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November 5, 1984  
ANPP-31054-TDS/TRB REGION V/8F

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 Reactor Safety and Projects

Subject: Final Report - DER 84-73  
A 50.55(e) Reportable Condition Relating To Logarithmic  
Circuit Cards In The Excore System.  
File: 84-019-026; D.4.33.2

Reference: A) Telephone Conversation between C. Sorenson and T. Bradish  
on September 25, 1984  
B) ANPP-30950, dated October 25, 1984 (Interim Report)

Dear Sir:

Attached is our final written report of the Reportable Deficiency under  
10CFR50.55(e), referenced above.

Very truly yours,

*EE Van Brunt* / *TSK*

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

EEVB/TRB/nj  
Attachment

cc: See Page Two

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Mr. T. W. Bishop  
DER 84-73  
Page Two

cc: Richard DeYoung, Director  
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U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

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FINAL REPORT - DER 84-73  
DEFICIENCY EVALUATION 50.55(e)  
ARIZONA PUBLIC SERVICE COMPANY (APS)  
PVNGS UNIT 1

I. Condition Description

SFR 1SE-191/NCR SM 4859 was initiated on September 7, 1984 to document a condition wherein instrumentation logarithmic circuit cards in the Excore Neutron Flux Monitoring System failed to meet the acceptance Criteria of Calibration Procedure 6276-1.

The drawer Calibration Procedure CP6276-1 requires that the test card be calibrated such that when the Log Calibrate Test Switch is set at the LCR-2 position the pulse amplitude should be "minus 800 millivolts." When the test card was set to provide the "minus 800 millivolts," the log calibrate card failed to meet its acceptance criteria for output voltage. It was also noted that double pulsing of the discriminator card occurred when it fires due to the test pulse. A single pulse output from the discriminator card is required. Corrective action involved replacement of three test cards which had incorrect resistors.

SFR 1SE-193/NCR SM-4927 initiated on September 17, 1984 reported that Channel B failed to meet its acceptance criteria for the LCR-2 position during performance of test procedure 92CM1SE04. The failure occurred in the Channel B safety circuit which included a test card having correct resistors. Subsequent troubleshooting determined that double pulses at the discriminator card were still a concern; the replacement of the incorrect resistors in the three test cards (Reference 1SFR 1SE-191/NCR SM 4859) with resistors per design did not correct the double pulses experienced during either testing periods.

Evaluation

The safety channels provide reactor power information over a range of  $2 \times 10^{-8}$  (Exp. -8)% to 200% of full power on a logarithmic scale, and over a range of 0 to 200% of full power on a linear scale. Reactor power level readings are obtained by monitoring neutron flux outside the reactor. Gamma radiation produces background noise in the neutron detector, but this noise may be suppressed since neutrons produce pulses of much greater amplitude than those produced by gamma particles.

The pulse amplitude due to neutrons is compared to a previously established threshold in the discriminator circuit. This threshold is representative of background noise for the specific plant. Adjustments in this threshold are normal procedure and are made, if required, during preoperational testing and during power ascension when actual fission and gamma action occurs.

Typical troubleshooting reported in SFR1SE-191/NCR SM-4859, to determine the cause for the double pulses, involved readjustment of the pulse amplitude to "minus 500 millivolts." When this adjustment did not eliminate the double pulses, further investigation discovered the incorrect resistor (R26) value, the double pulsing was determined to be associated with the initial selection of circuit components (e.g., resistors and capacitors) which must filter out background noises and account for high or low reactor cavity fluxes, changes in detector sensitivity, differing preamplifier gains, and differences in field cable AC attenuation. All of these variables are estimated during initial circuit design and adjustments are included which cover expected field conditions.

The root cause for the circuit deficiency involving incorrect resistors on three test cards is attributed to quality control deficiencies at the manufacturer's plant (Electro-Mechanics, Inc., New Britain, CT), Reference SFR 1SE191/NCR-SM4859. The root cause for the circuit problems of double pulses is a deficiency in the circuit adjustments which did not permit field adjustments to compensate for the above variables, Reference SFR 1SE193/NCR-SM4927.

## II. Analysis of Safety Implications

Since the actual output of the LCR card with the incorrect resistor was "double pulsing," the gain of the log circuit card could have been adjusted to provide a non-conservative indication of neutron flux activity (i.e., lower than actual). If the log circuitry had passed the pre-requisite testing in the delivered configuration, the safety trip for high logarithmic power (credited in the safety analysis for low power CEA ejection events) may not have met the performance requirements. This deficiency is considered safety significant and reportable under the requirements of 10CFR50.55(a).

The project has also evaluated this condition involving the incorrect resistors as reportable under the requirements of 10CFR21(b)(3) since the situation may have broader application to other manufactured and/or delivered units with the vendor. This report addresses the reporting requirements of the regulation, with the exception of subpart (vi) regarding the number and location of such components supplied to other facilities.

III. Corrective Action

Final disposition of SFR 1SE191/NCR SM-4859 replaced the deficient test cards for Channels A, B, and C and also replaced two spare cards in warehouse storage. The replacement test cards each included an R26 resistor as per design specifications.

A copy of this report will be sent to the supplier of the Excore Neutron Flux Monitoring System (Combustion Engineering, Inc.) and the manufacturer (Electro-Mechanics, Inc.) for notification of the Part 21 reporting evaluation.

Final disposition of SFR 1SE193/NCR SM-4927 modified the discriminator card of each safety channel (A, B, C, and D) with a change in the RC filter circuit, i.e., a new value of resistance R and capacitance C were substituted to eliminate the double pulses. The modification was completed at the jobsite for Unit 1. The same modification of the circuits will be performed at Combustion Engineering, Inc., Windsor, CT as required. Design drawings will be revised by the manufacturer to include the required circuit changes.

IV. Reference Documents

- (1) SFR 1SE-191/NCR SM-4859
- (2) SFR 1SE-193/NCR SM-4927
- (3) Instruction Manual N001-1304-46-6