair time distributions for failed hardware and the recovery time distributions for human error. Since all of the required information is not included in WASH-1400 or other available documents, some of the information would have to be generated as a part of the report.

It is not expected that the order of preference for the four cases will change as the result of a reliability analysis based on an 8 hour operating period. The primary reason is that the failure events whose recovery might take place in 8 hours and appreciably affect the calculations are outside the auxiliary feedwater system, thus would not affect the ranking of the design alternatives. Restoration of loss of offsite power and diesel generators are two dominant events outside of the auxiliary feedwater system.

In the event of station AC blackout, for instance, all cases are the same since only the steam turbine driven pump train is available. Restoration of the diesel generators would shift the cases to the loss of offsite power event and restoration of offsite power shifts all cases to the loss of main feedwater initiating event. The order of preference does not change for any of the above initiating events.

The dominant events within the AFS boundary are human error which especially affects Cases 1 and 2. The 8 hour time period makes the difference between

Cases 1', 2, and 2A negligible during LMFW and reduces the difference between Cases 2 and 2A during LOOP. None the less, the preference for the design alternatives would not change.

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Attachment B
(Response to Open Item #4)

ARIZONA PUBLIC SERVICE COMPANY

COMPANY CORRESPONDENCE

November 26, 1980
PVNGS-80-652-FWH/RRC

TO: J. M. Allen
Sta. # 3003

FROM: F. W. Hartley
Sta. # 4015
Ext. # 6300

SUBJECT: Throttling Auxiliary Feedwater Valves

File: 419.~~##~~ 06

Reference: ANPM-9885-JMA/TFQ

PVNGS does not plan to throttle back on AFAS valves to prevent water-hammer. Should an actual AFAS signal be received, the system would be allowed to function as designed; that is, pump and valve control would be automatic with no operator action. After automatic initiation, some operator action will be required to prevent overcooling of the reactor coolant system. This will be accomplished by throttling the auxiliary feedwater flow control valves to the steam generators, AF-HV30, 31, 32, and 33.

Some throttling may be done to accommodate surveillance testing, and normal start-up and shutdown when low flow rates may be required. Surveillance testing will require throttling of the auxiliary feed-water flow test valves to the condensate tank, AF-V018 and AF-V027. During normal start-up and shutdown, feed flow will be controlled by throttling AF-HV30, 31, 32 and 33 as required.

F. W. Hartley, Manager
PVNGS

RRC/pr

cc: T. L. Cotton
N. L. Hoefert
R. E. Younger
R. A. Bernier
G. C. Andognini (1740)
E. E. Van Brunt (3003) ✓

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Attachment C
(Response to Open Item #7)

ARIZONA PUBLIC SERVICE COMPANY

COMPANY CORRESPONDENCE

December 19, 1980
PVNGS-M80-RRC-70

TO: John Allen
Sta. # 3003

FROM: T.L. Cotton
Sta. # 4015
Ext. # 6328

SUBJECT: Auxiliary Feedwater System Review Open Item Response

File: 80-001-419.06

REF.: (1) ANPM-9968-JMA/TFQ dated November 18, 1980
(2) PVNGS-M-80-100-TLC/RWK dated December 4, 1980
(3) ANPM-10062-JMA/TFQ dated December 9, 1980

The above open item resulted from a concern expressed by Olan Parr of the NRC for the potential of having the steam-driven auxiliary feedwater pump and the B diesel-generator (which powers the motor-driven auxiliary feedwater pump) both inoperable at the same time. Reference (3) proposed a technical specification action statement in the event both auxiliary feedwater pumps were inoperable.

The existing CESSAR-F and PVNGS FSAR Technical Specifications already address the concerns raised by Mr. Parr and additional action statements are not required. Section 3.7.1.2 requires two auxiliary feedwater pumps and associated flowpaths to be operable in modes 1 through 4. Implicit in the definition of operable is the assumption that all necessary instrumentation, controls, normal and emergency power sources, etc., that are required for the system to perform its function are also capable of performing their related support functions. Therefore, in the event of loss of one auxiliary feedwater pump or one diesel-generator, the plant will already be in an action statement.

Please note also that the latest information available indicates that the non-safety auxiliary feedwater pump will be modified to allowing powering from the "A" diesel-generator. This will provide added assurance that there is a source of feedwater available.

Thomas L. Cotton
Engineering & Technical Services Supt.
Palo Verde Nuclear Generating Station
Station Number 4015

RRC:sj

cc: E.E. Van Brunt,
G.C. Andognini
F.W. Hartley
Hoefert
Kramer
J. Self
R. R. Clifford

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rev. 8-78

Attachment D
(Response to Open Item #8)

ARIZONA PUBLIC SERVICE COMPANY

COMPANY CORRESPONDENCE

December 19, 1980
ANPM-10132 - JMA/TFQ

TO: E. E. Van Brunt, Jr.
Sta. #

FROM: J. M. Allen
Sta. #
Ext. #

SUBJECT: PVNGS Auxiliary Feedwater System (AFS) Review
Response to Open Item
File: 80-001-419.06

Open Item #8 of the AFS Review Meeting asked how the technical specifications addressed in CESSAR-FSAR will be applied specifically to PVNGS so that the PVNGS-FSAR contains tech specs with no cross references to CESSAR-FSAR.

In accordance with Regulatory Guide 1.70, Revision 2, CESSAR-FSAR contains proposed technical specifications and their bases. These tech specs are consistent with the format and content of NUREG-0212, Standard Technical Specifications for Combustion Engineering Pressurized Water Reactors. These Tech Specs, along with Balance-of-Plant Tech Specs in the PVNGS-FSAR, will be reviewed and modified, if necessary, by the NRC staff, and will then be issued by the Commission as Appendix A to the operating license. This is required by 10 CFR, Section 50.36.

This response to the open item was discussed with Janis Kerrigan, NRC Licensing Project Manager for PVNGS. She concurred with the above resolution and she considered it unecessary for the PVNGS-FSAR to incorporate the tech specs addressed in CESSAR-FSAR.

John

JMA/TFQ/av

cc: G. C. Andognini
A. C. Rogers
A. C. Gehr
W. G. Bingham
C. Ferguson

AUXILIARY FEEDWATER SYSTEM

The modifications resulting from the Auxiliary Feedwater System Review are described below.

Even though there is not a CESSAR interface requirement to have a check valve to prevent cold condensate from the AFS startup pump from entering the steam generator economizer box, as stated in the Bechtel response to Open Item No. 3, we have decided to install the subject check valve. Two factors influenced our decision to make this design change; first, a recommendation to do so from Combustion Engineering and, second, the results of NUREG/CR-1606, which stated that a high probability of waterhammer existed for CE preheater steam generators.

A steam flow indicator will be installed in the auxiliary feedwater pump turbine steam line. This steam flow [illegible], in conjunction with the radiation concentration measured on the main steam line, will provide the amount of radiation being released through the axuiliary feedwater turbine exhaust.

The condensate storage tank level instrumentation will be upgraded from one non-Class IE indication channel to redundant Class IE instrumentation channels.

Manual valves on the auxiliary feedwater pump room drain lines will be locked-open and check valves will be installed to prevent backup into those rooms.

The design will be changed to provide the capability to manually load the startup auxiliary feedwater pump onto the "A" train diesel generator and to provide power to the suction valves for the startup auxiliary feedwater pump from the "A" train diesel generator.

The auxiliary feedwater pump bypass-test valve position indication will be provided in the control room to assure that the valves will be closed after the full flow surveillance testing.