GE Nuclear Energy

General Electric Company
175 Curtner Avenue, San Jose, CA 95125

April 6, 1990
GBS90025.wp
MFN-029-90

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Station P1-137
Washington, D. C. 20555

Attention Carl H. Berlinger, Chief
Generic Communications Branch

Subject: Response to Review of Proposed Information Notice on Magne-Blast Circuit Breakers

This letter is in response to your Reference letter requesting a review of a proposed Information Notice (IN). The date for response was extended initially per our request and subsequently because of questions from and discussions with Jack Ramsey of your office.

As a result of our review of the proposed IN, GE feels obliged to comment on the scope as well as the technical content of the document. The proposed IN covers four topics 1) the prop spring, 2) the bent retaining rings, 3) the welds on striker plates, and 4) the lubricating grease. These four topics are very distinct and unrelated, yet they are discussed together without differentiation. There are two very distinct types of equipment first, the Vertical Lift (AM type) circuit breakers and second, the Horizontal Draw-Out (AMH type) circuit breakers. These two different types are not usually found together at the same facility.

Topic 1)
(AM type Vertical Lift & AMH type Horizontal Draw-Out)

It is GE's opinion that the identified failures of the prop spring represent a small number of reported failures, considering the total population of these products in industry. The reported items were supplied to these plants in the late 1960's. GE's Breaker Plant Operation (BPO) is continuing to investigate the problems reported with the spring design and may issue a Service Advice Letter (SAL) when their investigation is complete. In the interim, GE recommends replacement of springs with approximately 2000 accumulated operations. Alternately, there is a design utilizing 2 prop springs which is presently installed in some circuit breaker ratings. The recommendation to replace springs with approximately 2000 operations has already been supplied to some of the IN identified utilities. The prop spring topic is the only one with more than one example of a utility report.

Topic 2
(AMH type Horizontal Draw-Out)

It is GE's opinion that the identified failure of the bent retaining rings and spacer washers represent a random failure of the location of the prop, not the prop pin. GE does agree that the misalignment in the breaker should have been identified and corrected during the

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Service center performed maintenance. An additional Service center inspection step to check the alignment after circuit breaker reassembly has been added. GE is concerned that there are technical discrepancies between the original text of the Fitzpatrick Licensee Event Report (LER) and Fitzpatrick's failure report. These discrepancies could result in other utilities implementing inappropriate corrective actions.

The LER focuses on the prop pin clearance rather than the prop itself and the listed corrective action is not sufficient to prevent a reoccurrence of the failure.

After systematically trying various configurations GE believes that the root cause of the failure was the location of the prop. The prop was found to be off center in the mechanism and when it was centered there was equal clearance between the prop and both prop pin retaining rings.

Topic 3
(AM type Vertical Lift)

It is GE's opinion that the identified failure of the welds on the striker plates represents reidentification of an old issue previously identified in the mid-1970s and may not warrant an IN mention. SAL No. 325.1 (issued March 3, 1978) covered this specific condition, however the SAL did have a minor error with the breaker size, for 4.16 it was printed as 5.16, however a knowledgeable reader should pickup the error because there is no breaker size 5.16. There is insufficient information to definitively expand the concern to other breakers beyond the SAL defined time frame of 1964 to 1973.

Topic 4
(AM & AMH types)

It is GE's opinion that the identification of Service Information Letter (SIL) No. 448 (issued December 23, 1986) be deleted because it applies only to low voltage AK Series Circuit Breakers. There shouldn't be a mixing of recommendations between AK breakers and Magne-Blast breakers. Greases D50H15 (White) and D50H109 (Yellow) are available and still recommended for their specific applications inside Magne-Blast breakers. Type D6A15A1 is the new (Red) grease that replaces type D50H47 (Black) in Magne-Blast breakers. Wiping clean the grease application points inside the breaker is recommended, however the level of incompatibility of the different greases is not specifically known.

Summary

If all of these topics are to be included in this IN then maybe the title and introduction should state that all Magne-Blast circuit breakers equipped with ML-13 mechanisms are covered. There are two markups attached here, the first is GE's recommendation for the scope and content with corrections. The second, is GE's alternate but less preferred recommendation, if all issues are to be discussed, containing a different sequence and other corrections.

GE hopes this information is useful in completing this IN. We appreciate this opportunity to comment on this proposed IN, and strongly support NRC efforts to provide the most accurate information available. We offer our assistance on future issues as needed.

Very truly yours,

George Stramback

G. B. Stramback
Safety Evaluation Programs Manager
M/C 187, (408) 925-1913

Attachments

cc: J. M. Austin (GE-Atlanta)
E. J. Dugan (GE-Philadelphia)
L. S. Gifford (GE-Rockville)
D. M. Jones (GE-Philadelphia)
P. W. Marriott (GE-San Jose)
R. C. Mitchell (GE-San Jose)
J. E. Ramsey (NRC-Rockville)
R. D. Royal (GE-Oak Brook)
G. W. Sanders (GE-King of Prussia)
K. Utsumi (GE-San Jose)

Reference: Letter Carl H. Berlinger to George Strambach (sic), subject PROPOSED NRC INFORMATION NOTICE ON POTENTIAL FAILURE OF GENERAL ELECTRIC MAGNE-BLAST CIRCUIT BREAKERS, dated March 21, 1990, MFN-027-90

Attachment 1

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

DRAFT

March XX, 1990

NRC INFORMATION NOTICE NO. 90-XX: POTENTIAL FAILURE OF GENERAL ELECTRIC MAGNE-BLAST CIRCUIT BREAKERS

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors utilizing General Electric Company (GE) ~~4.16-350 and 4.76-250 series~~ Magne-Blast circuit breakers ~~used in 4.16-kV applications.~~

Vertical Lift (AM) & Horizontal Draw-Out (AMH)

with ML-13 operating mechanisms.

Purpose:

This information notice alerts licensees to ~~three~~ safety problems involving possible failure of GE ~~4.16-350 and 4.76-250~~ Magne-Blast circuit breakers. ~~Both of these~~ types of circuit breakers utilize ML-13 operating mechanisms to close or open them. GE informed the NRC that it is aware of these problems and that GE routinely checks and corrects ~~these~~ specific problems if the circuit breakers are serviced at one of the four GE service centers in the United States. The NRC is aware that some licensees have their circuit breakers repaired or serviced at places other than the four GE service centers.

Vertical Lift (AM) & Horizontal Draw-Out (AMH)

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It is expected that recipients will review this information for applicability and consider actions to prevent this or similar problems at their facilities. Suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

Vertical Lift (AM type)

On April 7, 1988, a service water pump at Peach Bottom Atomic Power Station (PBAPS) would not auto-start. The pump circuit breaker (GE 4.16-kV) would attempt to close but would trip free. The defective circuit breaker was replaced. A broken prop reset spring had prevented the defective circuit breaker from closing. The licensee for PBAPS authorized an independent analysis of the failed spring. This analysis revealed that the spring failed at a right angle bend in the wire as a result of a metal fatigue crack ~~caused by a~~ lap in the wire. The licensee authorized the analysis of five additional prop reset springs. Two of the five springs tested had surface laps similar in depth to those of the original spring; however, no fatigue- or surface-induced cracks were found on any of the five springs. The licensee intends to replace the prop reset spring every 2000 cycles.

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Horizontal Draw-Out (AMH type)

On August 16, 1989, a GE AMH-4.76-type circuit breaker failed to remain shut at FitzPatrick nuclear power plant as a result of a broken prop reset spring. This circuit breaker had operated for 1625 cycles. Subsequently, the licensee replaced the prop reset springs on all safety-related circuit breakers that had

move to last position

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operated for more than 900 cycles. On the basis of the practice recommended at PBAPS, FitzPatrick will replace the prop springs after 2000 cycles of operation.

Delete

move to last

On November 5, 1988, while FitzPatrick was shut down for refueling, a 4.16-kV residual heat removal (RHR) service water pump motor circuit breaker failed to trip on demand. Inspection of the 4.16-kV circuit breaker revealed a bent snap ring (retaining ring) and two bent spacer washers (shims) in the bottom of the circuit breaker frame. The retaining ring and shims are part of the "prop-pin" assembly and are intended to establish the axial position of the prop pin. The ML-13 operating mechanism opens or closes the circuit breaker's main electrical contacts and uses a linkage that is maintained in that position by a "prop" at one point in the linkage. When the circuit breaker is tripped, the trip-latch is operated, causing the linkage to collapse and a spring to open the main contacts. The prop supports the prop pin (makes the linkage rigid) and prevents the stored energy from closing the springs that in turn close the circuit breaker's main electrical contacts. In an acceptable prop-pin assembly, the prop pin is aligned to strike the prop and is secured in that position with shims and a retaining ring. It is believed that the prop pin and the prop in the failed circuit breaker were not aligned properly, and the misalignment permitted the prop to strike the retaining ring and the shims instead of the prop pin, causing the retaining ring and the shims to bend and eventually to fail. With the loss of the retaining ring and the shims from the prop-pin assembly, the prop pin was free to drift far enough to hang up in the frame and eventually to prevent the circuit breaker from tripping.

FitzPatrick reported (Licensee Event Report 88-014-01) that this and other circuit breakers had been refurbished during 1986 and 1987 at the GE service center located in King of Prussia, Pennsylvania. During the refurbishing process, GE technicians apparently did not specifically verify the alignment of the prop pin. If the prop pin is not properly aligned and secured in the correct position with a retaining ring and spacer washers, then the prop pin will be free to drift far enough to hang up and ultimately prevent the circuit breaker from tripping. The licensee corrected the problem by properly aligning the prop pin with spacers and securing it in that position with a snap ring. As a result of this problem, GE has imposed an additional inspection step to check the alignment after reassembling the circuit breaker. GE informed the NRC that the other three GE service centers have been alerted to this problem and that corrective action has been taken to preclude recurrence of this problem.

On December 2, 1989, a GE AM-4.16-350-1H-type circuit breaker being used to operate a safety injection pump motor failed to remain closed at the Turkey Point nuclear power plant Unit 4 (Turkey Point) as a result of a broken prop reset spring. The circuit breaker had operated for approximately 1400 cycles before the failure. The broken prop reset spring was replaced and the circuit breaker was returned to service on December 3, 1989. Florida Power and Light Company (FPL), the licensee for Turkey Point, examined the failed spring metallurgically and determined that the fatigue fracture occurred at the end of the coil where the wire was bent 90 degrees to form the hook. Examination of the surface revealed a number of small extrusion marks which ran longitudinal

to the wire axis along the entire length of the spring. FPL has established a schedule to replace the existing springs on all the remaining circuit breakers with a new style spring supplied by GE. The new GE springs are reported to have a slight taper on the spring barrel before the hook is formed.

Delete

In a letter dated November 18, 1988, the licensee for the Wolf Creek nuclear power plant notified the NRC that welds attaching the latch roller link striker plate to the operating mechanism frame were observed to be broken on 12 of 16 GE AM-4.16-350-2H Magne-Blast circuit breakers. The licensee determined that the welds were not strong enough to resist impact loads generated during circuit breaker operation and subsequently had to be repaired. Broken welds on striker plates were previously identified in the mid-1970s and were the subject of GE Service Advisory Letter (SAL) No. 325.1, dated March 3, 1978. SAL No. 325.1 identified this problem and recommended that the striker plate be rewelded to the frame. The SAL stated that this problem should be checked only in AM-4.76-250-1 and 4.16-250-6 (H or C)-type circuit breakers and several other 5-, 7-, and 13-kV circuit breakers shipped between 1964 and 1973. As the Wolf Creek-type circuit breakers are not listed in SAL No. 325.1, it is possible that similar broken welds can exist in other types of circuit breakers outside the scope of the SAL.

Delete

During an NRC inspection in January 1990 at the GE service center in Philadelphia, Pennsylvania, the inspectors determined that the D50H15- and D50H47-type grease (black grease) in the stationary cubicles of the switchgear may not have been completely removed before the D50HD38-type grease (red grease) was applied. GE Service Information Letter (SIL) No. 448, dated December 23, 1986, expressly requires that the black grease be removed completely before applying the red grease. It is possible for licensees or their service agents to overlook removing the existing black grease in the stationary cubicles. The black grease in the stationary cubicles is not compatible with the red grease in the overhauled draw-out circuit breakers. When GE overhauls the draw-out circuit breakers, GE reminds the licensee to remove the black grease from the stationary cubicles. Licensees who overhaul their draw-out switchgear at locations other than GE service centers, should consider measures to ensure that both the stationary cubicles and draw-out circuit breakers are properly lubricated with red grease supplied by GE.

MH discussion here from above

Discussion:

Licensees may want to review this information to determine the applicability of the failure mechanisms to circuit breakers at their plants and to ascertain if their circuit breakers are susceptible to this possible failure. Those addressees that are utilizing service facilities other than GE facilities are reminded that the circuit breakers that failed were outside the population previously identified by GE and that the correct grease should be used in both stationary cubicles and draw-out circuit breakers in the switchgear.

Delete

Licensees and construction permit holders may wish to review the performance of their circuit breakers in light of this information.

Attachment 2

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

DRAFT

March XX, 1990

NRC INFORMATION NOTICE NO. 90-XX: POTENTIAL FAILURE OF GENERAL ELECTRIC MAGNE-BLAST CIRCUIT BREAKERS

Addressees:

All holders of operating licenses or construction permits for nuclear power reactors utilizing General Electric Company (GE) ~~4.16-350 and 4.76-250~~ series Magne-Blast circuit breakers ~~used in 4.16-kV applications.~~

Purpose:

This information notice alerts licensees to ~~three~~ safety ~~problems~~ involving possible failure of GE ~~4.16-350 and 4.76-250~~ Magne-Blast circuit breakers. Both of these types of circuit breakers utilize ML-13 operating mechanisms to close or open them. GE informed the NRC that it is aware of these problems and that GE routinely checks and corrects these specific problems if the circuit breakers are serviced at one of the four GE service centers in the United States. The NRC is aware that some licensees have their circuit breakers repaired or serviced at places other than the four GE service centers.

It is expected that recipients will review this information for applicability and consider actions to prevent this or similar problems at their facilities. Suggestions contained in this notice do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

On April 7, 1988, a service water pump at Peach Bottom Atomic Power Station (PBAPS) would not auto-start. The pump circuit breaker (GE 4.16-kV) would attempt to close but would trip free. The defective circuit breaker was replaced. A broken prop reset spring had prevented the defective circuit breaker from closing. The licensee for PBAPS authorized an independent analysis of the failed spring. This analysis revealed that the spring failed at a right angle bend in the wire as a result of a metal fatigue crack ~~caused by a~~ lap in the wire. The licensee authorized the analysis of five additional prop reset springs. Two of the five springs tested had surface laps similar in depth to those of the original spring; however, no fatigue- or surface-induced cracks were found on any of the five springs. The licensee intends to replace the prop reset spring every 2000 cycles.

On August 16, 1989, a GE AMH-4.76-type circuit breaker failed to remain shut at FitzPatrick nuclear power plant as a result of a broken prop reset spring. This circuit breaker had operated for 1625 cycles. Subsequently, the licensee replaced the prop reset springs on all safety-related circuit breakers that had

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operated for more than 900 cycles. On the basis of the practice recommended at PBAPS, FitzPatrick will replace the prop springs after 2000 cycles of operation.

AMH-4.76

Bent Retaining Ring

On November 5, 1988, while FitzPatrick was shut down for refueling, a 4.76-kV residual heat removal (RHR) service water pump motor circuit breaker failed to trip on demand. Inspection of the 4.16-kV circuit breaker revealed a bent snap ring (retaining ring) and two bent spacer washers (shims) in the bottom of the circuit breaker frame. The retaining ring and shims are part of the "prop-pin" assembly and are intended to establish the axial position of the prop pin. The ML-13 operating mechanism opens or closes the circuit breaker's main electrical contacts and uses a linkage that is maintained in ~~shot~~ position by a "prop" at one point in the linkage. When the circuit breaker is tripped, the trip-latch is operated, causing the linkage to collapse and a spring to open the main contacts. The prop supports the prop pin (makes the linkage rigid) and prevents the stored energy from closing the springs that in turn close the circuit breaker's main electrical contacts. In an acceptable prop-pin assembly, the prop pin is aligned to strike the prop and is secured in that position with shims and a retaining ring. It is believed that the prop pin and the prop in the failed circuit breaker were not aligned properly, and the misalignment permitted the prop to strike the retaining ring and the shims instead of the prop pin, causing the retaining ring and the shims to bend and eventually to fail. With the loss of the retaining ring and the shims from the prop-pin assembly, the prop pin was free to drift far enough to hang up in the frame and eventually to prevent the circuit breaker from tripping.

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On December 2, 1989, a GE AM-4.16-350-1H-type circuit breaker being used to operate a safety injection pump motor failed to remain closed at the Turkey Point nuclear power plant Unit 4 (Turkey Point) as a result of a broken prop reset spring. The circuit breaker had operated for approximately 1400 cycles before the failure. The broken prop reset spring was replaced and the circuit breaker was returned to service on December 3, 1989. Florida Power and Light Company (FPL), the licensee for Turkey Point, examined the failed spring metallurgically and determined that the fatigue fracture occurred at the end of the coil where the wire was bent 90 degrees to form the hook. Examination of the surface revealed a number of small extrusion marks which ran longitudinal

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to the wire axis along the entire length of the spring. FPL has established a schedule to replace the existing springs on all the remaining circuit breakers with a new style spring supplied by GE. The new GE springs are reported to have a slight taper on the spring barrel before the hook is formed.

Welds on Striker Plates

In a letter dated November 18, 1988, the licensee for the Wolf Creek nuclear power plant notified the NRC that welds attaching the latch roller link striker plate to the operating mechanism frame were observed to be broken on 12 of 16 GE AM-4.16-350-2H Magne-Blast circuit breakers. The licensee determined that the welds were not strong enough to resist impact loads generated during circuit breaker operation and subsequently had to be repaired. Broken welds on striker plates were previously identified in the mid-1970s and were the subject of GE Service Advisory Letter (SAL) No. 325.1, dated March 3, 1978. SAL No. 325.1 identified this problem and recommended that the striker plate be rewelded to the frame. The SAL stated that this problem should be checked only in AM-4.76-250-1 and 4.16-250-6 (H or C)-type circuit breakers and several other 5-, 7-, and 13-kV circuit breakers shipped between 1964 and 1973. As the Wolf Creek-type circuit breakers are not listed in SAL No. 325.1, it is possible that similar broken welds can exist in other types of circuit breakers outside the scope of the SAL.

Lubricating Grease

D6A15A1

During an NRC inspection in January 1990 at the GE service center in Philadelphia, Pennsylvania, the inspectors determined that the ~~D50H15 and~~ D50H47-type grease (black grease) in the stationary cubicles of the switchgear may not have been completely removed before the ~~D50UD30~~ type grease (red grease) was applied. GE ~~Service Information Letter (SIL) No. 448, dated December 23, 1986, expressly~~ requires that the black grease be removed completely before applying the red grease. It is possible for licensees or their service agents to overlook removing the existing black grease in the stationary cubicles. The black grease in the stationary cubicles is not compatible with the red grease in the overhauled draw-out circuit breakers. When GE overhauls the draw-out circuit breakers, GE reminds the licensee to remove the black grease from the stationary cubicles. Licensees who overhaul their draw-out switchgear at locations other than GE service centers, should consider measures to ensure that both the stationary cubicles and draw-out circuit breakers are properly lubricated with red grease supplied by GE.

Discussion:

Licensees may want to review this information to determine the applicability of the failure mechanisms to circuit breakers at their plants and to ascertain if their circuit breakers are susceptible to ~~this~~ these possible failures. Those addressees that are utilizing service facilities other than GE facilities are reminded that ~~the circuit breakers that failed were outside the population previously identified by GE and that~~ the correct grease should be used in both stationary cubicles and draw-out circuit breakers in the switchgear.

Licensees and construction permit holders may wish to review the performance of their circuit breakers in light of this information.