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July 24, 1996

Mr. Edward J. Dugan
General Electric Company
Specialty Breaker Plant
6901 Elmwood Avenue
Philadelphia, PA 19142

SUBJECT: REQUEST FOR A TECHNICAL REVIEW OF A DRAFT INFORMATION NOTICE REGARDING RECENT FAILURES OF MAGNE-BLAST CIRCUIT BREAKERS

Mr. Dugan:

The U.S. Nuclear Regulatory Commission (NRC) is planning to issue an information notice discussing the problems with GE Magne-Blast circuit breakers recently experienced at the Dresden Nuclear Power Station, Unit 3 (Docket #05000249), and the Salem Nuclear Generating Station (Docket #05000272). We ask that you review the enclosed draft of that information notice to ensure technical accuracy. Your cooperation in this matter is appreciated. Please return any comments you may have as soon as possible. A copy of this request and your response will be placed in the Public Document Room for review by the public. Your response should be mailed to:

U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
ATTN: Vern Hodge, NRR/PECB
MAIL STOP: O11E1

This letter follows a facsimile communication to you on July 22, 1996. We would appreciate your prompt review. Please address any questions you may have on this matter to Vern Hodge of my staff at (301) 415-1861. If no comments are received by close of business July 25, 1996, we will assume the technical information in the notice is correct.

[Original signed by R.L. Dennig]
for Alfred E. Chaffee, Chief
Events Assessment and
Generic Communications Branch
Division of Reactor Project Management
Office of Nuclear Reactor Regulation

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555-0001

July xx, 1996

NRC INFORMATION NOTICE 96-XX: FAILURES OF GENERAL ELECTRIC MAGNE-BLAST CIRCUIT BREAKERS

Addressees

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

Purpose

The U.S. Nuclear Regulatory Commission is issuing this Information Notice (IN) to alert addressees to recent failures of General Electric (GE) medium-voltage Magne-Blast circuit breakers at the Dresden Nuclear Power Station, Unit 3, because of hardened grease and at the Salem Nuclear Generating Station because of mispositioning of the prop pin. A separate information notice is being prepared to discuss failures related to refurbishment practices, including recently discovered broken lock washers from hydrogen embrittlement at Salem. 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 IN are not NRC requirements; therefore, no specific action or written response is required.

Failure Due to Hardened Grease

Description of Circumstances

On June 11, 1996, at the Dresden Nuclear Power Station, Unit 3, a 4.16-kV GE Magne-Blast power supply breaker associated with a low pressure coolant injection loop failed to open on demand from the control room following a surveillance run of the pump. Examination of the failed breaker indicated hardened grease in the breaker.

In subsequent testing the licensee observed two indications of potential grease hardening on four similar breakers. These four breakers were formerly in service but were out of service at the time of testing. In one of the two breakers, which had a high number of cycles, hardened grease was observed on the trip lever roller bearing, making the mechanism "stiff" to operate and unreliable. In the second breaker, the latch mechanism moved freely but fibrous material from an adjacent bushing was observed in the bearing grease. From its subsequent root cause investigation, the licensee concluded that the hardening of grease in the "trip latch roller bearing" was the most likely cause for the failure but discounted that the grease hardening was caused by the fibrous material.

The licensee identified 13 safety-related breakers on Unit 3 as susceptible to this failure mechanism because of the number of operations since the last

overhaul. On June 20, 1996, the Dresden licensee initiated a shutdown of Unit 3 and contracted with the vendor, GE, to completely overhaul each of these 13 breakers and the similar ones on Unit 2.

Discussion

In 1989, the NRC Maintenance Team Inspection at Dresden identified a lack of lubrication of these same breakers. At that time, the licensee instituted a preventive maintenance program as a corrective measure. Recent resident inspector review of that program indicates that the Dresden licensee had not fully incorporated vendor (GE) recommendations.

The GE vendor manuals (GEK-7320F and GEI-88771D) and GE Safety Advisory Letter (SAL) 354.1, dated August 25, 1995, on Magne-Blast circuit breakers recommends that these circuit breakers be lubricated once every two years. The licensee, however, had been using a 6-year maintenance period and had not maintained the failed breaker for 6.5 years. The following factors may have contributed to grease aging and hardening over this protracted maintenance period: (1) A degreaser was used in vendor-recommended maintenance in 1989; (2) Lubricating oil used contained an additive; (3) Heaters were installed within the breaker cubicles for equipment qualification purposes; and (4) Grease originally packed in the trip latch roller bearing contained lithium. The vendor no longer recommends use of this type of grease.

Failure Due to Mispositioning of Prop Pin

Description of Circumstances

On January 5, 1996, at the Salem Nuclear Generating Station, a 4.16-kV GE Magne-Blast power supply breaker associated with a service water pump failed to latch closed on demand from the control room. On January 30 - February 1, 1996, during the root cause investigation, the same breaker failed to latch closed on the seventh attempt after successfully closing six times.

On February 15, 1996, a different service water pump breaker at Salem failed to latch closed. This breaker had been returned to service after an overhaul at the GE Apparatus Service Center in Philadelphia.

On September 27, 1993, at the Maine Yankee Atomic Power Plant, a 4.16-kV GE Magne-Blast power supply breaker associated with a component cooling water pump failed to latch closed on demand from the control room. The licensee enabled this breaker to close reliably by replacing the installed prop spring with a heavier prop spring.

Discussion

IN 94-54 alerted licensees to failures of Magne-Blast breakers to latch closed and discussed the vendor recommendation to add a second prop spring to correct the failure. IN 94-54 pointed out that breakers that are grossly out of adjustment or badly worn may fail to latch closed even with the addition of a second prop reset spring. This phenomenon is technically called "failure to latch closed" but is often termed "trip free."

Through the use of high-speed digital video equipment at Salem, GE has learned that the failure occurs when the prop pin fails to achieve the required position above the prop and causes the prop to hit the prop pin. Such impact causes the prop to bounce back, allowing the prop pin to miss the prop; in this way the breaker fails to latch in the closed position. The impact also causes the leading edges of the prop to become chipped and flattened. In agreement with the vendor, the Salem licensee believes the prop pin may fail to achieve the required position because of (1) the age and wear of the breaker, (2) misalignment of the prop mechanism, (3) errors that may be introduced in the alignment of the operating mechanism causing the prop and or articulated mechanism to twist, (4) misalignment of the stationary cubicle in which the breaker operates, and (5) misadjustment of the opening springs. The cause of any particular failure to latch may have to be determined on an individual basis.

The following vertical lift circuit breakers with ML-13 mechanism which have close and latch ratings of 77 kA or above may fail to latch closed under certain conditions:

4.16 KV-250MVA-8, -9HB	4.16 KV- 350MVA-2H
7.2 KV-500MVA-6HB	13.8 KV-1000MVA-3, -4H
13.8 KV-750MVA-5, -6HB	

The Salem licensee concluded the following conditions indicate that a breaker is likely to fail to latch closed:

- The prop stop pin is not in the fully forward position in the inspection window when the breaker is closed.
- The leading edges of the prop are chipped or have a flattened tip. (The prop tips may be viewed through both inspection holes.)
- The breaker has a previous history of intermittently failing to latch closed.
- If the arcing contacts have overstroked, the tips of the arcing contacts will probably be damaged by their impact on the dividers in the stationary arcing contacts, and the buffer blocks may be cracked.
- There is unequal prop wipe, indicating prop twist.

In agreement with the vendor, the corrective action taken at Salem was to raise the preload on the opening spring to slow down the closing action, thus allowing more time for the prop to get into position. However, this approach is limited by the minimum speed that must be achieved by the moving contacts in order to maintain the 78-kA (high momentary) close-latch rating.

The GE Specialty Breaker Plant (SBP), where the circuit breakers were originally manufactured, is pursuing an alternative solution: (1) replacing the second prop spring with a heavier one, (2) installing a second prop stop to restrict the prop movement on the left hand side, and (3) adjusting the wipe on the main contacts. GE SBP informed the NRC that it has not completed testing this remedy, needs some time to manufacture the required parts, and will issue a SAL on this subject.

Related Generic Communications

1. Information Notice 95-22, "Hardened or Contaminated Lubricants Cause Metal-Clad Circuit Breaker Failure," April 21, 1995

2. Information Notice 94-54, "Failures of General Electric Magne-Blast Circuit Breakers to Latch Closed," August 1, 1994

3. Information Notice 94-02, "Inoperability of General Electric Magne-Blast Breaker Because of Misalignment of Close-Latch Spring," January 7, 1994

4. Information Notice 93-91, "Misadjustment Between General Electric 4.16-KV Circuit Breakers and Their Associated Cubicles," December 3, 1993

5. Information Notice 93-26, "Grease Solidification Causes Molded Case Circuit Breaker Failure to Close," April 7, 1993

6. Information Notice 90-41, "Potential Failure of General Electric Magne-Blast Circuit Breakers and AK Circuit Breakers," June 12, 1990

7. Information Notic_ 84-29, "General Electric Magne-Blast Circuit Breaker Problems," April 17, 1984

8. Bulletin 74-09, "Deficiency in General Electric Model 4KV Magne-Blast Breakers," August 6, 1974

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

Brian Grimes, Director
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Office of Nuclear Reactor Regulation

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Attachment: List of Recently Issued NRC Information Notices