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

August 5, 1996

NRC INFORMATION NOTICE 96-44: FAILURE OF REACTOR TRIP BREAKER FROM CRACKING OF PHENOLIC MATERIAL IN SECONDARY CONTACT ASSEMBLY

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 possible failure of reactor trip breakers to properly function because of cracking or breakage of the secondary disconnecting contact assemblies. The disconnect assemblies provide circuit connections between the control and monitoring devices on the breaker and external control circuits. The housing of the electrical contacts in the disconnect assemblies consists of a phenolic material. Breakage or partial cracking of these assemblies may prevent the breaker from performing its design function or other secondary functions provided by the status of the breaker position. It is expected that recipients will review this 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

On June 12, 1996, during reactor trip breaker testing at McGuire Nuclear Station, Unit 2, the licensee for McGuire (Duke Power Company) found that one of the bypass breakers failed to open electrically when the local shunt trip push button was depressed. The breaker was later opened mechanically. McGuire Unit 2 was in cold shutdown (MODE 5) at the time. Main reactor trip breakers and bypass reactor trip breakers of the McGuire Units 1 and 2 are 480 volt Westinghouse Model DS-416 equipped with four secondary disconnecting contact assemblies, each containing eight spring-loaded contacts, mounted on the upper rear portion of the breaker. The shunt trip, the undervoltage trip, and the open/closed monitoring circuits for the breakers are wired through these assemblies. The assemblies are made of a molded, cellulose-filled, phenolic material that appears to have low impact strength and may be highly susceptible to chipping or cracking. During subsequent inspection of the breaker, a small piece of the assembly was found lodged in the secondary disconnecting contact assembly, which may have prevented reliable electrical continuity for the local shunt trip push button circuitry for the manual trip function.

On July 1, 1996, while inspecting the remaining breakers of Units 1 and 2, the licensee discovered that an entire secondary disconnecting contact assembly on a Unit 1 breaker was broken in half and one of the spring-loaded finger contacts held together by a phenolic block had fallen out in the breaker cubicle. Unit 1 was operating at 100 percent at the time of discovery. According to the licensee, the broken disconnecting assembly was held in place by the breaker cubicle stops and the wiring harness, and this breaker had successfully passed its in situ surveillance test. The licensee replaced the failed breaker with an available bypass breaker.

On the basis of the situation identified at McGuire, the licensee performed additional inspections of breaker assemblies at Catawba, and found cracks in 12 of 32 secondary disconnecting contact assemblies. All reactor trip breakers at Catawba were tested in situ and successfully passed their surveillance tests. Most of the cracks discovered at Catawba were found in the top disconnecting assemblies.

The postulated root cause of the chipped disconnecting assembly of the breaker in McGuire Unit 2 and the cracked assembly in Unit 1 was determined to be stress induced from mishandling or overtorquing of the disconnecting assembly mounting bolts.

Discussion

In a typical control-rod power-supply system, two series-connected main breakers in each train transmit power from the rod control motor-generator sets to the control rod mechanism. A loss of power to the control rod mechanism causes rods to drop into the core. A bypass breaker is installed in parallel with each main breaker to allow on-line testing of the main breakers. The main breaker is tested in its latched (closed) position whereas the bypass breaker is tested slightly drawn out to disengage main contacts. The bypass breaker is normally in its fully disconnected position and when required for service is moved to its test position and tested before it is inserted into its fully latched position. The bypass breaker is subjected to more handling and thus is more susceptible to mishandling compared to the main breaker. Most of the cracks were on the top contact blocks which are susceptible to damage because they may be used as convenient points for lifting the breaker in and out of the cubicle.

In 1993, Westinghouse issued a revised technical manual for a variety of breakers, including the DS-416 model. The revised manual specifies a maximum torque value for the mounting bolts of the secondary disconnecting contact assemblies. Ensuring that maximum torque values have been specified in maintenance procedures may prevent overtorquing and resultant cracking of the assemblies. Inspection of secondary disconnecting contact assemblies may identify abnormalities prior to the breaker being rendered inoperable.

Information Notice 95-19, "Failure of Reactor Trip Breaker to Open Because of Cutoff Switch Material Lodged in the Trip Latch Mechanism," was issued on March 22, 1995, to alert licensees to a related problem involving breakage of phenolic material in the breaker (General Electric Model AK 2-25 circuit breaker) subcomponents.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

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Information Notice No.	Subject	Date of Issuance	Issued to
96-43	Failures of General Electric Magne-Blast Circuit Breakers	08/02/96	All holders of OLs or CPs for nuclear power reactors
96-42	Unexpected Opening of Multiple Safety Relief Valves	08/05/96	All holders of OLs or CPs for nuclear power reactors
96-41	Effects of a Decrease in Feedwater Temperature on Nuclear Instrumentation	07/26/96	All holders of OLs or CPs for pressurized water reactors
96-40	Deficiencies in Material Dedication and Procurement Practices and in Audits of Vendors	07/25/96	All holders of OLs or CPs for nuclear power reactors
96-09, Supp. 1	Damage in Foreign Steam Generator Internals	07/10/96	All holders of OLs or CPs for pressurized-water reactors
96-39	Estimates of Decay Heat Using ANS 5.1 Decay Heat Standard May Vary Significantly	07/05/96	All holders of OLs or CPs for nuclear power reactors
96-38	Results of Steam Generator Tube Examinations	06/21/96	All holders of OLs or CPs for pressurized water reactors
96-37	Inaccurate Reactor Water Level Indication and Inadvertent Draindown During Shutdown	06/18/96	All pressurized water reactor facilities holding an operating license or a construction permit
96-36	Degradation of Cooling Water Systems Due to Icing	06/12/96	All holders of OLs or CPs for nuclear power reactors
96-35	Failure of Safety Systems on Self-Shielded Irradiators Because of Inadequate Maintenance and Training	06/11/96	All U.S. Nuclear Regulatory Commission irradiator licensees and vendors

OL = Operating License
CP = Construction Permit

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Original signed by Brian K. Grimes

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The majority of the reactor trip breaker failures at power reactors have been caused by problems with relatively small electrical subcomponents in the breaker assembly, rather than by the malfunction of the main breaker mechanism itself. Proper care of these components during routine and corrective maintenance may prevent similar problems at other facilities.

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* see previous concurrence

† via phone call w/ Marvin Sykes on 7/31/96

breaker assembly, rather than the malfunction of the main breaker mechanism itself. The failures identified at McGuire and Catawba involving cracking of breaker phenolic material is another example of subcomponenent failure. Proper care of these components during routine and corrective maintenance could prevent similar problems at other facilities.

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