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SUBJECT: Responds to NRC ltr re violations noted in insp rept 50-528/94-22,50-529/94-22 & 50-530/94-22.Corrective action: procedure 40ST-9ZZ16,routine surveillance daily midnight logs has been revised.

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WILLIAM L. STEWART
EXECUTIVE VICE PRESIDENT
NUCLEAR

102-03140-WLS/AKK/DRL
October 5, 1994

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
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Dear Sirs:

Subject: **Palo Verde Nuclear Generating Station (PVNGS)**
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
Reply to Notice of Violation 50-528/94-22-01
File: 94-070-026

Arizona Public Service Company (APS) has reviewed NRC Inspection Report 50-528/529/530/94-22 and the Notice of Violation (NOV), dated September 6, 1994. Pursuant to the provisions of 10 CFR 2.201, APS' response is enclosed. Enclosure 1 to this letter is a restatement of the NOV. APS' response is provided in Enclosure 2.

Should you have any questions, please contact Ms. Angela K. Krainik at (602) 393-5421.

Sincerely,

WLS/AKK/DRL
Enclosures:
1. Restatement of Notice of Violation
2. Reply to Notice of Violation

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ENCLOSURE 1

RESTATEMENT OF NOTICE OF VIOLATION 50-528/94-22-01

NRC INSPECTION CONDUCTED JUNE 12 THROUGH

JULY 23, 1994

INSPECTION REPORT Nos. 50-528/529/530/94-22

Restatement of Notice of Violation 50-528/94-22-01

During an NRC inspection conducted on June 12 through July 23, 1994, a violation of NRC requirements was identified. In accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," 10 CFR Part 2, Appendix C, the violation is listed below:

Unit 1 Technical Specification 4.3.1.1, Table 4.3-1, Item I.C.2,requires, in part, that once every 24 hours, with reactor power greater than 15 percent rated thermal power, the licensee adjust the core protection calculator (CPC) delta T power to agree with the calorimetric power calculation if the absolute difference is greater than 2 percent.

Contrary to the above, during a period from February 18, 1993, to June 19, 1994, when the reactor power was greater than 15 percent rated thermal power, the licensee did not adjust the CPC delta T power to agree with the calorimetric power calculation when the CPC channel D Delta T power was fluctuating with an absolute difference of greater than 2 percent.

This is a Severity Level IV violation (Supplement I) applicable to Unit 1.

ENCLOSURE 2

REPLY TO NOTICE OF VIOLATION 50-528/94-22-01

NRC INSPECTION CONDUCTED JUNE 12 THROUGH

JULY 23, 1994

INSPECTION REPORT Nos. 50-528/529/530/94-22

Reply to Notice of Violation 50-528/94-22-01

Reason for the Violation

During the performance of the calibration of CPC Channel D Delta T Power on June 19, 1994, questions were raised as to the validity of the calibration by a Control Room operator. Prior to June 19, 1994, the CPC Delta T Power signals had been averaged by Control Room personnel for determining agreement with the calorimetric. The averaging of this fluctuating signal was not proceduralized or a subject of formal operator training. The initial investigation identified that the exact method of determining an average for this signal varied between operators.

The validity of the calibration was questioned because the Control Room operator felt the fluctuations had become larger than before; and even after adjusting the average for the signal to within +/- 2 percent of actual power, the fluctuations would still cause the Delta T Power signal on CPC Channel D to periodically swing outside a band of +/- 2 percent. Because of this and the lack of written guidance on how to obtain an average for the signal, it was determined by the Control Room staff that the fluctuations should not be averaged. Thus, CPC Channel D Delta T Power could not be calibrated as required and the channel was declared inoperable. During the investigation a review of past data on CPC Channel D Delta T Power showed that fluctuations of the same magnitude have existed for several fuel cycles.

To calculate Delta T Power, the CPC's monitor several primary plant parameters. One of those parameters is hot leg temperature (T-h). T-h data is received from eight (8) Resistance Temperature Detectors (RTD). The RTD's are arranged with four (4) in each hot leg. Each hot leg is a 42 inch diameter pipe. The RTD's are inside thermal wells which protrude approximately three (3) inches into the process stream. The thermal wells are located at 45, 120, 240 and 315 degrees, respectively. An additional thermal well and RTD exists ten (10) inches closer to the steam generator inlet, in the top half of the pipe, and is used as an input to the Core Operating Limits Supervisory System (COLSS).

Each CPC channel receives one (1) T-h signal from each hot leg. For example, CPC Channel D receives T-h inputs from one (1) Loop 1 RTD and one (1) Loop 2 RTD. These signals are combined with signals from cold leg temperature, mass flow rate, and Reactor Coolant System (RCS) pressure to produce the Delta T Power calculation. The Delta T Power calculation is one (1) input to the Maximum Power Calculation auctioneering algorithm.

The Maximum Power Calculation auctioneering algorithm also receives two (2) other power signals (Neutron Flux and a twenty (20) percent minimum signal) and auctioneers the highest of the three (3) powers. The output of the Maximum Power Calculation is used in calculating Departure from Nucleate Boiling Ratios (DNBR)

and Local Power Density (LPD). The same T-h signals are also used as an input to the auxiliary trip logic for the generation of an auxiliary hot leg saturation trip. The auxiliary trip is provided when the highest T-h, including uncertainties, reaches or exceeds the saturation temperature.

Prior to declaring CPC Channel D inoperable, Unit 1 was operating at 86.08 percent actual power as determined by secondary plant calorimetric. The CPC Channel D thermal power indications were observed to be between approximately 81.6 and 86.6 percent power even though Unit power was not varying. This was attributed to fluctuations in one of the T-h RTD's (Loop 2) which supply a signal to CPC Channel D Delta T Power.

Prior to this event, APS Engineering had been investigating these fluctuations since January, 1991, when ABB Combustion Engineering (ABB-CE) responded to a request by APS for an explanation of a T-h anomaly which had been observed in Unit 1, Loop 1. The response described the normal coolant temperature stratification effects which occur in reactor hot legs and the effects and postulated cause for the phenomenon known as the Hot Leg Temperature Anomaly.

Hot Leg Temperature Anomaly is a phenomenon observed in the RCS hot legs where temperatures measured at the same distance from the core exit, but at different radial locations, may differ by several degrees. Although flow at the core exit is highly turbulent and mixing is expected to be complete, hotter water from the center of the core and colder water from the periphery do not always mix completely. This shows as varying temperature readings.

ABB-CE's response concluded that the T-h trends in PVNGS Unit 1 were consistent with trends observed in other ABB-CE reactors. This caused APS Engineering to follow the changes in T-h RTD fluctuations and conduct several reviews to verify that the RTD's were accurately responding to temperature changes. At no time during these investigations did the results identify problems specific to the instrumentation.

On February 18, 1994, the investigation team concluded that:

- The RTD's were functioning correctly,
- There was no safety concern since the fluctuation did not cause the CPC system to perform its safety function in a non-conservative manner, and

- based on the available industry information and plant observations, the temperature variations seen in the hot legs were being caused by thermal-hydraulic effects of the phenomenon known as Hot Leg Anomaly or Hot Leg Stratification.

Recently, Nuclear Fuels Management (NFM) has identified the following:

- A three dimensional fluid dynamics model of a similar CE designed plant confirms that fluid exiting the reactor vessel is thermally stratified as it travels down the hot leg and the model predicts distinct thermal vortices in the region of the hot leg RTD's.
- Other plants using Core Protection Calculators have RTD's located only in the top half of the hot leg or use an averaging technique with top and bottom located RTD's.

Additionally, results of analysis of data collected from all three PVNGS units during the first two weeks of September, 1994 indicate that:

- Variations in CPC calculated thermal power are primarily caused by changes in hot leg temperature indications.

- Thermal power variations are most pronounced in Units 1 and 2 but also exist to some degree in Unit 3.
- Hot leg temperatures from RTD's located in the lower half of the hot leg piping indicate a higher degree of variability and lower relative temperatures than the RTD's located in the upper half of the hot leg piping.
- The actual average value of thermal power varies less than +/- 2 percent.

Based on the above, the root cause of this violation is management and operations failure to aggressively pursue all aspects of the Hot Leg Stratification problem. Management was aware through Plant Review Board (PRB) meetings of the problem with the CPC Channel D Delta T Power fluctuations, but was not fully aware that operators were having difficulty performing the calibration of the channel. Initial indications were that as long as the channel could be calibrated to within two (2) percent of calorimetric power, the CPC was operable. Because management was not fully aware and as a result, did not ask the right questions, they were not able to provide operators with the tools they needed to properly perform their jobs. The problem with the fluctuations was known to operators for several cycles. They were also aware that this issue had been reviewed by Engineering and

Plant Management with the conclusion that the instrument was performing properly. Operators, therefore, felt comfortable averaging the indication and did not raise the concern or the difficulty in calibration to management.

Corrective Actions Taken and Results Achieved

- When CPC Channel D was declared inoperable on June 19, 1994, a temporary modification, which substituted the COLSS Loop 2 T-h RTD with the CPC Channel D T-h RTD, was initiated. The Loop 2 T-h RTD creating the Delta T Power fluctuations was electronically switched with the COLSS T-h RTD. CPC Channel D was successfully calibrated and was declared operable at approximately 1812 MST on July 2, 1994.

- A new procedure, 40DP-90P28, "Dampening/Averaging of Instrument Fluctuations," was issued in August, 1994 to provide operators necessary guidance.

- Procedure 40ST-9ZZ16, "Routine Surveillance Daily Midnight Logs" has been revised to incorporate guidance for RTD inputs.

Corrective Actions That Will Be Taken To Avoid Further Violations

Engineering has made a recommendation to relocate the CPC channel A and D RTD's from the thermal well locations in the lower half of the RCS hot leg piping to the spare thermal well locations slightly closer to the Steam Generators and in the upper half of the hot leg piping. This recommendation is currently being evaluated for future consideration.

Date When Full Compliance Will Be Achieved

Full compliance was achieved on June 19, 1994 when CPC Channel D was declared inoperable.