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October 26, 1989

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

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES)
DOCKET NOS. 50-445 AND 50-446
NAMCO LIMIT SWITCHES BROKEN CONTACT STRIPS
SDAR: CP-89-001 (FINAL REPORT)

Gentlemen:

On January 16, 1989, TU Electric notified the NRC of a deficiency regarding defective materials in NAMCO limit switches. The last report on this issue was logged TXX-89219, dated April 24, 1989. After further evaluation, TU Electric concluded that this deficiency is reportable pursuant to 10CFR50.55(e).

Description

During replacement of electrical conductor seal assemblies for NAMCO limit switches mounted on safety-related air operated valves, nine switches were found to have broken or cracked contact strips. The failed switches were Model # EA-180 with date code 1882 (manufactured during the 18th week of 1982).

Considerable effort has been made by TU Electric and NAMCO to identify the cause of these failures. NAMCO's efforts included engineering studies, laboratory analysis and testing. Six of the cracked assemblies were provided by TU Electric to NAMCO. The results of NAMCO's review are summarized as follows:

- NAMCO confirmed TU Electric's finding that the cracked contact strips were all from a lot manufactured during the 18th week of 1982.
- Switches in NAMCO stores manufactured in 1982 were inspected and found free of cracks. Further, NAMCO stated that similar contact strip assemblies were used in switches manufactured between January 1982 and February 1984. No changes in the manufacturing process could be identified during this period.

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- Returned switches with cracks were cycled to 500,000 cycles (design life) without failure. Four uncracked switches from NAMCO stores were cycled to 10^6 cycles without crack initiation.
- Lab analysis showed the material in the contact strips was the same throughout the period in question, although some differences in grain structure were found.
- The manufacturing operation performed by NAMCO most likely to cause the cracks is the riveting of the contact strip to the contact block. In 1984, at the end of the manufacturing period in question, this operation included a detailed inspection point. No cracks were recorded during these inspections.

TU Electric's review for the potential cause of the cracking focused on limit switch installation procedures, maintenance procedures and additional inspections of limit switches. No construction or maintenance practices that could account for the cracking were identified. Additionally, TU Electric sent six contact strip assemblies to an independent laboratory for testing. Tests performed included the following:

- Visual examination and photography.
- Scanning electron microscopy of contact strip fracture surfaces.
- Energy Dispersive X-ray (EDX) and Auger elemental analysis of deposits on the contact strip fracture surfaces.
- Cutting, mounting, polishing and metallographic examination of the contact strips.
- Chemical analysis of the material from a cracked contact strip using NBS standards and comparison to specifications.
- Hardness testing of the contact strips, and
- Over-torque tests of screws into the contact strip inserts.

Metallographic examination of the fractures in the contact strips indicated extensive branched intergranular (along grain boundaries) and transgranular (through the grain) cracking alongside the main fracture. The independent laboratory concluded that the cracks were probably stress corrosion related. The probable cause was residual stress in the contact strip and the presence of pre-plating (contact strips are nickel plated brass) contaminants.

The manner in which conditions favorable to stress corrosion cracking could occur is not known. The results of the independent testing will be forwarded to NAMCO for their information.

There are approximately 455 NAMCO Model # EA-170 and EA-180 limit switches installed in Class 1E circuits in Unit 1. This includes 110 date code 1882, 279 date codes between 1982 and 1984 (exclusive of 1882) and 66 outside the 1982 to 1984 range. Twenty-five (25) date code 1882 and sixty-two (62) date code 1982 and 1984, EA-170 and EA-180 switches are located in stores. During performance of the corrective action described below (which was proceeding in parallel with attempts to isolate the root cause) an additional 10 cracked contact strips in NAMCO EA-170 and EA-180 (date code 1882) limit switches were identified. Inspection of the 279 installed and 87 in stores, NAMCO EA-170 and EA-180 limit switches, identified no cracks. The 66 switches outside the suspect date codes were not inspected.

Based on the above, TU Electric has established reasonable confidence that this deficiency is confined to NAMCO EA-180 and EA-170 limit switches at CPSES with a date code of 1882. No cracks have been found in limit switches utilizing similar contact strips manufactured between 1982 and 1984 (outside the 18th week of 1982).

Safety Significance

Class 1E limit switches are utilized with safety related valves to provide position indication, electrical seal-in to keep valves open and, in some cases, interlocking functions to ensure proper coordination with other safety related valves or components. Failure to provide proper valve position indication could have resulted in safety systems not being in the proper lineup to perform their associated safety function or misoperation of equipment during post accident conditions. Therefore, this condition is a deficiency in the construction that could have been adverse to safe operations. As a result, this deficiency meets the criteria for reportability pursuant to 10CFR50.55(e).

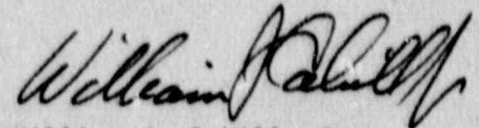
Corrective Action

TU Electric is replacing all NAMCO EA-170 and EA-180 date code 1882 limit switches (approximately 110). The two hundred seventy-nine (279) installed and eighty-seven (87) in stores, potentially affected EA-170 and EA-180 limit switches manufactured between 1982 and 1984 (outside of the 18th week of 1982) were inspected and found to be free of cracks. NAMCO EA-180 and EA-170 date code 1882 limit switches have been added to the Nuclear Operations Defective Items List to preclude future use of these switches. The remaining 1882 date code switches in CPSES stores and the 1882 date code switches removed from field installations and returned to CPSES stores will be scrapped.

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Limit switch replacement will be completed in Unit 1 prior to Unit 1 fuel load
and in Unit 2 prior to Unit 2 fuel load.

Sincerely,



William J. Cahill, Jr.

VPC/smp

c - Mr. R. D. Martin, Region IV
Resident Inspectors, CPSES (3)