UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

AUG 11 1982

MEMORANDUM FOR: Victor Stello, Jr., Deputy Executive Director for Regional Operations and Generic Requirements

FROM: Richard C. DeYoung, Director, Office of Inspection and Enforcement

SUBJECT: REQUEST FOR BRIEFING ON PROPOSED IE CIRCULAR ENTITLED: "DEFICIENCIES IN PRIMARY CONTAINMENT ELECTRICAL PENETRATION ASSEMBLIES"

In accordance with the Commission approved CRGR Charter dated June 16, 1982, the Office of Inspection and Enforcement requests review of the proposed subject IE Circular (copy enclosed). This Circular reflects those review comments which were submitted by the Offices of IE, NRR, RES, and the Regions.

The Circular contains no new requirements but merely recommended actions by licensee and construction permit holders to provide added assurance that the subject penetrations and module assemblies are correctly installed and will perform as intended. IE recommends approval by CRGR. To this end, we would be happy to provide a briefing to the Committee.

Upon CRGR approval of issuance of this circular, we will issue a Temporary Instruction (TI) to the Regional/Resident Inspectors. The TI will provide guidance regarding appropriate follow-up of the licensee actions and the method of documenting the inspectors' findings in routine inspection reports.

Please let us know the scheduled date for the briefing if it is deemed necessary.

R C DeYoung

Richard C. DeYoung, Director
Office of Inspection and Enforcement

Enclosure:
IE Circular 82- : Deficiencies in Primary Containment Electrical Penetration Assemblies

CRGR

DED/ROGR
NO. 82-151

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IEC 82-

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT
WASHINGTON, D.C. 20555

August , 1982

IE CIRCULAR NO. 82- : DEFICIENCIES IN PRIMARY CONTAINMENT ELECTRICAL PENETRATION ASSEMBLIES

Addressees:

All nuclear power reactor facilities holding an operating license or construction permit.

Purpose:

This Circular is provided to transmit findings from a joint Region III and Region IV study which have potential safety significance and generic implications at a limited number of plants. We expect recipients to review the information for applicability to their facilities and to take appropriate corrective actions.

Description of Circumstances:

Several deficiencies in containment electrical penetrations supplied by Bunker Ramo, have been identified. A summary of these deficiencies is provided below:

1. On January 15, 1979, Consumer Power Company submitted 10 CFR 50.55(e) report No. 78-12 for the Midland nuclear facility identifying deficiencies associated with #10 AWG and smaller wire terminations located in the Bunker Ramo penetration assemblies' inboard terminal boxes. The deficiencies identified included improper lug crimps, incorrect lug types, and loose connections on terminal blocks. These deficiencies were attributed, in part, to a Bunker Ramo inexperienced employee.

2. On March 26, 1980, Union Electric Company submitted 10 CFR 50.55(e) report No. 80-03 for the Callaway nuclear facility identifying deficiencies associated with electrical penetration assemblies supplied by Bunker Ramo. The deficiencies included improperly crimped lugs and penetration cables without proper identification. During hand pull tests at least 38 wires separated from their lugs. The reported cause of this deficiency was the overcrimping and undercrimping of lugs by Bunker Ramo.

3. On June 12, 1980, the NRC was informed by Standardized Nuclear Unit Power Plant Systems (SNUPPS) that additional inspections at the Wolf Creek nuclear facility identified further concerns regarding the quality and

integrity of Bunker Ramo electrical penetration terminations. Deficiencies identified at the Wolf Creek facility included improperly crimped lugs and incorrectly sized lugs.

4. On October 2, 1980, Commonwealth Edison submitted 10 CFR 50.55(e) report No. 80-02 for the LaSalle County Station Unit 2 facility identifying cracked or missing insulation (exposing bare copper) on small diameter conductors as they enter/exit the epoxy module portion of the Bunker Ramo electrical penetrations. The report stated, in part, "The cracking was determined to have resulted from stress points in the insulation created by a mechanical bond between the potting compound (used to form the over-mold portion of the module) and the insulation. Movement of the conductors entering or exiting the modules produced cracks along the stress points."

5. On March 31, 1982, the NRC was advised through a 10 CFR 21 report that deficiencies have been identified in Bunker Ramo electrical penetrations installed at the Midland nuclear facility. The deficiencies involve #2, #6, #8, #10, #14, and #16 AWG splices and cracks in the insulation of some conductors as they emerge from certain types of modules. The deficiencies were reported to have occurred when site personnel moved cables to inspect for rodent damage.

6. On April 8, 1982, Consumers Power Company submitted 10 CFR 50.55(e) report No. 82-02 for the Midland nuclear facility identifying deficiencies in Bunker Ramo electrical penetrations. The identified deficiencies include cracks in conductor insulation at the conductor-module interface (resulting in some exposure of the module copper conductors) and inadequately crimped butt splices (resulting in several #2 AWG butt splices being pulled apart). These deficiencies were observed in installed electrical penetrations. In addition, similar deficiencies were observed in crated electrical penetrations and spare module assemblies stored in warehouse facilities. The cracked insulation was reported to have been probably caused by a chemical/mechanical reaction between the module materials, mechanical stresses resulting from the module design, and a lack of explicit handling/packing instructions reflecting the frailty of the electrical penetrations/modules. The inadequately crimped butt splices were reportedly caused by a breakdown in the fabrication/design of the module assemblies.

The above deficiencies have all been identified on Bunker Ramo electrical penetrations utilizing a hard epoxy module design. In addition to the above construction sites, Bunker Ramo has identified the Comanche Peak, Byron and Braidwood sites as using this design. These deficiencies could result in failures of Class 1E equipment essential to the safe operation and or/shutdown of nuclear facilities. The potential failures which could occur include electrical short-circuits, localized circuit overheating, adjacent circuit cross-talk, and circuit discontinuities.

In addition to the above documented deficiencies associated with nuclear facilities under construction, a deficiency in Bunker Ramo electrical penetrations utilizing a soft epoxy module design has recently been identified at Davis Besse, an operating nuclear facility. Davis Besse has experienced numerous spurious asymmetric rod alarms. The licensee has determined that the spurious alarms are caused by intermittent voltage drops within the electrical penetration module assemblies. To determine the cause of the voltage drops, two module assemblies have been removed during the current refueling outage and will be shipped to a laboratory for testing. Dresden, Calvert Cliffs, Trojan, Arkansas and Quad Cities plants also use the soft epoxy module design. A supplement to this circular will be issued, if deemed necessary, when the Davis Besse laboratory results are available.

Recommended Actions for Holders of Operating Licenses or Construction Permits

1. If spare Bunker Ramo electrical penetrations or module assemblies utilizing the hard epoxy module design are planned for use in safety-related systems at your facility, we recommend the following course of action:

   a. Inspect electrical penetration terminal boxes and verify satisfactory termination of conductors.

   b. Visually inspect electrical penetration conductors as they enter and exit penetration modules and verify the integrity of the insulation around the conductors of the module assembly.

   c. Conduct pull tests in accordance with your cable splice/termination criteria on in-line butt splices (#2 AWG and smaller) and ascertain the acceptability of these connections.

2. If Bunker Ramo electrical penetration assemblies utilizing the hard epoxy module design are installed in safety-related systems at your facility, we recommend inspecting those assemblies as soon as practical. For plants holding a construction permit, these inspections should be completed before licensing. For plants having an operating license, the inspections should be completed before resuming operation, following next refueling outage. The specific inspections recommended are:

   a. Visually inspect electrical penetration terminal boxes, and module conductors, and verify satisfactory termination of conductors and integrity of conductor insulation of the module assembly.

   b. Perform pull test on in-line butt splices (# 2 AWG and smaller) to ascertain acceptability of the connections.

   c. Perform circuit continuity and/or insulation resistance tests, if deemed necessary, when steps 2 a. and b. above are completed.

You are not required to respond to this Circular in writing. Each licensee or applicant should determine the applicability of deficiencies identified above for its facility. Having made that determination, correct any deficiency identified. If deficiencies are identified, a report may be needed to meet applicable NRC reporting requirements. For more information, you may contact the Administrator of the appropriate NRC Regional Office or this office.

Richard C. DeYoung, Director
Office of Inspection and Enforcement

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Attachment:
Recently issued IE Circulars