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Gentlemen:

HOPE CREEK EQUIPMENT QUALIFICATION PROGRAM
INSTRUMENT LOOP ACCURACY
HOPE CREEK GENERATING STATION
DOCKET NO. 50-354

During the recent NRC team inspection of the Hope Creek Equipment Qualification Program (NRC Inspection No. 50-354/88-03, January 25-29, 1987), an unresolved item was identified regarding safety-related instrumentation loop accuracy under Design Basis Accident conditions. In particular, the inspectors questioned the extent to which the effect of a worst case accident scenario on safety-related instrumentation loop accuracy has been considered. Time constraints precluded the inspectors from evaluating this item in detail during the inspection. PSE&G has requested, in conversations with NRC Region I subsequent to the inspection, the opportunity to provide additional information related to this issue. This information is provided herein.

PSE&G has always considered the requirements of instrument setpoint and loop accuracy under the most degraded environmental conditions. This consideration has been included in all phases of the design, engineering, procurement and installation of instrumentation circuits in order to minimize the effect of environmental stressors on instrumentation loop accuracy.

As part of the original purchase order specifications under which the equipment in question was obtained for Hope Creek, circuit operability requirements and the potential degradation to instrument accuracy due to environmental parameters has been addressed. The degradation of circuit operation was a major concern during the design process and the preparation of equipment and component specifications which led to the development of the purchase order specifications. This

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concern has been similarly addressed in the subsequent installation practices and operation and maintenance requirements applied to the instrumentation. Setpoint calculations were performed and instrument calibration methodology was developed to address loop accuracy requirements under various environmental parameters encountered during both normal and abnormal plant operation. The following list summarizes the major elements involved in our assessment and assurance of instrumentation loop accuracy for safety-related instrumentation which may be exposed to a harsh environment.

1. Design and engineering requirements which address the potential effect of environmental stressors on instrument accuracy.

2. Purchase order specifications and procurement methodology reflective of Item 1 above.

3. Equipment Qualification review of specified instrumentation and accuracy requirements versus tested parameters and its relation to installed conditions.

4. Analysis of insulation resistance (IR) and leakage currents encountered during cable qualification testing and its relation to installed conditions of equipment to ensure acceptable cable IR values.

5. Responses to NRC Information Notices and Bulletins relating to degradation of instrument accuracy, loop accuracy and setpoint limits.

6. Elimination of terminal blocks in junction boxes associated with instrument circuits in LOCA environments to avoid possible circuit degradation.

7. Installation of qualified instrumentation and circuit configurations utilizing nuclear grade Raychem WCSF splices and moisture intrusion seals.

8. Implementation of installation criteria and guidelines in Bechtel Document E-1408, Wire and Cable - Notes and Details, during construction.

9. Operation and Maintenance procedures.

Through implementation of these efforts, all known contributors to the degradation of instrument accuracy have been considered and included in the performance characteristics of the instrumentation and instrument loop circuits. To support this position, PSE&G has analyzed the loop accuracy of selected worst case instrument loops for safety-related instruments and

circuits. Instruments performing exclusively trip and post-accident monitoring functions to attain and maintain safe shutdown of the reactor were considered. Instrument setpoints, setpoint selection and loop accuracy calculations were performed with actual degraded parameters for various loop circuit elements involved.

Typical calculations were made for a Rosemount Transmitter and a Weed RTD on the basis of worst case design basis accident conditions of the circuits and loop elements. Degraded circuit parameters were obtained from the vendor qualification reports contained in the EQ documentation binders. Total loop allowance (TLA) was calculated as:

$$TLA = \sqrt{AL^2 + CL^2 + DL^2 + PEA^2 + PMA^2}$$

Where: AL = Loop Accuracy
CL = Loop Calibration Error
DL = Loop Drift
PEA = Primary Element Accuracy
PMA = Process Measurement Accuracy

Engineering judgement was employed in obtaining values for PEA and PMA.

No terminal blocks were evaluated as part of this effort as none are used in the drywell or in High Energy Line Break areas for safe shutdown instrument and instrument circuit terminations, unless included by the instrument suppliers and specifically tested in conjunction with the basic instrument qualification programs. Circuit analysis and loop accuracy calculations utilized maximum cable lengths of 1400 feet, 500 feet of which was conservatively assumed to be installed in the harsh environment.

For the Rosemount transmitter loop, the calculated inaccuracy at the trip unit was 0.00754% of span. The specific circuit analyzed by the calculation was not "typical" due to the inclusion of features intended to represent a worst case condition. For example, Hope Creek design does not typically use 1400 foot transmitter cables with 500 feet being exposed to LOCA conditions. Typically, transmitters of this type are located in rooms where the maximum temperature does not exceed 148°F. The worst case cable IR value was selected after thermal and radiation aging. The leakage currents across the terminal blocks within the transmitter were not considered in the calculation as their effect is enveloped by the EQ testing and device specifications.

For the RTD loop, the inaccuracy was calculated as 0.0196% of span. The assumptions for cable length were the same as those assumed for the worst case Rosemount transmitter loop. Additionally, the RTDs analyzed were the three-wire type with the third wire utilized as a reference. Should the resistance of the third wire change due to a degraded environment, the other two wires would experience a proportional change, thereby negating the potential detrimental effect on the instrument accuracy.

Other potential worst case instrument loops were evaluated (thermocouples, IRMs/PRMs). Due to the high input impedance values presented by the individual components in these loops, additional calculations were not deemed to be necessary. The Rosemount transmitter and Weed RTD calculations are available on-site for NRC review, if requested.

In conclusion, PSE&G feels that the above calculations and evaluations have indicated that instrument and loop accuracies under all conditions of plant operation, including DBA, are within acceptable calibration limits, instrument accuracy and transient overshoot. These efforts have confirmed that the measures which have been taken by PSE&G to assure safety-related instrument and instrumentation loop accuracy are valid.

If you have any further questions, please do not hesitate to contact us.

Sincerely,

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Attachment

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