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SUBJECT: Forwards responses to equipment qualification audit open items, per NRC audit during wk of 871102.

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Docket Nos. STN 50-528/529/530

U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Document Control Desk

Subject: Palo Verde Nuclear Generating Station (PVNGS)
Units 1, 2 and 3
Equipment Qualification Audit Open Items
File: 87-A-056-026

Dear Sirs:

The NRC conducted an audit of the PVNGS Equipment Qualification (EQ) program during the week of November 2, 1987. Nine specific concerns were raised by the NRC at the audit exit meeting. At this time, ANPP has additional information to present on six out of the nine items. This additional information is contained in the attachment to this letter.

If you have any questions on this matter, please contact Mr. Brad Albert at (602) 371-4238.

Very truly yours,

E. E. Van Brunt

E. E. Van Brunt, Jr.
Executive Vice President
Project Director

EEVB/BJA/dlm
Attachment

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ATTACHMENT

ADDITIONAL INFORMATION ON EQUIPMENT QUALIFICATION
AUDIT OPEN ITEMS

1) NRC CONCERN:

Environmental qualification of nylon insulated wire connectors in Limitorque motor operated valve actuators with dual-voltage AC motors.

ANPP RESPONSE:

ANPP review indicates that there are approximately 62 Limitorque motor operated valve actuators with dual-voltage AC motors in each of the PVNGS units that are required to be qualified. These actuators are all located in outside containment areas. ANPP has initiated work activities to replace the nylon insulated wire connectors with environmentally qualified AMP butt splices and Raychem heat shrink sleeves. The goal is to replace all of the nylon insulated wire connectors prior to the end of each unit's first refueling outage. However, ANPP has demonstrated a 6 year qualified life for the nylon insulated wire connectors. Therefore, if ANPP is not able to replace the connectors prior to restart from the first refueling outage for each unit, then the connectors will be replaced by the end of their 6 year qualified life.

4) NRC CONCERN:

A general concern about split black plastic sheath on Anaconda flex conduit inside the Unit 1 containment with a specific concern on the conduit associated with pressurizer pressure transmitter RC-PT-103. The concern is in regards to the effect of moisture intrusion on the qualification of the transmitter seal.

ANPP RESPONSE:

The NRC concern on this item is best illustrated by a description of the specific concern associated with PT-103. During the Unit 1 walkdown, the NRC auditor found split jackets on the Anaconda flex conduit associated with PT-103. The concern was that the split jacket could allow moisture ingress into the conduit which would then condense and form a column of water above the Conax Electrical Conduit Seal Assembly (ECSA) to the pressure transmitter. ANPP explained that moisture intrusion during normal operations was not a concern due to the fact that the split jackets are normally repaired by taping. However, the NRC concern regarding moisture intrusion remained due to the fact that the tape is not qualified for a post-accident environment and failure of the tape would allow moisture intrusion into the conduit and a resulting water column on the ECSA. ANPP has not demonstrated submergence qualification of the ECSAs.

To resolve this problem, ANPP has initiated discussions with Conax. Conax stated that they have conducted submergence testing on the ECSAs. ANPP is presently in the process of obtaining a copy of the test report for our review. It is hoped that the Conax submergence testing will demonstrate full qualification of the ECSAs and that no other modifications will be needed for the Anaconda flex conduit.

5) NRC CONCERN:

The qualification files do not have adequate similarity documentation for certain solenoid operated valves supplied by Skinner.

ANPP RESPONSE:

ANPP has conducted a review to verify adequate similarity between the models subjected to qualification testing (model numbers V5H61090 and V5H61100) and the models supplied to PVNGS (model numbers V5H65590 and V5H65600). The results of the review indicate that the only difference between the model numbers are for the coil drawing numbers and the electrical housing types.

The difference in the coil drawing numbers between the tested and supplied models allows for different coil configurations inside the housing. The coil materials are identical and the difference in coil configuration does not affect the coil operability or its continuous operating temperature of 160°C.

The tested models use an electrical housing designated "EN". This electrical housing is used in low voltage DC and AC applications and uses a two pin AN electrical connector. This housing is normally specified for military applications. The supplied models use an electrical housing designated "EC". This electrical housing uses a 1/2 inch NPT conduit as required by Underwriters Laboratories and many local ordinances for most industrial, commercial and domestic applications where the valve is not otherwise enclosed. This is the only type housing approved for explosion-proof applications. The electrical housing is a metallic material and no non-metallic materials are affected by the difference in housings. There are no differences in size or weight between the housings.

In conclusion, based upon the above two differences between the model numbers, adequate similarity does exist between the model numbers to justify the qualification of the valves supplied to PVNGS. The similarity review will be included in the qualification files.

6) NRC CONCERN:

For the containment high range radiation monitors supplied by Kaman, provide an analysis of how the monitors comply with Regulatory Guide 1.97 requirements in light of the known transient error attributed to thermally induced noise currents. Additionally, the NRC was concerned that this inaccuracy could potentially mislead an operator during an accident.

ANPP RESPONSE:

Testing by the vendor has shown that the Mineral Insulated (MI) cables associated with the two containment high range radiation monitors (RU-148 and RU-149) are subject to a thermally induced current during temperature rises inside containment. The NRC was concerned that a temperature transient could result in erroneous radiation indications for RU-148 and RU-149 which could exceed the accuracy requirements of Regulatory Guide 1.97. Further investigation by ANPP has shown that this error source is potentially applicable to the primary coolant radiation monitors (RU-150 and RU-151) due to the essentially identical MI cables supplied.

As background into how these four radiation monitors are utilized during emergency situations, the Emergency Operating Procedures (EOPs) provide the following guidance on the use of the containment radiation monitors:

1) Procedure 41EP-1ZZ01 (Emergency Operations), Appendix D states that containment temperature, humidity, sump levels, radiation and containment pressure are used in the diagnostic as secondary indications of a loss of inventory.

2) Procedure 41RO-1ZZ07 (Loss of Coolant Accident) states in section 1.0, Verification of a LOCA, containment radiation levels increasing. This is one of the five items used to verify a LOCA.

3) In section 5.0 of 41RO-1ZZ07, a note states that during casualties where containment temperature reaches in excess of 200°F, instrument error may be encountered. The procedure goes on to direct the operator to monitor all available channels to ensure proper trending.

4) The control room operators utilize the Radiation Monitoring System (RMS) display in the main control room to monitor containment radiation levels. The RMS minicomputer develops 10 minute, 1 hour, and 24 hour averages for the individual radiation monitors.

6) NRC CONCERN: (Continued)

To arrive at the values for the thermal error source in the table below, ANPP utilized the following assumptions: i) The entire length of MI cable is simultaneously exposed to the most rapid temperature rise. This is a conservative assumption since the MI cables will not see the maximum temperature transient due to the fact that they are routed in four inch closed cable trays, ii) normal containment ambient temperature was assumed to be 80°F, iii) the LOCA temperature profile has a peak of 297°F at 90 seconds, iv) the MSLB temperature profile has a peak of 367°F at 84 seconds, v) the thermally induced error current was approximated as 0.25 pA per foot based on the rate of temperature rise experienced and the Kaman qualification report for the MI cable, vi) the current to radiation (R/hr) conversion factor is 0.1 R/hr/pA, and vii) cable lengths are given by the table below:

Radiation Monitor	Maximum Radiation Indication Due to Thermally Induced Current Error	Normal Operational Background Radiation	MI Cable Length (ft)
RU-148	6 R/hr	<1 R/hr	240
RU-149	6 R/hr	<1 R/hr	220
RU-150	4 R/hr	25 R/hr	145
RU-151	5 R/hr	25 R/hr	205

During a LOCA or MSLB event, the two high range radiation monitors (RU-148 and RU-149) may exceed the accuracy requirements of Regulatory Guide 1.97 for a short time into the event. During a LOCA, the inaccuracy would be approximately a factor of six and last for approximately 20 seconds. During a MSLB event, the inaccuracy lasts for the duration of the MSLB temperature ramp (84 seconds) plus the error current decay time (approximately 200 seconds) after the peak containment temperature is achieved. The total period of inaccuracy lasts for less than five minutes after initiation of the MSLB event. The ten minute average information, which the operator refers to per procedure, would reflect an error factor of less than four for the period of the MSLB anomaly. Succeeding ten minute averages, for the MSLB event, would be back to normal. A factor of six inaccuracy for twenty seconds during a LOCA event has an insignificant effect on ten minute average readings.

During a LOCA, a radiation alert alarm may be received as a result of the thermally induced noise currents. The operators would then consult their alarm response procedure which directs them to verify the alarm and then inform personnel of a possible radiation or contamination hazard. Verification of the alarm could involve a comparison of the radiation signals with other available radiation monitors and an inspection of the trend display for the monitors. Due to the duration of the thermally induced noise currents and the fact that the actual radiation lags the temperature ramp by approximately 20 seconds during a LOCA, the alert

6) NRC CONCERN: (Continued)

alarm will not clear. The radiation alert alarm will be replaced by a high radiation alarm as the radiation monitors detect the actual LOCA radiation levels. Therefore, we believe that there will be no observable dip in the indicated radiation levels during a LOCA.

ANPP will evaluate whether FSAR Table 1.8-1 needs to be revised to reflect the short duration exception to the accuracy requirements of Regulatory Guide 1.97 for radiation monitors RU-148 and RU-149. In spite of this short duration error source due to temperature changes, ANPP believes that the monitors will provide useful information to the operators during accidents. Additionally, ANPP believes that the MI cable is one of the best products commercially available for this application.

7) NRC CONCERN:

The qualification files for the Masoneilan transducers only contains a summary qualification report. A full qualification report should be included in the files.

ANPP RESPONSE:

ANPP has obtained the full qualification reports from the vendor. The reports have been reviewed and there were no deficiencies observed between the full test reports and the summary reports previously obtained from the vendor. ANPP will incorporate these test reports into the qualification files.

9) NRC CONCERN:

The concern on the Core Exit Thermocouples (CETs) was in regards to long-term degradation of the Litton connectors.

ANPP RESPONSE:

The Core Exit Thermocouple (CET) system was supplied to PVNGS by Combustion Engineering (CE) and was qualified under qualification program numbers 14273-PE-5800 and 14273-PE-5802. The CET System uses multi-wire Mineral Insulated (MI) cable and Litton connectors designed for in-containment use. The CET system consists of four channels of sensors located at the coolant exit from the active core region. Channel A (15 CET sensors) and Channel C (16 CET sensors) are routed to the Channel A cabinet via an isolation cabinet. Channel B (15 CET sensors) and Channel D (15 CET sensors) are routed to the Channel B cabinet via an isolation cabinet. Calculations for the two highest core exit temperatures in each core quadrant and an overall representative core exit temperature are performed by each microprocessor unit which is part of the Qualified Safety Parameter Display System (QSPDS). These parameters along with the individual CET signals are displayed in the main control room via the QSPDS Channels A and B displays. In addition, the representative core exit temperature is used, along with two other diverse temperature parameters, in the calculation of RCS subcooled margin.

CE letter to ANPP dated May 21, 1987 informed ANPP of the results of an investigation concerning post-accident uncertainties associated with Litton cable connectors used in the CET system. ANPP concurs with the CE assessment that the CET system continues to meet all operability requirements. The accuracy of $\pm$45°F is acceptable since the CET processing algorithm, included in the CE-supplied QSPDS, can accommodate the increased uncertainty while still providing useful information to the plant operators.

ANPP has reviewed the revised CE qualification report on the CET system. ANPP comments on the report have been transmitted to CE. ANPP is actively pursuing the resolution of these comments and CE has indicated that they expect to respond by the first week of December, 1987. Following CE resolution of the comments, ANPP will revise the qualification files to reflect the new revision of qualification program number 14273-PE-5800.