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

July 2, 1997

NRC INFORMATION NOTICE 96-44, SUPPLEMENT 1: FAILURE OF REACTOR TRIP BREAKER FROM CRACKING OF PHENOLIC MATERIAL IN SECONDARY CONTACT ASSEMBLY

Addressees

All holders of operating license permits for nuclear power reactors.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) issued Information Notice (IN) 96-44 to alert addressees to the possible failure of reactor trip breakers (RTBs) to properly function because of cracking or breaking 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. Breaking or partial cracking of these assemblies may prevent the breaker from performing its design function or other secondary functions that are controlled by the status of the breaker position.

The NRC is issuing this supplement to IN 96-44 to notify the addressees of the findings of the survey conducted by the Westinghouse Owners Group (WOG) on the RTB breaker failures from cracking of phenolic material in secondary contact assemblies. This survey [Attachment 1(a)] highlights typical causes of damage and ways to minimize damage to the secondary contact assembly. 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 RTB testing at McGuire Nuclear Station, Unit 2, the licensee found that one of the bypass breakers failed to open electrically when the local shunt trip pushbutton was depressed. During subsequent inspection of the breaker, a small piece of the assembly was found in the secondary contact block, which prevented electrical continuity for the local shunt trip pushbutton circuitry for the manual trip function. Following this incident, the licensee for Catawba Nuclear Station conducted an inspection of the RTBs and

found cracks in several secondary contact blocks. The NRC staff issued IN 96-44 to alert the licensees to possible failure of properly functioning reactor trip breakers because of cracking or breaking of the secondary contact blocks. As a result of the information notice follow-up on this issue, Farley Nuclear Plant reported cracks similar to those found at McGuire and Catawba. Although the RTBs are functional with minor cracks, this failure mode may lead to eventual failure of the RTB to perform its safety function.

Discussion

After preliminary assessment of this problem, the staff contacted the WOG to assess the scope of the breaker problem by surveying member utilities to determine the generic implication of the RTB failures. The survey findings indicated that 53 secondary contact assemblies have been replaced during the last 10 years out of an estimated 9,000 secondary contact assemblies used on 3,000 DS series breakers. Seven failures occurred when the breaker was cycled during startup and periodic testing. Five operational failures occurred, involving three plants, and these failures were considered to be of no safety significance. The typical causes of damage to secondary contact assemblies were from the lifting of breakers by the secondary contact assemblies, over-torquing of secondary contact assembly bolts, aging, and cycle fatigue.

In 1993, Westinghouse issued the MPM-DS breaker manual. This manual was provided as an attachment to Technical Bulletin NSD-TB-93-05-R0, dated January 10, 1994. The Westinghouse guidance in the manual included the following:

1. "Inspect the secondary contacts closely to ensure they are firmly mounted and there are no cracks in the insulating material. The conductive surfaces should be free of abnormal or uneven wear. Check for evidence of overheating. Depress each contact of the assembly and observe its spring return to normal."

2. "The secondary contact assembly mounting hardware including the contact covers should not exceed 25 to 35 inch-pounds." [Found under specific torque requirements.]

3. Proper circuit breaker handling guidance.

The survey findings indicated that adequate procedures describing testing, inspection, specific torque requirements, and proper handling of circuit breakers are available to the licensees and are being used in procedures for maintenance and surveillance purposes.

IN 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) 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.

Seymour H. Weiss for

Marylee M. Slosson, Acting Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Technical contacts: Amar Pal, NRR
301-415-2760
E-mail: anp@nrc.gov

Eric Benner
301-415-1171
E-mail: ejb1@nrc.gov

Attachments:
1. Letter (OG-97-033) from R. A. Newton, Chairman, Regulatory Response Group/Issues Review Group/PI Core Team, Westinghouse Owners Group (WOG) to WOG Representatives, dated March 18, 1997
2. List of Recently Issued NRC Information Notices

LIST FILED in JACKET.

Domestic Utilities
American Electric Power
Carolina Power & Light
Commonwealth Edison
Consolidated Edison
Duquesne Light
Duke Power
Georgia Power
Florida Power & Light
Houston Lighting & Power
New York Power Authority
Northeast Utilities
Northern States Power
Pacific Gas & Electric
Public Service Electric & Gas
Rochester Gas & Electric
South Carolina Electric & Gas
Southern Nuclear
Tennessee Valley Authority
TU Electric
Union Electric
Virginia Power
Wisconsin Electric Power
Wisconsin Public Service
Wolf Creek Nuclear
International Utilities
Electrabel
Kansai Electric Power
Korea Electric Power
Nuclear Electric plc
Nuklearna Elektrana
Spanish Utilities
Taiwan Power
Vattenfall

OG-97-033

March 18, 1997

To: Westinghouse Owners Group Primary Representatives (1L, 1A)

Subject: Westinghouse Owners Group
Response to NRC Questions on DS Type Circuit Breakers Regarding Failures of Secondary Disconnecting Contact Blocks (MUHP-4011)

Reference: 1) OG-96-089, dated October 4, 1996

On June 12, 1996, during reactor trip breaker testing at McGuire Nuclear station, one of the bypass breakers did not open on a manual shunt trip demand. The potential cause of the inability to open was a chipped secondary contact assembly. The chip lodged in the assembly which may have prevented proper actuation of the shunt trip device. The NRC issued Information Notice 96-44 "Failure of Reactor Trip Breaker from Cracking of Phenolic Material in Secondary Contact Assembly" to alert utilities of the possibility of cracked or broken secondary contact assemblies to affect breaker performance.

The NRC Project Manager for the WOG requested a meeting/telecon with the WOG on IN 96-44 and provided a proposed agenda of six items. The WOG IRG decided to prepare for the NRC discussion by surveying the plants (Reference 1) which use DS circuit breakers for specific information regarding inspection procedures and contact block replacement for both reactor trip and balance of plant applications. The results of the survey were used to prepare responses to the six NRC items as indicated on the attachment. When root cause was determined, handling and overtorquing were frequently identified as causes for replacing the secondary contact assemblies. Each plant should review their procedures, such that these root causes of handling (proper use of lifting devices) and overtorquing are adequately addressed to minimize secondary contact assembly damage. Please refer to Westinghouse 1993 MPM-DS BREAKER manual (attached to Westinghouse Technical Bulletin NSD-TB-05-R0, dated 1/10/94) for the recommended guidance provided by Westinghouse.

A telecon was held with the NRC (Egan Wang, Paul Gill, and Amar Pal) on March 12, 1997 to discuss the attachment. The survey responses indicated inspections are included in site procedures and a limited number of contact assembly replacements were identified. Based on these results it was concluded that this issue is being adequately addressed, if all of the provided guidance has been implemented into plant maintenance procedures and practices. The NRC requested that we include them on the distribution of this letter and provide this information to non-WOG plants who have purchased safety related breakers from Westinghouse. The NRC will most likely use the attached information to issue a Supplement to the Information Notice 96-44.

ATTACHMENT 1(a)

Should you have any questions concerning this issue please contact Dick Miller of Westinghouse at (412) 374-5953 or Dave Campbell, WOG Project Office, at (412) 374-6206.

Very truly yours,

Roger A Newton

R.A. Newton, Chairman
Regulatory Response Group/ Issues Review Group/
PI Core Team
Westinghouse Owners Group

JDC/RAN/dmh

Attachment

cc: Steering Committee (1L, 1A)
Systems and Equipment Engineering Subcommittee (1L, 1A)
T.H. Cloninger, Houston Lighting & Power (1L)
[redacted] Wang, NRC (1L, 1A)
W.W. Foster, Chairman, B&WOG (1L, 1A)
K.P. Donovan, Chairman, BWROG (1L, 1A)
D. Pilmer, Chairman, CEOG (1L, 1A)
M.M. DeWitt, W (1L)
A.P. Drake, W (1L, 1A)

WOG RESPONSE TO QUESTIONS RAISED BY IN 96-44

Item 1. To scope the problem with secondary disconnecting assemblies and its safety significance as it relates to reactor trip breakers (RTB) and other DS-416 breakers.

RESPONSE:

The secondary disconnecting contacts are used to apply electrical signals to the various devices mounted on the DS circuit breakers and to connect auxiliary and overcurrent trip switch contacts that are mounted on the breaker to various interlocking, indicating and data recording networks. The reported failure mode was an open circuit.

Up to four (4) sets of eight (8) contacts each may be mounted on the rear of the DS breaker. On Reactor Trip Breakers and Bypass Breakers all 32 contacts are provided and wired on the breaker but some are spares. On other applications there are 24, 16 and 8 contacts. The following is a list of the typical contact numbers and their functions. Each breaker or group of breakers are factory wired per the information on the front panel nameplate on the breaker which should be used to determine how each breaker is actually wired.

Contacts 5 & 6 are usually used to supply power to the Shunt Trip Attachment which operates when energized and will not function to open the breaker if the circuit is open at either contact. This is a back-up function to the undervoltage trip in the Reactor Trip Breaker application. The shunt trip would typically be utilized to open the circuit for equipment protection in other applications where the function is completed when the circuit is energized.

Contacts 15 & 16 are used to supply power to the Undervoltage Trip Attachment (when supplied) which will function in the safe direction and open the breaker if the circuit is open at either contact.

Contacts 3, 4 and 7 are used to supply power to the breaker Closing Springs Charging Motor, the Spring Release Device and the Anti-Pump (Y) Relay. If the circuit is open at either 4 or 7 the motor cannot charge the closing springs and the breaker will not close on demand. If 3 or 4 is open, the Y relay cannot be energized and the spring release device cannot be energized to close the breaker.

Contacts 4 and 8 are typically wired to the breaker auxiliary switch and used to provide remote indication that the breaker is open. If the circuit is open at either contact the remote indicating light would imply that the breaker is closed when it may actually be open. This false indication may cause incorrect operator actions. As noted above, if contact 4 was open, the breaker could not be closed.

Contacts 9, 10, 11, 12, 13 and 14 are typically used with various combinations of Normally Open and/or Normally Closed breaker mounted Over Current Trip Switches to provide remote indication and prevent the breaker from closing into a fault. For example, if either 9 or 10 were open, the overcurrent trip device could not be reset, if either 11 or 12 were open the proper indication of what initiated the breaker opening would not be provided, and if either 13 or 14 were open the breaker would not close on demand.

Contacts 1, 2 and 17 through 32 are spares or are connected to Normally Open or Normally Closed Auxiliary Switch contacts mounted on the breaker to provide remote indication or interlocking with other breakers. For example, depending on the logic arrangement, failed open contacts could prevent the transfer of a power source when required. P4 contacts opening would prevent blocking SI, altering the sequence of switchover from injection to recirculation phase, and would preclude turbine trip on reactor trip.

Failure of single components to operate does not result in failure of the function to be performed. The design of a nuclear plant takes these possible failures into account by providing redundancy with the use of two trains. Failure of the safety function would require simultaneous failure in the same contacts in both trains.

Item 2. To discuss the issue of new torque values on the mounting bolts of secondary disconnect blocks issued by Westinghouse in 1993.

RESPONSE:

The torque values on the 0.250-20 mounting hardware used to attach the secondary contact assemblies to the rear of the breaker were provided by Westinghouse after requests from DS Breaker customers. In 1988 tests were run by Westinghouse that showed cracking would occur at between 170 and 230 inch-pounds. These values are well above the industry recommended value of 72 to 96 inch-pounds when bolting heat treated steel components using 0.250-20 hardware. The 1993 MPM-DS BREAKER manual (attached to Technical Bulletin NSD-TB-93-05-R0, 1/10/94)recommended torquing the hardware to between 25 and 35 inch-pounds when new plastic assemblies are installed. This ensures that the split type lock washers would be compressed flat and this value was demonstrated to be sufficient in the last seismic test run by Westinghouse.

Item 3. To discuss the handling and interchangeability on the RTB, bypass RTB breakers and other DS-416 breakers.

RESPONSE:

The recommended handling procedures in the MPM-DS BREAKER manual are similar to those that Westinghouse has recommended in all previous manuals on DS Switchgear. Breaker lifting devices have always been recommended when moving the breakers in and out of the switchgear cells to prevent injury to personnel and damage to the equipment. The smallest DS breaker (DS-206) weighs in excess of 150 pounds and is difficult to move without using the recommended lifting adapter (P/N 9562D43G01) and chain block or a platform type lifter. Hand lifting a DS circuit breaker to or from the cell rails is very awkward because the cell compartment door is located on the left front of the cell and is in the way.

As stated in response #1 there are many variations to the wiring used in the DS circuit breakers. Interference brackets are provided on each size of breaker to prevent mismatching a breaker with a cell that is not of sufficient interrupting capacity but these brackets do not prevent installing the same size breakers with different wiring into a properly sized cell. Preventing interchanging the same size breakers and cells that do not match secondary contact assembly wiring must be administratively controlled by plant procedures.

Item 4. To discuss the testing and inspection of the RTB, bypass RTB breakers and other DS-416 breakers.

RESPONSE:

The WOG survey results indicate that the customers have procedures that direct plant maintenance personnel to inspect Reactor Trip/ Bypass Breakers and other DS Balance of Plant Breakers for physical damage to the secondary disconnecting contact blocks. A WOG initiated reactor trip breaker maintenance manual (MPM-WOGRTSDS416-01, 11/30/86) contained guidance on inspection practices. Guidance provided by Westinghouse in the 1993 MPM-DS BREAKER manual included: 1) "Inspect the secondary contacts closely to insure they are firmly mounted and there are no cracks in the insulating material. The conductive surfaces should be free of abnormal or uneven wear. Check for evidence of overheating. Depress each contact of the assembly and observe its spring return to normal.", 2)Under specific torque requirements: "The secondary contact assembly mounting hardware including the contact covers should not exceed 25 to 35 inch-pounds.", and 3) proper circuit breaker handling guidance. In addition, the qualified life of the breaker secondary contacts is 100 cycles (breaker motion from Test to Disconnect position).

Item 5. To discuss the failure and inspection data on these breakers, especially on secondary disconnecting assemblies, that is not reported to the NRC.

RESPONSE:

The WOG survey results indicate that at least 53 secondary disconnecting assemblies have been replaced by the plants that responded. The typical causes were " lifting of breaker by the secondary block", " over torque of secondary block bolts", "cause unknown", "no root cause performed ", " aging and cycle fatigue", " breaker had been dropped since the frame was bent", "damaged in the maintenance shop during routine inspection and testing", "minor blemishes and cracking" and " physical damage during maintenance (bumping)". The data represents various breaker applications, including those that are not required to be reported to the NRC. Most of the above were determined during periodic maintenance/surveillance of the breakers. Seven failures occurred when the breaker was cycled during start-up or periodic testing.

Five operational failures (failed in service)were attributed to the secondary contacts in the survey results. Events included failure to close and failure to provide the proper status. Problems documented were: secondary contact block broken, fingers worn, mounting frame bent, and loose spade lug.

Westinghouse reviewed the breaker refurbishment program and found that 96 DS breaker secondary disconnect contact assemblies (P/N 591C498G01) have been installed on over 150 DS breakers during factory refurbishment since 1986. Most of these were replaced for minor cosmetic chips, damage caused by handling, or cracks at the mounting holes indicating over torquing. In that same period 393 assemblies have been sold for replacement stock to support the estimated 9000 installed assemblies in nuclear plant applications.

Item 6. To discuss license experiences and/or vendor recommendations for detecting and minimizing the identified problems with the secondary disconnecting (auxiliary contact blocks) assemblies.

RESPONSE:

The WOG survey response indicates that the utilities have procedures for detecting and minimizing the problems with the DS Breaker secondary disconnecting contacts. No new procedures are needed other than incorporating the Westinghouse recommendations in the 1993 MPM-DS BREAKER manual where this has not already been done. This manual was provided as an attachment to Technical Bulletin NSD-TB-93-05-R0, 1/10/94.

As an update on this issue, the WOG will send the responses to these six questions and the survey results to its members for information.

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
97-45	Environmental Qualification Deficiency for Cables and Containment Penetration Pigtails	07/02/97	All holders of OLs or CPs for nuclear power reactors
97-44	Failures of Gamma Metrics Wide-Range Linear Neutron Flux Channels	07/01/97	All holders of OLs or CPs for test and research reactors
97-43	License Condition Compliance	07/01/97	All holders of OLs or CPs for nuclear power reactors
97-42	Management Weaknesses Resulting in Failure to Comply with Shipping Requirements for Special Nuclear Material	06/27/97	All fuel cycle conversion, enrichment, and fabrication facilities
97-41	Potentially Undersized Emergency Diesel Generator Oil Coolers	06/27/97	All holders of OLs or CPs for boiling-water reactors
97-40	Potential Nitrogen Accumulation Resulting from Backleakage from Safety Injection Tanks	06/26/97	All holders of OLs or CPs for pressurized-water reactors
97-39	Inadequate 10 CFR 72.48 Safety Evaluations of Independent Spent Fuel Storage Installations	06/26/97	All holders of OLs or CPs for nuclear power reactors. All holders of licenses for independent spent fuel storage installations

OL = Operating License
CP = Construction Permit

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.

original signed by S.H. Weiss for

Marylee M. Slosson, Acting Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Technical contacts: Amar Pal, NRR
301-415-2760
E-mail: anp@nrc.gov

Eric Benner
301-415-1171
E-mail: ejb1@nrc.gov

Attachments:
1. Letter (OG-97-033) from R. A. Newton, Chairman, Regulatory Response Group/Issues Review Group/PI Core Team, Westinghouse Owners Group (WOG) to WOG Representatives, dated March 18, 1997
2. List of Recently Issued NRC Information Notices

DOCUMENT NAME: 9644SUP1.IN
*SEE PREVIOUS CONCURRENCE
Tech Editor has reviewed and concurred on 6/5/97

OFC	Contacts*	BC/EELB*	BC/PECB:DRPM*	D/DRPM
NAME	APal EBenner	JCalvo	AChaffee	MSlosson
DATE	06/09/97 / /97	06/09/97	06/19/97	6/24/96

[OFFICIAL RECORD COPY]

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.

Marylee M. Slosson, Acting Director
Division of Reactor Program Management
Office of Nuclear Reactor Regulation

Technical Contacts: Amar Pal, NRR
301-415-2760
E-mail: anp@nrc.gov

Eric Benner
301-415-1171
E-mail: ejb1@nrc.gov

Attachments:
1. Letter (OG-97-033) from R. A. Newton, Chairman, Regulatory Response Group/Issues Review Group/PI Core Team, Westinghouse Owners Group (WOG) to WOG Representatives, dated March 18, 1997

2. List of Recently Issued NRC Information Notices

DOCUMENT NAME: G:\EJB1\RTBSUPP.IN
*SEE PREVIOUS CONCURRENCE

OFC	Contacts*	BC/EELB*	BC/PECB:DRPM*	D/DRPM
NAME	APal EBenner	JCalvo	AChaffee	MSlosson
DATE	06/09/97 / /97	06/09/97	06/19/97	/ /96

[OFFICIAL RECORD COPY]
mkm 6/25/97

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.

Marylee M. Slosson, Acting Director
Division of Reactor Program Management Office
of Nuclear Reactor Regulation

Technical Contacts: Amar Pal, NRR
(301) 415-2760
E-mail: anp@nrc.gov

Eric Benner
(301) 415-1171
E-mail: ejb1@nrc.gov

Attachments:
1. Letter (OG-97-033) from R. A. Newton, Chairman, Regulatory Response Group/Issues Review Group/PI Core Team, Westinghouse Owners Group (WOG) to WOG Representatives, dated March 18, 1997

2. List of Recently Issued NRC Information Notices

DOCUMENT NAME: G:\EJB1\RTBSUPP.IN
*SEE PREVIOUS CONCURRENCE

S 6/20/97

OFC	Contacts	BC/EELB	BC/PECB:DRPM	D/DRPM
NAME	APal apal EBenner	JCalvo	AChaffee	MSlosson
DATE	6/19/97 / /97	6/19/97	6/17/97	/ /96

[OFFICIAL RECORD COPY]