Commonwealth Edison
Quad-Cities Nuclear Power Station
Post Office Box 216
Cordova, Illinois 61242
Telephone 309/654-2241

FAP-72-146

July 24, 1972

Mr. J. F. O'Leary
Director, Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

50-265

Dear Mr. O'Leary:

Ref: Quad-Cities Nuclear Power Station
Unit 2-DPR-30 Appendix A
Sections 6.6.A.3 and 6.6.B.3

The purpose of this letter is to inform you of the details regarding the fire in two electrical cable trays in the Reactor Building at Quad-Cities Station Unit 2. This incident occurred on July 16, 1972, at 1:30 a.m.

This letter was prepared by Messrs. B. H. Temple, N. J. Kalvianakis, and W. C. Lui, members of a special committee appointed by Messrs. H. K. Hoyt (Superintendent of Generating Station - Nuclear) and F. A. Palmer (Superintendent, Quad-Cities Nuclear Power Station) to investigate the incident.

Description of Incident

During startup testing on Unit 2 at Quad-Cities Nuclear Power Station with the reactor operating at 80% thermal power, Reactor Water Recirculation Motor-Generator Set 2B tripped and the indicating lights for the following equipment were initially observed to be out:

Reactor Water Recirculation Suction Valve MO-2-202-4B

Reactor Water Recirculation Discharge Valve MO-2-202-5B

Reactor Water Recirculation Equilizer Bypass Valve MO-2-202-9B.

Reactor Water Recirculation Discharge Bypass Valve MO-2-202-7B

Drywell Cooling Blower 2C, 2D, and 2E

Standby Liquid Control System

Reactor thermal power dropped to 60% after the recirculation pump tripped. An operator was dispatched to investigate and attempt to reset the Reactor Water Recirculation System in preparation for restart of 2B Recirculation Motor-Generator Set

7/31
IRM
JH
JK
RM

50-265 original

4155

COPY SENT REGION III

while a second operator was dispatched to investigate the Standby Liquid Constrol System and replace the blown fuse. It was discovered that none of the valves that had lost their indicating lights could be reset. The voltage on their supply bus, Bus 28/29-5, was checked and found to be normal. One of the Station Operating Engineers was notified while a search for abnormal conditions in the station was in progress. At 3:30 a.m. a small fire was discovered in the two electrical cable trays in the TIP (Traversing In-Core Probe) room in Unit 2. The fire appeared to have extinguished itself. No smoke was detected in the room when it was entered. Some remaining sparks were extinguished with a portable CO_2 fire extinguisher.

Immediate Actions

When the source of the trouble was discovered an orderly shutdown of the reactor was initiated. All equipment affected by the fire was taken out of service. The turbine-generator was off the system at 5:37 a.m. and all rods were inserted by 9:16 a.m.

Investigation

An investigation was performed to determine the cause of the fire. Engineers from Commonwealth Edison's Station Electrical Engineering and Production Departments were on site to investigate and concurred with the corrective action recommended by General Electric. Investigation revealed the following:

1. Location

The fire was located in the TIP room in the southwest quadrant of the 595' elevation of the Reactor Building in cable pan sections 603T (top) and 603B (bottom). The trays are 30" wide and 6" deep. The fire had confined itself to approximately 5 feet at the end of cable tray sections 603T and 603B. The major burning was in the bottom cable tray, 603B. The cable trays in this area are ladder type trays and run against the drywell at elevations 614'6" and 616' above the drywell penetrations which are at elevation 611'. The only cables affected were those going through penetration 100F. All of the electrical leads coming out of penetration 100F were led up into the bottom ladder tray and spliced onto the incoming cable after their jackets had been stripped back. Nineteen of the total of 24 damaged cables had been routed in the bottom cable tray. The remaining 5 cables had been routed in the top cable tray and looped down through the ladder section for splicing to the penetration leads in the lower ladder section directly above penetration 100F.

2. Location of Hottest Area of Fire

The apparent hot spot of the fire was located approximately 3 feet from the end of the bottom pan and towards the front edge of the pan. This was also the location of the majority of the conductor splices.

3. Area of Spread

The fire had fairly well consumed all of the insulation in the front half of the lower pan at the apparent fire center. It had spread along the loosely stacked cables to the point where they all came together in a tight bundle (approximately 2 feet from the fire center) to continue on along the pan. The fire extinguished itself as soon as it reached this tightly packed bundle and at the top of the vertical run of the penetration leads where they dropped out of the ladder tray. One 2-conductor number 14 cable (25799) in the top pan directly above the fire hot spot had its insulation burned off. Its conductors had burned through in two places as a result of electrical arcing on two of the rungs of the ladder section. Four reactor protection system cables were also routed through penetration 100F. As specified by design they were in separate conduit and were completely unaffected by the fire.

4. Cause of Fire

Cable 22770, the 3 conductor 1/0 power feed for Drywell Cooling Blower 2D, was buried near the bottom of the apparent hottest spot of the fire. After removal of the upper cables, it was observed that phase T3 (C) conductor was burned through at the end of the splice which had the penetration leads crimped into it. The cable was burned completely through with face pitting and fusion. This type of burn is typical of a high resistence joint failure. The 2 pieces of the conductor were completely separated and there was no apparent arcing to the other phases of the cables, to any of the surrounding wires, or the cable pan.

Repair Procedure

1. The conductor bundles from the penetration were all opened and the individual conductors were cut back to good conductor and good insulation. This left approximately a three foot lead from the penetration.

2. A new 12" x 12" wire tray was run from the original pan just inside the TIP room wall directly to the penetration. A 45° elbow sloping down to the penetration was installed on the wire duct for the purpose of making the cable splices.

3. The cables in the bottom tray were rerouted into the new wire tray.

4. The cables in the upper pan were left there until they were rolled out for splicing.

5. The rerouted cables were then cut back to good conductor and good insulation and spliced to the penetration leads as per original procedures with the exception of the drywell cooling blower power feeds.

6. For the drywell cooling blower power feeds, the splices were accomplished as follows:

   A. A standard 1/0 YS25 Burndy sleeve was crimped to the 1/0 cable with a Burndy MY29-3 indenting tool.

   B. The seven #10 101 strand conductors from the penetration were inserted into the other end of the 1/0 connector sleeve.

   C. Three solid #10 copper filler pins were then inserted into the connector sleeve with the #10 stranded conductors. This gave a total copper cross section of 102,800 circular mills verses 105,600 circular mills for 1/0 cable. The connector was then indented using a MY29-3 indenting tool set on the 1/0 index. Several of the splices were made on a trial basis. They were then sectioned at the dents in the connector. The cross-section of the 7 #10 101 strand conductors plus the 3 #10 filler pins were a homogeneous cross-section of copper. The #10 solid conductors were not visually identifiable in the cross-section. The entire splice was of very good quality.

7. The connectors were then insulated with GE8380 tape and the splice completed with a Scotchcast 82-A2 splicing kit.

Corrective Action

All remaining drywell cooling blower feeds for both Unit 1 and 2 were physically inspected for evidence of overheating at the splice.

No indications of over heating were discovered. Since the original splices were approximately 30,000 circular mills short on copper at the penetration end, all drywell cooling blower feeds will be respliced in the following sequence:

A. All feeds through penetration 100F in Unit 2 drywell.

B. All feeds through penetration 104B in Unit 2 drywell.

C. Unit #1 cables outside of the drywell as each drywell cooler can be taken out of service.

After completion of the cable repairs, tests were conducted to verify the correct operation of the affected system components. All required tests were completed prior to startup. The unit was returned to service at 3:45 p.m. on July 22, 1972.

Conclusion

Investigation indicated that the fire originated from a bad splice in the C phase of the power feed for the 2D Drywell Cooler. Although there was little visible evidence of arcing, it is reasonable to assume that the initial arc from this cable contributed to the spread of the fire. It was apparent that the fire did not spread out of the main zone by radiation or conduction. All power cable protective devices functioned properly and were instrumental in containing the spread of the fire. Had the fire occurred in an area where both division I and II engineered safeguard system cables were present, the separation system used throughout the plant would have prevented spread of the fire from one division to the other. A complete list of cables damaged by the fire is attached.

Very truly yours,

COMMONWEALTH EDISON COMPANY
Quad-Cities Nuclear Power Station

F. A. Palmer
Superintendent

FAP/zm

enc.

REACTOR WATER RECIRCULATION

CABLE #	EQUIPMENT NAME
22857	Suction valve MO-2-202-4B Motor
22864	Discharge valve MO-2-202-5B Motor
22871	Discharge Bypass valve MO-2-202-7B Motor
22883	Equilizer bypass valve MO-2-202-9B Motor
22859	Suction valve MO-2-202-4B Limit switches
22866	Discharge valve MO-2-202-5B Limit switches
22873	Discharge bypass valve MO-2-202-7B Limit switches
22885	Equilizer bypass valve MO-2-202-9B Limit switches
20592	Current Transformer at 2B pump motor
25779	Discharge valve MO-2-202-5B limit switches

DRYWELL COOLING

22430	Blower 2C
22770	Blower 2D
22435	Blower 2E

TIP (TRAVERSING IN-CORE PROBE)

25183	Channel #1 Indexing Mechanism
25185	Channel #2 Indexing Mechanism
25769	Channel #3 Indexing Mechanism
25771	Channel #4 Indexing Mechanism
25773	Channel #5 Indexing Mechanism

STANDBY LIQUID CONTROL

26340	Shut-off valve 1101-1 position indication

RESIDUAL HEAT REMOVAL

20687	Injection manual valve 1001-33B position indication.
22573	Shutdown cooling isolation Valve 1001-50 limit switch.

PLANT EVACUATION

24240	Reactor Building Siren - S-35

REACTOR VALVES AND EQUIPMENT

26336	Reactor head cooling drain valve AO-2-220-47
26326	Reactor head seal instrument Shut-off valve AO-2-220-52