UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

March 19, 1991

NRC INFORMATION NOTICE NO. 91-20: ELECTRICAL WIRE INSULATION DEGRADATION CAUSED FAILURE IN A SAFETY-RELATED MOTOR CONTROL CENTER

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors.

Purpose:

This information notice is intended to alert addressees to potential problems resulting from degradation of dielectric polyvinyl chloride (PVC) machine tool wire insulation used in Class 1E and non-Class 1E motor control center (MCC) equipment wiring. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On January 4, 1991, during a refueling outage at the H. B. Robinson Steam Electric Plant, Unit 2, the "B" feedwater motor-operated isolation valve failed to close during surveillance testing. The licensee investigated the incident and identified a clear, hardened coating on one of the contactors in one of the compartments in the associated Class 1E (safety-related) motor control center (MCC). During further investigation, the licensee identified a green "liquescent" substance coming out of the wires that connect the associated MCC electrical breaker to its forward and reverse contactors and that was hardening on the contactors (see Attachment 1).

The licensee inspected 110 other compartments in four Class 1E 480 and 208 volt (V) MCCs and in numerous balance-of-plant MCCs. The same type dielectric machine tool wire was used in these compartments and various amounts of the green liquescent substance were present on the wires.

A similar event had occurred at H. B. Robinson a week earlier when the isolation valve for a containment fan cooler return line radiation monitor failed to operate.

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The licensee determined that the same type of dielectric machine tool wire was used in this MCC as was used in that for the "B" feedwater isolation valve. There was also a green liquescent substance on the forward and reverse contactors located in the associated MCC compartment. The licensee now believes that this green liquescent substance caused the failure of the isolation valve for the containment fan cooler return line radiation monitor.

Discussion:

The H. B. Robinson licensee performed a laboratory analysis and identified the green liquescent substance as a "vegetable oil plasticizer," which is present in the composition of the cable's PVC insulation. The analysis indicated that the green liquescent substance is a conductor in liquid form, but when dried, may either be a conductor or an insulator, depending on the amounts of copper oxide salts present. In addition, the color of the substance can vary depending on the amount of copper oxide salts present.

In 1988, a similar event occurred at the San Onofre Nuclear Generating Station, Unit 1 (SONGS1), when the Southern California Edison Company (the licensee) was performing maintenance (i.e., cleaning) on several wires attached to the 480/120V control transformers, located in a Class 1E MCC. The licensee stated that after performing routine cleaning of the electrical wires with isopropyl alcohol, they found a green substance seeping from the wires attached to the primary side of the control transformer. Subsequent investigation later identified that of approximately 96 compartments inspected, 31 showed evidence of this green substance. This MCC contained both Class 1E and non-Class 1E equipment.

The SONGS1 licensee found that a black and green sticky gel was present on the entire length of the wire inside the wire's insulation and identified it as an interaction between the corrosion products formed on the surface of the copper wire and the chlorine leaching from the wire's PVC insulation. The licensee stated that the sticky consistency of the material was a result of a slight depolymerization of the inner surface of the insulation and that moisture from the environment had been transported, by capillary action, into the wire strand bundles. The licensee suspected that an electrochemical reaction contributed to the insulation degradation, which may have been accelerated by the high voltage differential across the control transformer. The licensee described the wire as a dielectric 600V machine tool wire (AWG #14).

The H. B. Robinson licensee identified the wire used between the MCC breaker and the contactors as a dielectric (insulated) PVC machine tool wire (AWG #12) with a temperature rating of 105° C. The cable is black in color, and the specific manufacturer has not been identified to date. Westinghouse (the manufacturer of the MCCs) has stated that this wire was procured in the 1962-65 time frame and records pertaining to this wire do not exist. It is possible that several different vendors may have manufactured similar wire and that this wire was not limited to any particular components (i.e., MCCs) or for use by any particular nuclear steam supply system (NSSS) vendor. The H. B. Robinson licensee has replaced all affected Class 1E MCC wiring with wiring identified as "Surprenant Wire and Cable CSA Type CL-1251 XLPE 600V, 125° C."

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact the technical contact listed below or the appropriate NRR project manager.

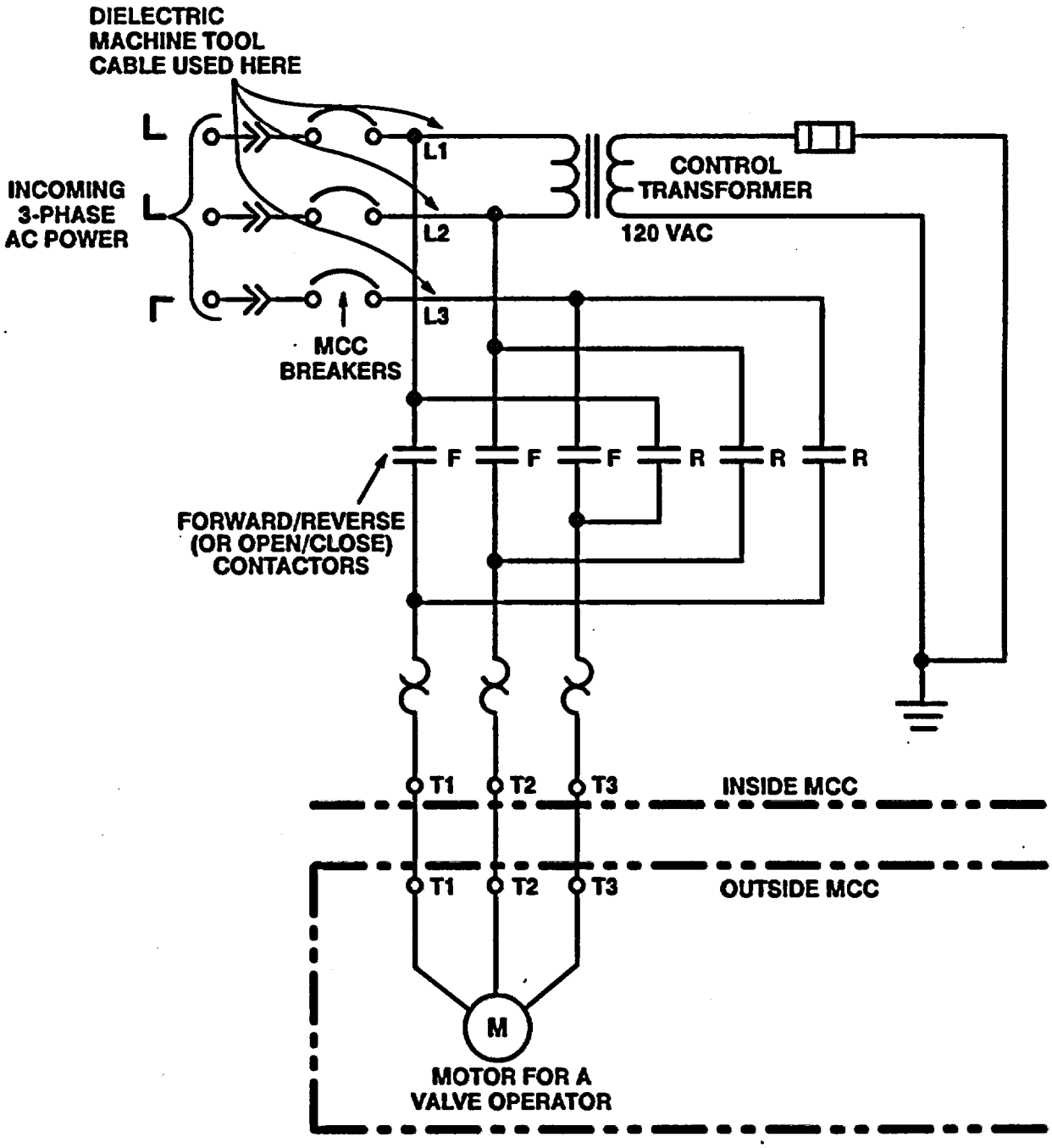
Charles E. Rossi

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contact: John Thompson, NRR
(301) 492-1171

Attachments:
1. Diagram of A Typical MCC Compartment
2. List of Recently Issued NRC Information Notices

A TYPICAL MCC COMPARTMENT



LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
90-43, Supp. 1	Mechanical Interference with Thermal Trip Function in GE Molded-Case Circuit Breakers	03/13/91	All holders of OLs or CPs for nuclear power reactors.
91-19	Steam Generator Feedwater Distribution Piping Damage	03/12/91	All holders of OLs or CPs for pressurized water reactors (PWRs).
91-18	High-Energy Piping Failures Caused by Wall Thinning	03/12/91	All holders of OLs or CPs for nuclear power reactors.
90-25, Supp. 1	Loss of Vital AC Power with Subsequent Reactor Coolant System Heat-Up	03/11/91	All holders of OLs or CPs for nuclear power reactors.
91-17	Fire Safety of Temporary Installations or Services	03/11/91	All holders of OLs or CPs for nuclear power reactors.
91-16	Unmonitored Release Pathways from Slightly Contaminated Recycle and Recirculation Water Systems at A Fuel Facility	03/06/91	All fuel cycle facilities.
91-15	Incorrect Configuration of Breaker Operating Springs in General Electric AK-Series Metal-Clad Circuit Breakers	03/06/91	All holders of OLs or CPs for nuclear power reactors.
91-14	Recent Safety-Related Incidents at Large Irradiators	03/05/91	All Nuclear Regulatory Commission (NRC) licensees authorized to possess and use sealed sources at large irradiators.
91-13	Inadequate Testing of Emergency Diesel Generators (EDGs)	03/04/91	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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Original Signed by
Charles E. Rossi

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

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Attachments:
1. Diagram of A Typical MCC Compartment
2. List of Recently Issued NRC Information Notices

*See previous concurrences.

OFC	:NRR:OEAB	:TechEd	:SC:NRR:OEAB	:SELB	:REGION II	:C:NRR:OEAB
NAME	:*JThompson	:*JMain	:*DFischer	:*FRosa	:*PFillion	:*AChaffee
DATE	:02/13/91	:02/11/91	:02/19/91	:02/20/91	:02/26/91	:02/25/91

OFC	:C:NRR:OGCB	:D:NRR:DOEA
NAME	:*CBerlinger	:ERossi
DATE	:03/05/91	:03/13/91

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NAME	:CBerlinger	:ERossi
DATE	:03/05/91	: / /91

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Licensees may wish to inspect their facilities for similar dielectric PVC machine tool wire and take appropriate action, as necessary.

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