

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

August 12, 1993

NRC INFORMATION NOTICE 93-64: PERIODIC TESTING AND PREVENTIVE MAINTENANCE
OF MOLDED CASE CIRCUIT BREAKERS

Addressees

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

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to the problem of age-related degradation of molded case circuit breakers (MCCBs) and to provide sources of information on MCCB periodic testing and preventive maintenance. 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 are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

Kewaunee

During special testing in 1992 of 35 spare Westinghouse Type EB and EHB MCCBs at the Kewaunee Nuclear Power Plant, 10 of the MCCBs tripped late in thermal trip tests at 300-percent overcurrent and 1 of the 10 failed to trip below the maximum allowable trip current in an instantaneous magnetic trip test. Subsequent testing during the 1992 outage showed a similar percentage of out-of-tolerance MCCBs. Because the MCCBs were available for use in safety-related and fire protection applications, the licensee reported the circumstances as an item of generic interest in Licensee Event Report (LER) 50-305/92-01.

The licensee attributed the out-of-tolerance trip values to age-related degradation and infrequent exercising of the MCCBs, some of which had not been exercised since initial plant startup in 1974. Sometimes retests were successful after the breaker was exercised manually, which is one type of preventive maintenance recommended by manufacturers and industry standards. However, without periodic testing, the degraded condition of the MCCBs was not detected earlier. The licensee replaced the Type EB and EHB breakers in service and plans to implement a program at Kewaunee to test and exercise safety-related MCCBs periodically starting in August 1993.

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Zion

An NRC diagnostic evaluation team at the Zion Nuclear Station observed that the licensee had no program for routinely testing MCCBs (U.S. Nuclear Regulatory Commission, "Diagnostic Evaluation Team Report for Zion Nuclear Power Station," August 1990). Many breakers had been in service for more than 20 years without being exercised or tested so the potential existed for undetected degradation that could impair the performance of safety-related systems.

Discussion

As a followup to the Zion evaluation, the NRC conducted an industry-wide study of MCCB performance history, reported in "Review of Operational Experience with Molded Case Circuit Breakers in U.S. Commercial Nuclear Power Plants" (June 1992). The study found that for the analyzed failure modes, most of the failure rates fell below those estimated generically in The Institute of Electrical and Electronics Engineers (IEEE) Std 500-1984, "IEEE Guide to the Collection and Presentation of Electrical, Electronic, and Sensing Component Reliability Data for Nuclear Power Generating Stations." The study also noted that, except for limited cases, there are no general technical specification requirements for periodic testing and preventive maintenance of safety-related MCCBs. Some plant-specific technical specifications require testing certain MCCBs used only for overcurrent protection for electrical containment penetrations, but the testing is limited, and not all of the circuits are safety-related. The study found that despite manufacturer recommendations and industry standards, many plants do not perform periodic testing or preventive maintenance on safety-related MCCBs, and for the few that do, frequency and procedures differ widely.

In addition, as part of its aging research program, the NRC sponsored a study reported in March 1992 in NUREG/CR-5762, "Comprehensive Aging Assessment Study of Circuit Breakers and Relays," that evaluated various inspection, surveillance, and monitoring techniques and preventive maintenance practices. The study found that MCCB preventive maintenance practices (such as manual exercising), can mitigate the effects of aging and help ensure continued MCCB reliability. However, manual exercising alone was not found effective in detecting or assessing age-related degradation. Detecting or assessing degradation, the study found, could only be accomplished through appropriate periodic testing and monitoring. Certain standard MCCB tests (such as individual pole resistance, 300-percent thermal overload, and instantaneous magnetic trip tests) performed periodically were found effective along with the additional techniques of infrared temperature measurement and vibration testing.

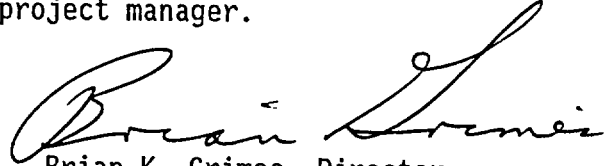
An example of the industry standards that address periodic testing and preventive maintenance is IEEE Std 308-1974, "IEEE Standard Criteria for Class 1E Power Systems for Nuclear Power Generating Stations" (endorsed by

Regulatory Guide 1.32, Revision 2, February 1977). Its Section 6.3 as well as Section 7.4.1 of the current (1991) edition of the standard recommend that periodic tests be performed at scheduled intervals to detect the deterioration of the equipment and to demonstrate operability of the components that are not exercised during normal operation. Other industry standards and publications that contain recommendations for testing and maintenance of MCCBs include the following:

- American National Standards Institute (ANSI)/IEEE Std 242-1986, "IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems"
- ANSI/National Fire Protection Association (NFPA) 70B-1990, "Recommended Practice for Electrical Equipment Maintenance"
- National Electrical Manufacturers Association (NEMA) Standard Publication No. AB 4-1991, "Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications"
- Electric Power Research Institute (EPRI) Report NP-7410, "Breaker Maintenance," Volume 3, "Molded-Case Circuit Breakers," September 1991

The recommendations of these publications may not be applicable in every instance, depending on the specific components installed, their functions, and their environment.

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Brian K. Grimes, Director
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

Technical contacts: Sikhindra K. Mitra, NRR
(301) 504-2783

Stephen D. Alexander, NRR
(301) 504-2995

Satish K. Aggarwal, RES
(301) 492-3829

Attachment:
List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED
NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
93-63	Improper Use of Soluble Weld Purge Dam Material	08/11/93	All holders of OLs or CPs for nuclear power reactors.
93-62	Thermal Stratification of Water in BWR Reactor Vessels	08/10/93	All holders of OLs or CPs for boiling water reactors.
93-61	Excessive Reactor Coolant Leakage Following A Seal Failure in A Reactor Coolant Pump or Reactor Recirculation Pump	08/09/93	All holders of OLs or CPs for nuclear power reactors.
93-60	Reporting Fuel Cycle and Materials Events to the NRC Operations Center	08/04/93	All fuel cycle and materials licensees.
93-59	Unexpected Opening of Both Doors in An Airlock	07/26/93	All holders of OLs or CPs for nuclear power reactors.
93-58	Nonconservatism in Low-Temperature Overpressure Protection for Pressurized-Water Reactors	07/26/93	All holders of OLs or CPs for pressurized-water reactors.
93-57	Software Problems Involving Digital Control Console Systems at Non-Power Reactors	07/23/93	All holders of OLs or CPs for test and research reactors and nuclear power reactors.
93-56	Weakness in Emergency Operating Procedures Found as Result of Steam Generator Tube Rupture	07/22/93	All holders of OLs or CPs for pressurized water reactors.
93-55	Potential Problem with Main Steamline Break Analysis for Main Steam Vaults/Tunnels	07/21/93	All holders of OLs or CPs for pressurized water reactors.

OL = Operating License
CP = Construction Permit

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Original signed by

Brian K. Grimes

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OFFICIAL RECORD COPY Document Name: MCCB.IN

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These manufacturers' arecommendations and industry standards provide guidance on "good practices" for performing testing and maintenance of MCCBs. However, their recommended practices for frequency and method of testing and maintenance of MCCBs are not necessarily applicable to the MCCBs at every nuclear plant because the specific tests and their frequencies depend on the specific components installed, their functions, and their environment.

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Attachments:

1. Referenced Codes and Standards
2. List of Recently Issued NRC Information Notices

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