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

June 12, 1990

NRC INFORMATION NOTICE NO. 90-41: POTENTIAL FAILURE OF GENERAL ELECTRIC MAGNE-BLAST CIRCUIT BREAKERS AND AK CIRCUIT BREAKERS

Addressees:

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

Purpose:

This information notice is intended to alert addressees to potential safety concerns that may result from failures of GE vertical lift (AM) and horizontal draw-out (AMH) Magne-Blast circuit breakers utilizing ML-13 operating mechanisms to open or close them and AK circuit breakers. 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 do not constitute NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances:

The particular breaker failures reported herein were caused by operating problems with prop springs, snap rings and lubricating grease. GE Nuclear Energy has informed the NRC that it is aware of these problems and that GE routinely checks and corrects them if the circuit breakers are serviced at one of the four GE nuclear service centers in the United States. However, the NRC is aware that some utilities may have their circuit breakers repaired or serviced at facilities other than the four GE nuclear service centers.

I. Prop Spring

A. Vertical Lift (AM Type) Magne-Blast Circuit Breakers

On April 7, 1988, a service water pump at Peach Bottom Atomic Power Station would not auto-start. The pump circuit breaker (GE AM-4.16-kV) would attempt to close but would trip free due to a broken prop reset spring. The defective circuit breaker was replaced. Philadelphia Electric Company authorized an independent analysis of the failed spring. This analysis revealed that the spring failed as a result of a metal

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fatigue crack that initiated at a surface lap in the wire. The licensee authorized the analysis of five additional prop reset springs. Although two of the five springs tested had surface laps similar in depth to those of the original spring, no fatigue- or surface-induced cracks were found on any of these five springs. The licensee intends to replace the prop reset spring every 2000 cycles.

On December 2, 1989, a GE AM-4.16-350-1H-type circuit breaker being used to operate a Turkey Point Unit 4 safety injection pump motor failed to remain closed 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 examined the failed spring metallurgically. The licensee determined that a fatigue fracture had occurred at the end of the coil, where the wire was bent 90 degrees to form the hook.

B. Horizontal Draw-Out (AMH Type) Magne-Blast Circuit Breakers

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 with more than 900 cycles of operation.

II. Snap Ring

A. Horizontal Draw-Out (AMH Type) Magne-Blast Circuit Breakers

On November 5, 1988, while FitzPatrick was shut down for refueling, an AMH-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 and two bent spacer washers (shims) in the bottom of the circuit breaker frame. The snap ring and shims are part of the "prop-pin" assembly. In an acceptable prop-pin assembly, the prop-pin is aligned with the prop and is secured in that position with shims and a snap ring. It is believed that the prop-pin and the prop in the failed circuit breaker were not aligned properly. The misalignment permitted the prop to strike the snap ring and the shims instead of the prop-pin. This resulted in the snap ring and the shims bending and eventually failing. With the loss of the snap ring and the shims from the prop-pin assembly, the prop-pin was free to shift far enough to hang up in the frame and to prevent the circuit breaker from tripping.

FitzPatrick reported (Licensee Event Report 88-014-01) that this circuit breaker and other circuit breakers had been refurbished during 1986 and 1987 at the GE nuclear service center located in King of Prussia, Pennsylvania. During the refurbishing process, GE technicians apparently did not specifically verify the alignment. As a result of this problem, GE has imposed an additional inspection step in their servicing procedures to check the alignment after reassembling the circuit breaker. GE informed

the NRC that the other three GE nuclear service centers have been alerted to this problem and that similar corrective action has been taken to preclude recurrence of this problem.

B. AK Circuit Breakers

On March 12, 1990, a GE model AK-2A-50 480-volt metal clad breaker failed to automatically close during an automatic bus transfer, in preparation for required surveillance testing at Pilgrim. On March 20, 1990, the same GE AK-2A-50 480-volt metal clad breaker failed to trip during an automatic bus transfer to restore the normal lineup. Both Pilgrim events were attributed to a missing snap ring and shims which held the prop assembly in place. Boston Edison Co. discovered that the prop which held the breaker closed by latching with the cam of the trip latch roller assembly had slipped out of its support, preventing the breaker from remaining closed. The bearing on which the prop rotates is held in place in the frame by a snap ring on both sides of the bearing. Boston Edison Co. found a snap ring on one end of the bearing to be missing. This permitted the bearing to slip out of the frame and prevented the proper operation of the breaker (failed to latch, failed to trip). This circuit breaker, as well as other AK 480-volt metal clad breakers were overhauled/refurbished in 1987 by the GE nuclear service center located in King of Prussia, Pennsylvania.

On March 8, 1989, a GE model AKS-2A-50 480-volt metal clad breaker (a later version of AK-2A-50) failed while Oyster Creek was shutdown and performing a routine check of the control rod drive breaker. GPU Nuclear Corporation discovered damage to a snap ring, prop bearings, and a breaker clevis pin which had fallen out due to a missing snap ring. Additionally, the prop shaft assembly was observed to be insecure. This breaker and others at Oyster Creek were refurbished by GE in 1987 and 1988.

On June 10, 1986, a GE model AK-2-25 480-volt metal clad breaker would not close at Crystal River 3, while an operator was attempting to reset control rod breakers during shutdown conditions. Florida Power Corporation discovered the snap ring was out of position which allowed the prop-pin to slip out of its support.

III. Lubricating Grease

A. Magne-Blast Circuit Breakers

In January 1990, the NRC conducted an inspection of the GE service center in King of Prussia, Pennsylvania. During this inspection, the NRC determined that D50H47-type grease (black grease) in the stationary cubicles of the switchgear may not be removed completely prior to the application of the new D6A15A1-type grease (red grease), as GE has recommended. It is particularly important for licensees who overhaul their circuit breakers at locations other than GE nuclear service centers to ensure that the stationary cubicles and draw-out circuit breakers are properly lubricated and the above recommendations are taken into account when applying the new red grease.

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

Charles E. Rossi, Director
Division of Operational Events Assessment
Office of Nuclear Reactor Regulation

Technical Contact: K. Naidu, NRR
(301) 492-0980

Attachment: List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
90-40	Results of NRC-Sponsored Testing of Motor-Operated Valves	6/5/90	All holders of OLs or CPs for nuclear power reactors.
90-39	Recent Problems With Service Water Systems	6/1/90	All holders of OLs or CPs for nuclear power reactors.
90-38	Requirements for Processing Financial Assurance Submittals for Decommissioning	5/29/90	All fuel facility and materials licensees.
90-37	Sheared Pinion Gear-to-Shaft Keys in Limitorque Motor Actuators	5/24/90	All holders of OLs or CPs for nuclear power reactors.
90-36	Apparent Falsification of State of Connecticut Weight Certificates	5/24/90	All holders of OLs or CPs for nuclear power reactors, and 10 CFR 70 licensees.
90-35	Transportation of Type A Quantities of Non-Fissile Radioactive Materials	5/24/90	All U.S. NRC licensees.
90-34	Response to False Siren Activations	5/10/90	All holders of OLs or CPs for nuclear power reactors.
90-33	Sources of Unexpected Occupational Radiation Exposures at Spent Fuel Pools	5/9/90	All holders of OLs or CPs for nuclear power reactors.
90-32	Surface Crack and Subsurface Indications in the Weld of A Reactor Vessel Head	5/3/90	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

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KNaidu:nrp	GCwalina	EWBrach	BKGrimes	TechEd
12/19/89	02/12/90	05/21/90	03/12/90	02/22/90

Discussion:

Licensees may wish to review this information to determine its applicability to circuit breakers at their plants.

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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 these possible failures.

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