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GRIER,B.H. Region 1, Philadelphia, Office of the Director

mail

SUBJECT: Final deficiency rept re power generation control complex/ advanced control room cable connector.Insp program nearly complete.All Unit 1 cable repairs will be completed prior to fuel load.Unit 2 cables will be installed & repaired.

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TWO NORTH NINTH STREET, ALLENTOWN, PA. 18101 PHONE: (215) 821-5151

September 29, 1980

Mr. Boyce H. Grier
Director, Region I
U. S. Nuclear Regulatory Commission
631 Park Avenue
King of Prussia, Pennsylvania 19406

SUSQUEHANNA STEAM ELECTRIC STATION
FINAL REPORT OF A DEFICIENCY ON PGCC/ACR
CABLE CONNECTORS
ERs 100450/100508 FILE 840-4/900-10
PLA-545

References: PLA-437 dated January 8, 1980
PLA-301 dated November 14, 1978

Dear Mr. Grier:

This letter serves to provide the Commission with a final report of a deficiency on Power Generation Control Complex/Advanced Control Room (PGCC/ACR) cable connector deficiencies originally reported in PLA-301.

The information is furnished pursuant to PP&L's obligations under the provisions of 10CFR50.55(e).

The attachment to this letter describes the deficient condition along with its safety implications and the corrective action being taken to achieve resolution.

We trust the Commission will find the information forwarded by this letter to be satisfactory.

Very truly yours,

N. W. Curtis
Vice President-Engineering & Construction-Nuclear

Attachment
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Ltello (15)
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# PGCC/ACR CABLE PROBLEMS
# FINAL REPORT

PGCC/ACR Cable Problems

DESCRIPTION

In letters from Bechtel Construction dated October 3, 1978, PP&L was informed that during implementation of General Electric's FDDR-KR1-521, Rev. 0 (General Cable Retrofit) rework, it was noted that numerous cases of insulation damages were found and that one cable was found to have four (4) conductors pulled from their pin connectors. Due to the high percentage of damaged cable, the quality of all terminations was rendered indeterminate.

NCR-3231 was generated to document the problems within the PGCC/ACR complex. It was agreed to by PP&L, Bechtel and General Electric, that GE would prepare an FDI which should have details of a complete inspection plan and an approved repair procedure.

In February, 1979, GE issued FDI-WJGO Rev. 0 to perform a 100% inspection of all GE supplied SITS/FITS cables used in the Susquehanna 1 ACR control room, upper relay room and lower relay room for damaged insulation and suspect pin crimps.

Approved methods of repair for damaged PGCC/ACR cable connectors identified during the inspections performed under FDI-WJGO were accomplished in accordance with GE FDDR-KR1-526. This FDDR was originally issued on Sept. 6, 1978 to control the repair of PGCC/ACR panel connectors. The Panel Connector problems were explained in our PLA-506 dated July 8, 1980.

The inspections, repair/rework and tests for the cables under FDI-WJGO, FDDR-KR1-526, their revisions and addendums are nearly complete. A total of 1762 cables have been inspected. The results of the inspection are as follows:

| | Damage | Quantity |
|---|---|---|
| 1. | Nicks to conductor insulation | 264 |
| 2. | Cuts to conductor insulation | 346 |
| 3. | Damaged or no shrink tubing | 265 |
| 4. | Pins pulled off during pull test or fell off during depinning | 58 |
| 5. | Not pinned in accordance with wire list or assembly method | 78 |
| 6. | Failed continuity | 21 |

CAUSE

(a) Items 1 and 2, nicks and cuts to conductor insulation; after having investigated damaged conductor insulation within the T-MOD wiring to a connector, it was determined by GE that during reassembly (i.e., pin insertion and extraction using the standard Amphenol tooling for the termination modules) continual difficulty was experienced. The ferrule edge during extraction and the sharp insertion tool edge during assembly impacted on the densely packed wires at the connector area causing nicks, cuts and abrasions.

(b) Item 3, damaged or no shrink tubing, can be broken into two (2) parts: (1) the damaged shrink tubing could have been caused at the factory during assembly of the cable or at the construction site during installation, and (2) the lack of shrink tubing was due to an oversight in manufacturing.

(c) Item 4, pins pulled off during pull test or which fell off during depinning; it was determined that a combination of manufacturing personnel error and crimping tool malfunction, due to inadequate QA coverage, was responsible for defective crimps. This would account for pins failing pull tests or falling off during depinning.

(d) Item 5, not pinned in accordance with wire list or assembly method, is a manufacturing error; i.e., the conductor might be pinned in hole A in a connector but in hole B in the connector on the opposite end of the cable.

(e) Item 6, failed continuity, is a direct result of the conductor not pinned in accordance with the wire list or assembly method (Item 5).

ANALYSIS OF SAFETY IMPLICATIONS

As the various problems are of a random nature and there are a number of Class 1E cables involved, the Safety Analysis is presented on an item by item basis as follows:

(a) In items 1, 2 and 3, nicks and cuts to conductor insulation and damaged or no heat shrink tubing, if bare copper wire is exposed and left uncorrected, it could permit shorting of wires or introduction of external voltages into safety related circuits. Any of these conditions could prevent the circuits from performing the designed safety function.

(b) Items 4, 5 and 6, pins pulled off during pull test or fell off during depinning, not pinned in accordance with wire list or assembly method and failed continuity, could affect the designed safety functions. If during a seismic event, the conductor vibrates loosely in the pin so that there is sporadic or no continuity between the pin and conductor, or if the conductor is not pinned correctly such that there is no continuity between the proper connector pins at each end of the table, the operation of the circuit could be adversely affected.

Project Engineering has determined that the above items are reportable under 10CFR50.55(e).

CORRECTIVE ACTIONS

The 100% inspection program for PGCC cable connectors and repair/rework for the problems listed in NCR-3231 is nearly complete.

[illegible] actions to prevent recurrences of like problems to future PGCC cable connectors, and which are also applicable to the Susquehanna PGCC/ACR Unit 2 cables, are indicated by GE to be:

(1) Appropriate training of personnel involved.

(2) Revision of fabrication techniques.

(3) Increased/revised inspection activities.

(4) GE has developed a supplemental reinspection instruction (GE Inspection Instruction CA-006) to identify damaged or nonconforming connectors prior to shipment. Satisfactory completion of this cable reinspection on Susquehanna Unit 2 cables was reverified by PP&L audit on Sept. 9-11, 1980 at the GE manufacturing facility in San Jose, CA.

In addition, faulty crimping tools were repaired or replaced and periodic testing of crimping tools was increased.

Construction site personnel have been given further instructions in the handling and installation of cables. The site electricians have been instructed to use a steady pull (not a yank) when making pull tests and the spring testers are calibrated every 30 days or sooner if deemed necessary.

CONCLUSIONS

The repair/rework and testing of the Unit 1 PGCC/ACR cables is nearly complete. All Unit 1 PGCC/ACR cables will be completed prior to fuel load.

The Unit 2 PGCC/ACR cables will be installed and repaired or reworked as necessary. Discrepancies will be documented on an NCR.

For Unit 2 PGCC/ACR cables, field inspections of the equipment and additional GE fabrication personnel training, inspection and revised fabrication techniques should preclude recurrence of similar problems.