

## POTENTIAL PROBLEMS WITH CONTAINMENT ELECTRICAL PENETRATION ASSEMBLIES

## Description of Circumstances:

On October 3, 1977, Northeast Nuclear Energy Company reported to the NRC Region I Office that two control valves installed inside containment at Millstone Unit No. 2 demonstrated abnormal operational characteristics. The licensee reported that an unexpected closure of a letdown flow stop valve occurred. While investigating this problem, the normally closed safety injection recirculation return line drain valve was found to be in the open position. Investigation of these events revealed the cause for failure to be electrical shorts between conductors within a containment low voltage penetration assembly.

The licensee subsequently determined that the wiring for both of the valves shared the same low voltage module in an electrical penetration. Electrical tests by the licensee revealed that 15 of the 85 conductors in the suspect connector module exhibited decreased insulation resistance between conductors. Based on this finding, it is believed that an electrical path between adjacent circuits in the connector module was established. This resulted in spurious operation of the valves. Similar resistance checks performed on the remaining low voltage modules within the affected penetration assembly revealed 17 additional conductors with reduced insulation resistances. All conductors with resistances less than 20 megohms were disconnected and their circuits were reconnected through spare conductors.

Examination of the three remaining low voltage penetration assemblies, identified seven additional conductors with resistances of less than 20 megohms. Each of these circuits was also reconnected through a spare conductor.

Investigation showed that the reduced insulation resistance was probably caused by moisture accumulation within the penetration assembly together with small fissures in the epoxy seals surrounding each conductor in the module. The licensee believes that moisture penetrating these cracks reduced the insulation resistance between adjacent conductors. To prevent further degradation from moisture buildup within the penetration assemblies, the licensee re-established a dry nitrogen pressure of 24 psig in the penetrations.

Subsequently the licensee reported that a second event of a similar nature occurred on October 14, 1977. In this instance the sample isolation valve for the pressurizer surge line failed to close on command.

Investigation into this event indicated that electrical shorts between conductors due to a moisture accumulation problem was the probable cause for valve misoperation. The shorted wires were disconnected and the valve was de-energized in the closed position.

In discussions on the issue with the licensee and the electrical penetration vendor, General Electric Company, NRC staff determined that maintenance of nitrogen pressure is essential to the integrity of both high and low voltage penetration assemblies. The General Electric Company specifies in its penetration assembly maintenance and operation manual that a 15 psig dry nitrogen pressure should be maintained on low voltage units while 30 psig should be maintained on high voltage units.

Action To Be Taken By Licensees Of All Power Reactor Facilities With An Operating License:

Containment Electrical Penetrations - For safety related systems

- 1.0 Do you have containment electrical penetrations that are of the G. E. Series 100, or are otherwise similar in that they depend upon an epoxy sealant and a dry nitrogen pressure environment to ensure that the electrical and pressure characteristics are maintained so as to ensure the functional capability as required by the plant's safety analysis report; namely, (1) to ensure adequate functioning of electrical safety-related equipment and (2) to ensure containment leak tightness?
  - 1.1 Have you experienced any electrical failures with this type of penetration?
- 2.0 For those penetrations referenced in Item 1 above, have you maintained the manufacturer's prescribed nitrogen pressure at all times?
  - 2.1 If you have operated the penetrations without maintaining a nitrogen pressure was any degradation of insulation resistance or anomalous component operation detected?
  - 2.2 If no measurements were taken during periods when nitrogen pressure was not maintained, how were you assured that the insulation resistance was not degrading or degraded?
  - 2.3 How do you determine that circuit insulation resistance values are satisfactorily maintained?

- 3.0 Is there a need, as determined by either the vendor or yourself, to maintain penetrations pressurized during a LOCA?
- 3.1 What measures have you taken to ensure that penetrations of this type will perform their design function under LOCA conditions? (design reviews, analyses or tests)
- 3.2 Are the measures that provide this assurance adequate to satisfy the Commission's regulations? (GDC 4, Appendix A to Part 50; QA Criteria, Appendix B to Part 50)
- 4.0 Provide your response to Items 1.0 through 3.2 above in writing within 10 days. In addition, provide an oral response by 4:00 p.m. (Local Time) November 25, 1977. Responses should be submitted to the Director of the appropriate NRC Regional Office. A copy of written responses should be forwarded to the U. S. Nuclear Regulatory Commission, Office of Inspection and Enforcement, Division of Reactor Operations Inspection, Washington, D. C. 20555.

Approved by GAO, B180225 (R0072); clearance expires 7-31-80. Approval was given under a blanket clearance specifically for identified generic problems.

LISTING OF IE BULLETINS  
ISSUED IN 1977

Bulletin No.	Subject	Date Issued	Issued To
77-05A	Supplement 77-05A to IE Bulletin No. 77-05 - Electrical Connector Assemblies	11/15/77	All PWR Power Reactor Facilities with an Operating License (OL) or Construction Permit (CP)
77-05	Electrical Connector Assemblies	11/8/77	All PWR Power Reactor Facilities with an Operating License (OL) or Construction Permit (CP)
77-04	Calculational Error Affecting the Design Performance of a System for Controlling pH of Containment Sump Water Following a LOCA	11/4/77	All PWR Power Reactor Facilities with an Operating License (OL) or Construction Permit (CP)
77-03	On-Line Testing of the W Solid State Protection System	9/12/77	All W Power Reactor Facilities with an Operating License (OL) or Construction Permit (CP)
77-02	Potential Failure Mechanism in Certain W AR Relays with Relays with Latch Attachments	9/12/77	All Holders of Operating Licenses (OL) or Construction Permits (CP)
77-01	Pneumatic Time Delay Set Point Drift	4/29/77	All Holders of Operating Licenses (OL) or Construction Permits (CP)