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STN-50-530 Palo Verde Nuclear Station, Unit 3, Arizona Publi 05000530
AUTH.NAME AUTHOR AFFILIATION
STEWART,W.L. Arizona Public Service Co. (formerly Arizona Nuclear Power
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SUBJECT: Responds to NRC 941207 RAI re Thermo-Lag-related ampacity derating issues.

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Arizona Public Service Company
P.O. BOX 53999 • PHOENIX, ARIZONA 85072-3999

WILLIAM L. STEWART
EXECUTIVE VICE PRESIDENT
NUCLEAR

102-03433-WLS/AKK/NLT
August 1, 1995

U. S. Nuclear Regulatory Commission
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References: 1) Letter dated December 7, 1994, from B. E. Holian, Senior Project Manager, Project Directorate IV-2, USNRC/NRR, to W. L. Stewart, Executive Vice President - Nuclear, APS

2) Letter No. 102-02658, dated September 27, 1993, from W. F. Conway, APS, to USNRC

3) Letter No. 102-03211, dated December 22, 1994, from W. L. Stewart, Executive Vice President, Nuclear, APS, to USNRC

Dear Sirs:

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2, and 3
Docket Nos. STN 50-528/529/530
Response to the Request for Additional Information Regarding Thermo-Lag-Related Ampacity Derating Issues

By letter dated December 7, 1994 (Reference 1), the NRC requested Arizona Public Service Company (APS) to submit additional information to resolve open issues and concerns regarding the original analytical approach for ampacity derating determinations described in APS letter dated September 27, 1993 (Reference 2). Specifically, in Reference 1, the NRC questioned several aspects of the "watts-per-foot" methodology for ampacity derating determinations at PVNGS. APS is in the process of revising the cable derating analysis as part of the PVNGS design basis reconstitution effort. This effort recognized the need to utilize the latest industry-recommended cable derating methodologies and has, therefore, eliminated the watts-per-foot methodology previously utilized.

The revised analysis constitutes a review of power cables in trays, including those which are routed through raceways enclosed in Thermo-Lag, to verify that the respective ampere loadings do not exceed the derated ampacities. First, the ampere loading is being determined based on the characteristics of the downstream load equipment. The rated ampacity without the fire-barrier material will be determined for each power cable

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based on PVNGS design information. This approach utilizes industry-recognized cable sizing methodologies in conjunction with as-built variables such as cable size and tray fill. The ampacities are based on a maximum cable insulation design criteria temperature of 90 degrees Celsius. Finally, a derating factor will then be applied to account for the thermal effect of the fire-barrier material.

As discussed in our December 22, 1994 letter (Reference 3), derating factors utilized for Thermo-Lag at this time, will be based on the latest available industry data. Recent industry tests, consistent with draft IEEE P848 methodology, indicate derating factors in the range of 12% to 38%. Prior to applying the derating factors based on industry test results, APS will evaluate the configurations installed at PVNGS to those tested configurations for applicability.

APS is following the resolution of NRC issues associated with the draft IEEE P848 standard and the potential generic applicability of industry tests performed to date. Upon resolution, APS will determine to what extent specific details of cable, raceway, and fire-barrier features must be reconsidered to demonstrate specific test applicability to installed configurations. Detailed evaluations of the tested configurations will be performed in the future, as necessary, to justify the use of the existing tests and resulting data for derating PVNGS cables enclosed in Thermo-Lag. PVNGS does not intend to perform ampacity testing for Thermo-Lag enclosures at this time, and is resolving ampacity issues separately from the fire endurance issues. However, the revised analysis will be formatted in a manner that will permit rapid re-evaluation of conclusions as required. PVNGS will also consider whether or not the fire-barrier material is required to meet regulatory requirements and commitments and may remove Thermo-Lag barriers as warranted.

Please note that during the design basis reconstitution effort, cases have been identified where the load current through the cable exceeds the standard ampacity values derived utilizing the ICEA Standard P-54-440. Conservatisms inherent in this standard and more rigorous analytical methods of performing the calculation, including cable diversity considerations, are being evaluated. APS has documented and is evaluating these cases in accordance with the PVNGS corrective action program. Should it be determined that a reportable condition or an operability concern exists, APS will take appropriate action(s).

The NRC concerns documented in Reference 1 are addressed by adopting the new methodology as follows:

1. General Modeling Concerns: The thermal behavior of individual cables is considered with the new methodology, in contrast with the watts-per-foot method which considered only the overall behavior of the system.

2. Cable Loading Effects: The power density within the cable mass is accounted for in the new methodology by the selection of the appropriate ampacity for the particular configuration prior to the application of the derating factor, thereby accounting for power density and tray fill. Power density and tray fill parameters are readily available in design documents and databases at PVNGS.

3. Cable Tray Diversity Effects: The new methodology will consider the heat transfer behavior of individual cables thereby eliminating the concerns regarding cable diversity.

4. Extrapolation of Experimental Results: Experimental results which were the basis of the watts-per-foot methodology are not applicable with the new methodology. More recent tests which utilize draft IEEE P848 methodology more accurately isolate the insulating effect of the fire-barrier material as stated in Reference 1.

5. Documentation of Cable Types and Properties: APS recognizes the NRC's difficulty in identifying cable sizes with the information contained in the analysis previously provided to the NRC. APS will clearly identify each cable of interest, including the physical characteristics of each cable and the actual in-plant ampacity factors, in the revised analysis.

6. Validation of the "Watts/Ft" Method: As discussed above, APS is in the process of adopting a new methodology for ampacity derating determinations as part of the design basis reconstitution effort and, therefore, will not be extrapolating Stolpe data to validate the watts-per-foot method.

Should you have any questions, please contact Scott A. Bauer at (602) 393-5978.

Sincerely,

WLS/AKK/NLT/rv

cc: L. J. Callan
K. E. Perkins
B. E. Holian
K. E. Johnston