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June 26, 1992

William J. Cahill, Jr.
Group Vice President

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES)
DOCKET NOS. 50-445 AND 50-446
DEVIATIONS IN ELGAR INVERTERS
SDAR: CP-92-004 (FINAL REPORT)

REF: 1) Telephone conversation between Mr. T. A. Hope of TU Electric
and Mr. L. A. Yandell of the NRC, Region IV, on June 11, 1992

Gentlemen:

On May 13, 1992, via facsimile, TU Electric notified the NRC of numerous manufacturing deviations in the Unit 2 IEEE Class 1E electric power inverters identified during preoperational testing. Reference 1 requested an extension to June 26, 1992, for submittal of our report to allow additional evaluation. Via Reference 1, the extension was granted by Mr. L. A. Yandell of NRC Region IV. TU Electric has determined that these deviations are indicative of a significant breakdown in the manufacturer's QA program which could have created a substantial safety hazard. Therefore, the deviations are considered reportable pursuant to 10CFR50.55(e).

Attached is the written report which satisfies the reporting requirements of 10CFR50.55(e). The report has been formatted in a manner that corresponds to the specific information requested by subparts (i) through (viii) of paragraph 10CFR50.55(e)(8). This is exclusive of that portion of subpart (viii) regarding the advice that has been or will be given to other facilities outside of TU Electric. Such advice would be dependent on the facilities' specific use and operating/maintenance history of the subject components.

A copy of this report will be sent to Elgar Corporation.

Sincerely,

William J. Cahill, Jr.

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Attachment

c - Mr. R. D. Martin, Region IV
Mr. L. A. Yandell, Region IV
Mr. T. A. Bergman, NRR
Mr. B. E. Holian, NRR
Elgar, San Diego, CA
Resident Inspectors, CPSES (2)

10CFR50.55(e) REPORTABLE CONDITION INVOLVING
ELGAR INVERTERS

(i) Information supplied by:

William J. Cahill, Jr.
TU Electric
400 North Olive Street, L. B. 81
Dallas, Texas 75201

(ii) The basic components are four Class 1E 10 KVA Elgar inverters, model number UPS 103-1-132.

(iii) The inverters described in (ii) were qualified and supplied to TU Electric by Elgar, San Diego, California.

(iv) Description

During the startup testing of IEEE Class 1E electric power inverters, numerous deviations were discovered as identified below.

- a) Failure in the inverter control circuit J7.
- b) Missing upgrade on circuit board.
- c) Incorrectly wound transformer on circuit board.
- d) Missing parts on circuit board J2.
- e) Poor crimp connections.
- f) Incorrectly supplied parts.
- g) Wiring errors.

Site Specific Summary

Item a): Failure in the Inverter Control Circuit J7.

The pulse width modulation drive circuit board, J7, of the inverter control circuit would not reliably control the gating of the silicon controlled rectifiers in the inverter circuit during the initial starting. As a result, the 300 amp DC supply fuse opened which isolated the inverter from its DC supply. Testing of J7 cards also identified integrated circuits (type 555 timers) on three different J7 cards that were not functioning correctly.

Elgar analyzed one of the suspect circuit boards and isolated the problem to a timing capacitor and an integrated circuit multivibrator used in the gate control circuits. These parts were determined to be inappropriate for the intended application.

Item b): Missing Record of Circuit Board J3 Modification

Elgar issued an Engineering Change Notice to change out a resistor and an integrated circuit on circuit board J3. There is no record of Elgar notifying CPSES of this change in the CPSES document control system. This change had not been implemented in Unit 2.

Item c): Incorrectly Wound Transformer on Circuit Board

During startup testing of inverters CP2-ECIVEC-02 and -03, a high in-rush current into the rectifier section was noted when the inverter was started. One of the suspect circuit boards was returned to Elgar for analysis. Elgar traced the problem to three transformers that were incorrectly wound.

Item d): Missing Parts on Circuit Board J2

Elgar issued an Engineering Change Notice to install a resistor on the J2 circuit board. When the new upgraded circuit boards were received on site they did not have all the parts required by the new design. Elgar issued a 10CFR Part 21 notification dated March 25, 1992, based on the above information.

Item e): Poor Crimp Connection

During startup testing of inverter CP2-ECIVEC-04, loose Molex crimp connections were discovered on four pins.

Item f): Incorrect Resistance Values R3, R4

Resistors shown in the Elgar literature as "field selected value" were substantially beyond their expected values during startup testing. The resistors were provided by Elgar and were selected during the initial factory testing. One of the resistors disabled the high ripple voltage alarm on capacitor bank C6. (High ripple voltage is an indication that a filter bank capacitor has failed or indicates problems in the charger section of the inverter). The other resistor disabled all of the inverter overload protection circuits.

Item g): Wiring Error in Inverter CP2-ECIVEC-03

During startup testing, transformer A2-T3 was discovered to have been connected incorrectly in inverter CP2-ECIVEC-03. This error resulted in an unstable rectifier control circuit which in turn resulted in unstable DC voltage regulation.

Item h): Cracked Solder Joints

Terminal strips were installed incorrectly on some of the circuit boards during manufacturing. When screws were installed, the solder joint connecting the terminal strip to the circuit boards would break.

Site Specific Implications

TU Electric believes that had these deviations remained uncorrected, random shutdowns of the inverters could have occurred during plant operations. This could have resulted in the loss of the Solid State Sequencer system, Hot Shutdown Panels indications, Main Control Board indication, Emergency Response Facility indications and various safety related valve position indications.

(v) The deviations (items iv a-h above) were identified as a group on CPSES Corrective Action document TUE 91-2209, Revision 3 on April 4, 1992. Previous revisions to the TUE documented single deviations associated with the inverters.

(vi) CPSES utilizes four Class 1E Elgar inverters in Unit 2. Their equipment numbers are as follows.

CP2-ECIVEC-01, 02, 03, and 04

(vi') TU Electric's corrective action for the eight items described above is as follows.

Item a)

Defective cards were returned to the vendor for rework. The reworked cards were installed in the inverters, retested and shown to operate in accordance with the design.

Item b)

Rework was completed by the vendor under P.O.#S0044458-7002.

Item c)

The charger gate drive circuit boards for CP2-ECIVEC-02 and CP2-ECIVEC-03 were sent to the vendor for rework under P.O.#S0040071-7S2. Cards were replaced and the inverters retested in accordance with the design.

Item d)

Missing parts on circuit board J2 were installed by the vendor.

Item e)

The vendor has reworked the bad crimps in inverter CP2-ECIVEC-04. Crimp connections in other Elgar inverters have been inspected and were considered satisfactory.

Item f)

The vendor will submit an Engineering Change Notice (ECN) to provide correct resistance values for resistors R3 and R4. DCA-85958 R/4 was initiated to implement the design change in accordance with information to be provided by the vendor under ECN-8208. The rework will be performed by the vendor on site.

Item g)

All other Elgar inverters were inspected. The vendor reworked the wiring transformer for CP2-ECIVEC-03. The reworked inverter was retested in accordance with the design.

Item h)

All circuit boards were inspected. Deficient circuit boards were reworked by the vendor on site.

A written report is being prepared by Elgar concerning these deviations and the actions needed to preclude recurrence. TU Electric will evaluate the report after issuance and implement any additional actions as required. The spare circuit cards for the 10KVA inverters presently onsite have had appropriate controls applied to preclude their use in Unit 1 and 2.

- (viii) The deviations identified via the Unit 2 corrective action document were discussed with Unit 1 Engineering personnel. A subsequent evaluation concluded that the deviations were not applicable to the Unit 1 equipment.