October 26, 1999

MEMORANDUM TO: Stuart A. Richards, Director
Project Directorate IV
Division of Licensing Project Management, NRR

FROM: Dale F. Thatcher, Chief (Original /s/ by D. Thatcher)
Electrical Engineering Section
Electrical & Instrumentation and Controls Branch
Division of Engineering, NRR

SUBJECT: PALO VERDE 1, 2 & 3 - TECHNICAL SPECIFICATION CHANGE TO REVISE ALLOWABLE VALUES FOR REACTOR PROTECTIVE SYSTEM INSTRUMENTATION (TAC NOS. MA5645, MA5646 AND MA5647)

By letter dated May 26, 1999, Arizona Public Service Company (the licensee) has proposed a Technical Specification change to revise the Allowable Values in Section 3.3.1, Table 3.3.1-1, Item 12, "Reactor Coolant Flow, Steam Generator #1-Low" and Item 13, "Reactor Coolant Flow, Steam Generator #2-Low." The proposed change is required to reduce spurious reactor trips associated with the trip setpoint. The Reactor Systems Branch is separately evaluating the Technical Specification change to verify that plant protection is maintained.

The staff concludes that the proposed change to the low reactor coolant flow trip setpoint will reduce or eliminate unnecessary challenges to the reactor protection system (RPS). The change is, therefore, acceptable.

This action closes TAC Nos. MA5645, MA5646, and MA5647.

Attachment: As stated

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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CONTACT: Narinder K. Trehan, NRR/EEIB
415-2777

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
TECHNICAL SPECIFICATION CHANGE TO REVISE ALLOWABLE VALUES
FOR RPS INSTRUMENTATION
PALO VERDE NUCLEAR GENERATING STATION UNITS 1, 2, & 3
DOCKET NOS. 50-528/529/530

1.0 INTRODUCTION

The reactor coolant flow, (Steam Generator #1-Low Reactor Coolant Flow and Steam Generator #2-Low Reactor Coolant Flow) reactor protection system trips provide protection against a reactor coolant pump (RCP) sheared shaft event. A reactor trip is initiated when the differential pressure across the primary side of either steam generator decreases below a variable setpoint. The variable setpoint normally stays below the indicated differential pressure by a preset value called the Step function, unless limited by a preset maximum decreasing rate determined by the Ramp function, or by a preset minimum value called the Floor function. The Step function is the amount by which the trip setpoint remains below the input signal unless limited by the Ramp or Floor Functions. The Ramp function is the maximum permitted rate of decrease of the trip setpoint. The Floor function is the enforced minimum value of the trip setpoint. The trip setpoint ensures that the resultant power to flow ratio provides adequate core cooling to maintain departure from nucleate boiling ratio (DNBR) under the expected pressure condition for these events. There is a separate trip for each steam generator.

In 1986, Palo Verde nuclear units experienced two plant trips caused by spurious operation of the low reactor coolant flow variable trip. The system vendor, Combustion Engineering determined that the steam generator differential pressure signal includes a random noise component. The source of noise was believed to be related to the large fluid system acoustic waves propagating throughout the reactor coolant system (RCS), and randomly initiated by the natural turbulence of flow. Subsequent Technical Specification amendments changed the variable trip setpoint (Step, Floor, and Ramp functions) so that process noise could be accommodated without tripping the units. However, since 1992, all three PVNGS units have experienced multi-channel pre-trip alarms and/or single channel trips which are attributed to the differential pressure signal. Recent investigation shows that the differential pressure signal periodically rises approximately three psid in six to eight seconds and then immediately drops by as much as six psid in about two seconds. During this sequence, the variable setpoint will increase and then hold at the increased setpoint when the process signal drops back down. This often results in the average value of the process signal falling close to the setpoint. PVNGS data indicates that such pressure changes occur every 10 to 20 minutes. Depending on the magnitude of the pressure change, a pre-trip alarm or even a trip signal trip may occur. The frequency of these spurious trips appears to be increasing. This is attributed to the slowly increasing differential pressure across the steam generators over time, primarily due to steam generator tube plugging. As the differential pressure increases, the magnitude of the signal excursion due to the random noise component also increases. Therefore, as more steam generator tubes are plugged, the potential for a spurious trip increases. PVNGS Engineering has concluded that a change to TS Allowable Values for the Ramp, Floor, and Step functions (i.e., lowering the effective setpoint) will directly increase the operating range and reduce the trip

hazard associated with the random noise component. By letter dated May 26, 1999, Arizona Public Service Company (the licensee) proposed a Technical Specification (TS) change to revise the Allowable Values in Section 3.3.1, Table 3.3.1-1, Item 12 "Reactor Coolant Flow, Steam Generator #1-Low" and Item 13 "Reactor Coolant Flow, Steam Generator #2-Low."

2.0 EVALUATION

The Allowable Values in Technical Specification Section 3.3.1, Table 3.3.1-1, Item 12 "Reactor Coolant Flow, Steam Generator #1-Low" and Item 13 "Reactor Coolant Flow, Steam Generator #2-Low," will be changed from $\leq$ 0.118 psid/sec to $\leq$ 0.115 psid/sec for Ramp, from $\geq$ 11.7 psid to $\geq$ 12.49 psid for Floor, and from $\leq$ 10.2 psid to $\leq$ 17.2 psid for Step. The changes to Allowable Values for the reactor coolant flow trip function settings will provide a larger Step function between the process signal (indicated differential pressure) and the variable trip setpoint, while making the Floor and Ramp more restrictive. The overall effect of these changes will delay the RPS trip for low reactor coolant flow.

Chapter 15 "Accident Analysis," identifies one event that relies on the low reactor coolant flow trip. This event involves a single RCP sheared shaft with a loss of offsite power (LOOP). The licensee reanalyzed the single RCP sheared shaft with a LOOP to determine the effect of the delayed reactor trip. The reanalysis of the sheared shaft event determined that the overall effect of the changes to the Allowable Values for the low reactor coolant flow trip function was to delay the RPS initiated low reactor coolant flow reactor trip for this event from the current value of approximately 1.2 seconds after event initiation to approximately 2.5 seconds after event initiation. In addition, the licensee reanalyzed a second event that involves a large steam line break during full power operation with concurrent LOOP in combination with a single failure, and a stuck control element assembly. For this event, the change in the Allowable Values for the reactor coolant flow trip function results in a delay in the reactor trip from the current time delay of approximately six seconds after event initiation to a delay of approximately 11 seconds after event initiation.

The staff has evaluated the licensee's submittal and determined that the proposed change to the Technical Specification Allowable Values for the Ramp, Floor, and Step functions (i.e., lowering the effective setpoint) will directly increase the operating range and, thereby, reduce or eliminate unnecessary challenges to the RPS.

3.0 CONCLUSION

Based on the above, the staff concludes that the proposed change to the low reactor coolant flow trip setpoint will reduce or eliminate unnecessary challenges to the reactor protection system and the change is, therefore, acceptable.