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SUBJECT: Forwards discussion on 861224 reactor trip & util plans for resolution of plant protection sys power supply problem. Bistable relay power supplies will be tested monthly to detect failed power supplies.

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**Arizona Nuclear Power Project**
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February 13, 1987
ANPP-40122-JGH/BJA/98.05

Director of Nuclear Reactor Regulation
Attention: Mr. George W. Knighton, Project Director
PWR Project Directorate #7
Division of Pressurized Water Reactor Licensing - B
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Unit 2
Docket No. STN 50-529 (License No. NPF-51)
Plant Protection System Power Supplies
File: 87-F-056-026

Reference: (1) Telephone conversation between ANPP personnel and the NRC Staff dated January 15, 1987. Subject: Unit 2 Reactor Trip of December 24, 1986.
(2) Telephone conversation between ANPP personnel and the NRC Staff dated January 16, 1987. Subject: Unit 2 Reactor Trip of December 24, 1986.

Dear Mr. Knighton:

The referenced telephone conversations were held to discuss the PVNGS Unit 2 reactor trip that occurred on December 24, 1986. The NRC Staff concerns were in regards to the Plant Protection System (PPS) actuations and how the power supply problems contributed to the actuations. The attachment to this letter discusses the causes of the reactor trip and ANPP's plans for resolution of the PPS power supply problem.

If you have any questions on this matter, please contact Mr. W. F. Quinn of my staff.

Very truly yours,

J G Haynes

J. G. Haynes
Vice President
Nuclear Production



JGH/BJA/dlm
Attachment

cc: O. M. De Michele (all w/a)
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ATTACHMENT

On December 24, 1986, PVNGS Unit 2 was operating at 100% power when an automatic actuation of the PPS initiated a reactor trip. The PPS actuation also initiated all Engineered Safety Features (ESF) actuations with the exception of the Containment Spray Actuation Signal (CSAS) and the Auxiliary Feedwater Actuation Signal #2 (AFAS-2). Upon investigation, the cause of the PPS actuation was determined to be an intermittent ground on 125 volt DC bus M42 (refer to the attached figure). The ground fault on the M42 bus was caused by a loose indication bulb in an essential cooling water system control circuit. When the ground fault was initially received, it resulted in the inverter going into a zero output voltage condition and an automatic transfer of the D26 load from the inverter to the voltage regulator by automatic operation of the static transfer switch. When the M42 ground cleared, the inverter returned to its full output condition and the static transfer switch automatically transferred back to the inverter position. After the D26 load returned to the inverter, an "out of synchronization" condition occurred between the inverter output and the voltage regulator output. This condition is expected while re-synchronization occurs and the inverter was in this condition for approximately 1.5 seconds. When a subsequent ground was received on the M42 bus during the "out of synchronization" condition, the inverter again went to zero output voltage and the static transfer switch did not automatically transfer the D26 loads over to the voltage regulator. The response of the inverter and the static transfer switch during this event were the normal (as designed) responses and the equipment is designed to respond in this manner for equipment protection purposes.

The events described above resulted in a loss of power to 120 volt AC bus D26 which resulted in a loss of power to the PPS Channel "B" instrumentation and a loss of power to Power Supply 3 (PS-3) which provides an alternate power supply to the PPS Channel "A" bistable relays. Additionally, the other power supply for the Channel "A" bistable relays (PS-1) was in a degraded voltage or "lockdown" condition at the time that D26 lost power. Thus, power was lost to the Channel "A" bistable relays due to the loss of PS-3 concurrent with PS-1 being in the "lockdown" condition. The loss of power to the Channel "A' bistable relays and the Channel "B" instruments satisfied the "AB" logic matrix and resulted in the PPS actuation.

During the review of the event, ANPP identified the fact that the degraded voltage condition of PS-1 had gone undetected because the "lockdown" condition for the power supply occurs at a higher voltage than the alarm relay actuation voltage. ANPP recognizes that it is clearly undesirable for a failed power supply in the PPS to go undetected. Therefore, ANPP is pursuing a modification to correct this undesirable condition. It should be noted that the objective of this modification is to ensure that any credible power supply failure is alarmed so that the power supply can be promptly repaired or replaced.

The resolution of this problem involves the implementation of a modification to the existing bistable relay power supplies to ensure that the power supplies are latched to a low output voltage for the over voltage lockdown condition. This will result in a positive alarmed condition. This power supply modification is being implemented at the vendor's facility. The modified power supplies will then be sent back to PVNGS for installation in the units. Additionally, ANPP is considering a modification to the power supply alarm relays. This modification would involve replacing or modifying the existing alarm relays to ensure that the alarm relays actuate at a higher voltage. The alarm relay modification would provide further assurance that power supply failures would be alarmed. Due to the uncertainties currently involved in the scheduling and completion of these modifications, a schedule for completion cannot be provided at this time. However, the monthly testing described below will be continued until such time as the modification is completed.

In the interim, until such time as the power supply modification can be completely implemented, the bistable relay power supplies in PVNGS Units 1, 2, and 3 will be tested monthly to detect failed power supplies. It should be noted that this monthly testing will not be conducted when the units are in shutdown modes where the PPS is not required to be operable. If plant conditions are such that the power supply test cannot be conducted without jeopardizing safe plant operations, then the test will be postponed until such time as it can be safely performed. ANPP believes that this monthly test is an acceptable interim measure until the modification is completed. This conclusion is supported by a reliability analysis which ANPP has performed. The analysis indicates that the probability of subsequent PPS actuations due to the specific scenario experienced on December 24, 1986, (loss of one instrument bus and a failure of a specific bistable power supply) is 9.4E-06 per month per unit. This low probability of a subsequent similar event shows that the PVNGS units can be operated in a safe manner until the final solution can be implemented.

# POWER SUPPLY SCHEMATIC