

IE Bulletin No. 77-07  
December 19, 1977

**CONTAINMENT ELECTRICAL PENETRATION ASSEMBLIES AT NUCLEAR POWER PLANTS  
UNDER CONSTRUCTION**

**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 7 additional conductors with resistances of less than 20 megohms. Each of these circuits were 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

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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 were 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 Applicants Of all Power Reactor Facilities With a Construction Permit:**

**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? If you do use penetrations of this type at your facility describe the manufacturer and model number of these units.
- 1.1 If you do not have penetration assemblies of the type(s) referenced in Item 1.0 above, describe the type(s) of penetrations e.g., manufacturer and model number now in use or planned for use in safety systems at your facility.

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- 1.2 Do the transition connector pins imbedded in the epoxy as discussed in Item 1.0 above, have an insulation jacket?
- 2.0 For those penetrations referenced in Item 1 above, has the manufacturer's prescribed nitrogen pressure been maintained at all times during shipping, storage and installation?
- 3.0 Is there a need, as determined by either the vendor or yourself, to maintain penetrations pressurized during normal operation, to assure functionality 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 30 days. Responses should be submitted to the Director of the appropriate NRC Regional Office. A copy of your response should be forwarded to the U. S. Nuclear Regulatory Commission, Office of Inspection and Enforcement, Division of Reactor Construction 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
77-06	Potential Problems with Containment Electrical Penetration Assemblies	11/22/77	All Power Reactor Facilities with an Operating License (OL)
77-05A	Supplement 77-05A to IE Bulletin No. 77-05 - Electrical Connector Assemblies	11/14/77	All Power Reactor Facilities with an Operating License (OL) or Construction Permit (CP)
77-05	Electrical Connector Assemblies	11/8/77	All 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 Latch Attachments	9/12/77	All Holders of Operating Licenses (OL) or Construction Permits (CP)

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ISSUED IN 1977

Bulletin No.	Subject	Date Issued	Issued To
77-01	Pneumatic Time Delay Relay Set Point Drift	4/29/77	All Holders of Operating Licenses (OL) or Construction Permits (CP)