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

December 3, 1982

IE BULLETIN NO. 82-04: DEFICIENCIES IN PRIMARY CONTAINMENT ELECTRICAL
PENETRATION ASSEMBLIES

Addressees:

All nuclear power reactor facilities holding an operating license (OL) or construction permit (CP).

Purpose:

The purpose of this bulletin is to inform CP holders and licensees about findings from a joint Region III, Region IV, and IE study concerning electrical penetrations supplied by the Bunker Ramo Company. It was concluded that there are potential generic safety implications at a limited number of plants. Therefore, we ask all recipients of this bulletin to review the information herein for applicability to their facilities and (1) to take appropriate action with respect to deficiencies found if their plants utilize hard epoxy containment electrical penetration assemblies manufactured by the Bunker Ramo Company or (2) submit reports stating that such assemblies are not used in their facilities.

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 inboard terminal boxes of Bunker Ramo penetration assemblies. The deficiencies identified included improper lug crimps, incorrect lug types, and loose connections on terminal blocks. These deficiencies were attributed, in part, to an inexperienced employee at Bunker Ramo.
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 improperly identified penetration cables. During hand-pull tests, at least 38 wires separated from their lugs. It was reported that this deficiency resulted when Bunker Ramo overcrimped and undercrimped lugs.

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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 included 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 probably been 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 fragility 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 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 determined that 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. Calvert Cliffs, Trojan, and Arkansas plants also use the soft epoxy module design. A supplement to this bulletin will be issued, if deemed necessary, when the Davis-Besse laboratory results are available.

Actions to Be Taken by Holders of Operating Licenses or Construction Permits

1. Plants Under Construction and in Operation

If Bunker Ramo electrical penetrations having module assemblies which utilize the hard epoxy module design are not yet installed in safety-related systems at your facility (plants under construction) or are non-installed spare units (operating plants), the following actions are requested:

- a. Inspect all supplier-provided electrical penetration terminal boxes and verify that the conductor terminations are satisfactory (correct lug sizes, proper crimps, and no loose connections).
- b. Inspect all electrical penetration conductors as they enter and exit penetration modules and verify the integrity of the insulation around the conductors. It may be necessary to remove the penetration modules from the assembly to perform this inspection, and removal will be necessary to conduct the examination discussed in Item c below.
- c. Conduct detailed examinations of all supplier-provided in-line butt splices having a wire size of #2 AWG and smaller, and ascertain acceptability of these connections.

2. Plants Under Construction

If Bunker Ramo electrical penetration assemblies utilizing the hard epoxy module design are installed in safety-related systems at your facility, the following actions are requested:

- a. Inspect the accessible* portions of all installed assemblies as described in Items 1a and 1b above.

*Throughout this bulletin the accessible portions are considered to be all of the supplier-provided electrical terminations (see Item 1a) and those parts of the penetration modules (Item 1b) that can be inspected while the assemblies are in place.

- b. Remove a sample of penetration modules from the assemblies and inspect the sample as described in Item 1b and 1c above. Minimum sample size considered acceptable shall be the greater of two modules or 10% of the modules for each wire size.

If failures are identified in either the non-installed assemblies (Items 1b and 1c) or in the sample from the installed assemblies, the sample size shall be appropriately increased.

3. Plants in Operation:

If Bunker Ramo electrical penetration assemblies utilizing the hard epoxy module design are installed in safety-related systems at your facility, you are requested to review past operational and related maintenance records of these electrical penetration units for circuit functionality problems similar to those discussed in this bulletin. If such problems have occurred, or if the inspection of spare assemblies in accordance with Item 1 have identified deficiencies, then the following actions are requested:

- a. Provide a basis for continued plant operation if problems as discussed in this bulletin are identified.
- b. Develop a plan for inspection of the installed assemblies. This plan should address the types of problems identified by past operational history and/or the inspection of non-installed spares. The plan should identify the wire sizes to be examined.
 - (1) If problems were only identified in accessible portions of the assembly then the sample may be restricted to that portion.
 - (2) If problems included inaccessible portions, then the sample shall include inaccessible portions of the assembly. This will require removal of the module from the assembly.

4. Repairs to conductor terminations, module insulation and butt splices identified as unacceptable under provisions of Items 1, 2 or 3 above shall be performed in accordance with appropriate procedures.

Initiate replacement or repair of any supplier-provided conductor termination, module insulation, or in-line butt splice if they are determined to be unacceptable based on the inspections and examinations discussed in Items 1 through 3 above. If the repairs involve recrimping of connection(s), such actions must be supported by documentation containing the results of the qualification tests conducted to support these corrective actions. This is to include pull tests on similarly installed sample connections from your facility. An acceptable alternative would be type

tests of recrimped connections of each wire size, performed by the connector manufacturer. These sample connections must be of similar parameters (i.e., wire size, connector type, qualified crimping tool and crimping procedures, etc.) as those of the connectors in question. Replacement of suspect connections with other types of connectors must also be supported by similar qualification documentation.

5. Complete the actions specified by this bulletin and provide a written report within 90 days of the date of this bulletin that either:
 - a. States that no Bunker Ramo electrical penetration which use the hard epoxy module design are installed or planned to be installed in safety-related systems at your facility. (No further action is needed), or
 - b.
 - (1) Provides the results of those actions discussed in Items 1a, 1b, 1c, and 4 above, as they apply to penetration assemblies identified as either spare units or units not yet installed.
 - (2) Provides the results of those actions discussed in Items 2 and 4 above, as they apply to plants under construction. The report must be submitted prior to issuance of an OL, if such action is contemplated within the 90 day period following the date of issuance of this bulletin.
 - (3) Provides the results of those actions discussed in Items 3a, 3b, and 4 above, as they apply to operating plants, including your plan and schedule for completing the required inspections, and also provides your basis for continued operation.
6. Provide a report describing the results of the inspections discussed in Item 3b and addressed by the plan described in the report specified in 5b(3) above, within 60 days of completion of the inspections.

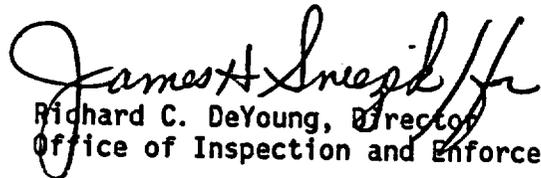
The written reports required by Items 5a, 5b(1), 5b(2), 5b(3), and 6 above shall be submitted to the appropriate Regional Administrator under oath or affirmation under provisions of Section 182a, Atomic Energy Act of 1954 as amended. The original copy of the cover letters and a copy of the reports shall be transmitted to the U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, D.C. 20555 for reproduction and distribution.

This request for information was approved by the Office of Management and Budget under clearance number 3150-0094 which expires on November 30, 1985. Comments on burden and duplication should be directed to the Office of Management and Budget, Reports Management, Room 3208, New Executive Office Building, Washington, D.C. 20503.

While no specific request or requirement is intended, the following information would be helpful to the NRC in evaluating the cost of implementing this bulletin:

1. Utility staff time to perform requested inspection.
2. Radiation exposure attributed to requested inspections.
3. Utility staff time spent to prepare written responses.

If you have any questions regarding this matter, please contact the Regional Administrator of the appropriate NRC Regional Office, or the technical contact listed below.


Richard C. DeYoung, Director
Office of Inspection and Enforcement

Technical Contact: V. D. Thomas
301-492-4755

Attachment:

1. List of Recently Issued IE Bulletins

LIST OF RECENTLY ISSUED IE BULLETINS

Bulletin No.	Subject	Date of Issue	Issued to
82-03 Rev. 1	Stress Corrosion Cracking in Thick-Wall Large-Diameter Stainless Steel, Recirculation System Piping at BWR Plants	10/28/82	Operating BWRs in Table 1 for action and other OLs and CPs for information
82-03	Stress Corrosion Cracking in Thick-Wall Large-Diameter, Stainless Steel, Recirculation System Piping at BWR Plants	10/14/82	Operating BWRs in Table 1 for action and other OLs and CPs for information
82-01 Rev 1, Supp 1	Alteration of Radiographs of Welds in Piping Subassemblies	08/18/82	All power reactor facilities with an OL or CP
82-02	Degradation of Threaded Fasteners in the Reactor Coolant Pressure Boundary of PWR plants	06/02/82	All PWR facilities with an OL for action and all other OLs or CPs for information
82-01 Rev. 1	Alteration of Radiographs of Welds in Piping Subassemblies	05/07/82	All power reactor facilities with an OL or CP
82-01	Alteration of Radiographs of Welds in Piping Subassemblies	03/31/82	The Table 1 facilities for action and to all others for information
81-02 Supplement 1	Failure of Gate Type Valves to Close against Differential Pressure	08/18/81	All power reactor facilities with an OL or CP
81-03	Flow Blockage of Cooling Water To Safety System Components by <u>CORBICULA</u> SP. (ASIATIC CLAM) and <u>MYTILUS</u> SP. (MUSSEL)	04/10/81	All power reactor facilities with an OL or CP
81-02	Failure of Gate Type Valves to Close Against Differential Pressure	04/09/81	All power reactor facilities with an OL or CP

OL = Operating License
CP = Construction Permit